



# ABSTRACT BOOK

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**WEDNESDAY, 15 AUGUST – Morning Sessions, W1 – W5**

<b>Room</b>	<b>Hennings 200</b>	<b>Hennings 201</b>	<b>Hennings 202</b>	<b>Buchanan A102</b>	<b>Buchanan A103</b>
<b>Session</b>	<b>W1. Behaviour</b>	<b>W2. Climate (predict)</b>	<b>W3. Community ecology</b>	<b>W4. Evolution</b>	<b>W5. Conservation</b>
<b>10:30</b>	<b>W1.1 Norris, A.*;</b> A double resource pulse of food and nest cavities increases intra- and inter-specific competition in cavity-dependent insectivores in interior British Columbia, Canada	<b>W2.1 Purcell, K.;</b> Avian population trends and predicting response to climate change based on 27 years of data from California oak woodlands	<b>W3.1 Gomez, J.P.;</b> A phylogenetic approach to disentangling the role of competition and habitat filtering in community assembly of Neotropical forest birds	<b>W4.1 Winger, B.;</b> A genomic approach to understanding allopatric speciation in montane birds	<b>W5.1 Macias-Duarte, A.;</b> Abundance and distribution of wintering grassland birds in chihuahuan desert grassland priority conservation areas from 2007-2011
<b>10:45</b>	<b>W1.2 Allen, M.;</b> A pathway of destruction: demonstrating how anti-predator behaviours can carry costs that cause nestlings to die	<b>W2.2 Conway, M.;</b> Effects of a drier climate on breeding phenology and clutch size in burrowing owls	<b>W3.2 Niemi, G.;</b> Breeding Bird Communities and Population Trends in the Western Great Lakes Region, USA	<b>W4.2 Claramunt, S.;</b> Andean uplift, climate change and macroevolutionary patterns of diversification in the Furnariidae	<b>W5.2 Camfield, A.;</b> All-bird conservation planning in Canada
<b>11:00</b>	<b>W1.3 Marzluff, J.;</b> Brain imaging reveals neuronal circuitry underlying the crow's perception of human faces	<b>W2.3 Kreuser, J.*;</b> Evaluating the relationship between climate change, range shifts, and differential guild responses of Michigan breeding birds	<b>W3.3 Wiens, J.D.;</b> Competitive interactions and resource partitioning between northern spotted owls and barred owls	<b>W4.3 Essak, M.;</b> Consistent directional selection on breeding date in song sparrows	<b>W5.3 Arcese, P.;</b> Birds as indicators of 'ecological integrity' and human influence: using occupancy maps to prioritize conservation effort
<b>11:15</b>	<b>W1.4 Villard, M-A.;</b> Can forest management inspired from natural disturbance regimes create ecological traps? A field experiment featuring Ovenbird and Brown Creeper	<b>W2.4 Steen, V.;</b> Potential Effects of Climate Change on Wetland-associated Birds in the Prairie Pothole Region, U.S.A.	<b>W3.4 Jusino, M.;</b> Demystifying the relationship between Red-cockaded Woodpeckers and heartwood inhabiting fungi	<b>W4.4 Danner, J.;</b> Cultural divergence as a driver of genetic divergence in a tropical bird	<b>W5.4 Marín-Togo, M.C.;</b> Connectivity and priority sites for conserving Psittacidae on the Mexican Pacific coast
<b>11:30</b>	<b>W1.5 Jones, M.;</b> Cooperative male display in the White-ruffed Manakin ( <i>Corapipo altera</i> )	<b>W2.5 Calle, L.*;</b> Predicted changes in foraging habitat of the Little Blue Heron ( <i>Egretta caerulea</i> ) as a function of sea level rise in the Great White Heron National Wildlife Refuge, FL, USA	<b>W3.5 Boyer, A.;</b> Effects of Extinctions and Introductions on the Functional Ecology of Hawaiian Bird Communities	<b>W4.5 Hudon, J.;</b> Disruption of Carotenoid Pathways in Hybrid Northern Flickers: The Path to Speciation	<b>W5.5 Bonnot, T.;</b> Landscape-based population viability models demonstrate importance of strategic conservation planning for birds
<b>11:45</b>	<b>W1.6 Ringelman, K.;</b> Dearest neighbors: conspecific cueing and adaptive nest clustering in waterfowl	<b>W2.6 LaRoche, D.;</b> The future of southwestern riparian birds in a changing climate; changes in species composition due to declines in available water and riparian vegetation.	<b>W3.6 Cockle, K.;</b> From static to dynamic 'nest webs': Changes in the architecture of an interspecific network of cavity-nesters over 12 years during an outbreak of Mountain Pine Beetle	End	<b>W5.6 Rich, T.;</b> Using species vulnerability assessment to reduce uncertainty in setting bird conservation priorities in North America

**WEDNESDAY, 15 AUGUST – Morning Sessions, W6 – W10**

<b>Buchanan A104</b>	<b>Buchanan A201</b>	<b>Buchanan A202</b>	<b>Chemistry B150</b>	<b>Chemistry B250</b>	<b>Room</b>
<b>W6. Landscape ecology</b>	<b>W7. Migration &amp; stopover</b>	<b>W8. Phylogeography</b>	<b>W9. Population biology</b>	<b>W10. Models &amp; methods</b>	<b>Session</b>
W6.1 <b>Howerter, D.;</b> Assessing Change in Waterfowl Abundance Relative to Anthropogenic Disturbance Across Canada's Boreal Plains	W7.1 <b>Hawk, L.C.;</b> Application of Light-level Geolocation to Migratory Bird Management	W8.1 <b>Smith, B.T.;</b> Comparative phylogeography of lowland neotropical birds with cross-andes distributions	W9.1 <b>Wilson, S.;</b> Declines or redistribution? Population trends of Western Grebes wintering along the Pacific Coast	W10.1 <b>Borgmann, K.;</b> A new method to measure nest concealment	<b>10:30</b>
W6.2 <b>Hadley, A.;</b> Bigger is better: Size of tropical forest patches, not total forest cover, is associated with pollination of an ornithophilous understory herb	W7.2 <b>Contreras, S.;</b> Bird Migration Patterns in the Lower Gulf Coast Region of Texas	W8.2 <b>Hindley, J.;</b> East coast, west coast and in-between: phylogeographic structure of black-capped chickadee	W9.2 <b>Szostek, L.;</b> Density dependent regulation in Common Tern ( <i>Sterna hirundo</i> ) colonies	W10.2 <b>Shaffer, T.;</b> Are Roadside Surveys of Secretive Marsh Birds in the Prairie Pothole Region Biased?	<b>10:45</b>
W6.3 <b>Ng, J.;</b> Influence of environmental and anthropogenic factors on ferruginous hawk home range selection	W7.3 <b>Yezerinac, S.;</b> Connecting Dunlin breeding sites with migratory stopover and wintering locations using light-level geolocation	W8.3 <b>Manthey, J.;</b> Ecological selection or environmental drift in western North American phylo-species?	W9.3 <b>Drake, A.;</b> ENSO-driven westerly winds during spring migration influences breeding phenology, productivity and annual survival of a neotropical migrant on the western flyway	W10.3 <b>Hannah, K.;</b> Bring on the night: using autonomous recording units to help develop survey designs for common nighthawks in boreal landscapes.	<b>11:00</b>
W6.4 <b>Knowlton, J.L.;</b> Interactive effects of invasive rats and forest fragmentation on density, nest survival, and behavior of native Hawaiian birds	W7.4 <b>Gardiner, R.;</b> Differences in morphology influence the stopover ecology of two Calidrid sandpipers on southward migration	W8.4 <b>Pruett, C.;</b> Evidence from the genetics of eleven landbird species for a forested refugium in the Haida Gwaii area	W9.4 <b>Dybala, K.*;</b> Effects of weather and fledge date on survival in juvenile Song Sparrows vary by developmental stage	W10.4 <b>Peele, A.;</b> Calibrating point-count surveys using intensive territory mapping: estimating density of migratory passerine populations in wintering habitats	<b>11:15</b>
W6.5 <b>Ozelski, A.;</b> Landscape composition differs with age structure in populations of Yellow Warblers ( <i>Setophaga petechia</i> ) in the Midwest United States	W7.5 <b>Gómez, V.;</b> Diversity and abundance of Neotropical migratory landbirds across an altitudinal gradient in northern Colombia during spring migration	W8.5 <b>Rauri, B.;</b> Gene trees, species trees and historical biogeography of the African Guineo-Congolian rainforest	<b>Withdrawn</b>	W10.5 <b>Robertson, E.;</b> Density, Breeding Stage, and Sex Affect Rail Broadcast Survey Results	<b>11:30</b>
W6.6 <b>Miller, K.;</b> Northern Bobwhite Population Structure and Diversity in Texas and the Great Plains	W7.6 <b>McKellar, A.*;</b> Experimentally delaying arrival timing reduces reproductive success of male American redstarts	W8.6 <b>Zink, R.;</b> Inferring the location of glacial refugia using niche modeling and phylogeography	W9.6 <b>Cann, R.;</b> Females lead demographic collapse of the endangered Hawaii creeper from competition with an introduced bird	W10.6 <b>Lyons, J.;</b> Detection probability of shorebirds, waterfowl, and wading birds in vegetated wetlands	<b>11:45</b>

**WEDNESDAY, 15 AUGUST – Early Afternoon Sessions, S1 – W12**

Room	Hennings 200	Hennings 201	Hennings 202	Buchanan A102	Buchanan A103
Session	Symposium 1	Symposium 2	Symposium 3	W11: Molecular ecology	W12: Conservation
1:30	S1.1 <b>Sauer, J.</b> ; Accommodating geographic scale in the analysis of species groups from the North American Breeding Bird Survey	S2.1 <b>Fraser, K.</b> ; Constrained migration schedules in a trans-hemispheric migrant songbird	S3.1 <b>Fox, T.</b> ; Investigating effects of offshore wind facilities on birds: The Danish experience.	W11.1 <b>Wheeler, M.</b> ; Assessing the Genetic Diversity and Distinctness of Eastern North American Golden Eagles: Long Term Conservation Impacts of Exotic Introductions on a Small Native Population	W12.1 <b>Nichols, K.S.</b> ; Bird Collisions from an Architectural Perspective: An Analysis of a Long-term Citizen Science Monitoring Project
1:45	S1.2 <b>Bayne, E.</b> ; Estimating population sizes of landbirds from non-standardized point-count surveys in North America's boreal forest: making the most of a potentially messy situation	S2.2 <b>Heckscher, C.</b> ; Spatial and temporal aspects of intratropical movement of the Veery ( <i>Catharus fuscescens</i> ) using geolocators		W11.2 <b>Saucier, J.</b> ; Combining population and landscape genetic approaches to test divergence hypotheses in the <i>Thryothorus modestus</i> complex	W12.2 <b>Hager, S.</b> ; Avian mortality from window collisions is highest at only a small subset of buildings in an urban landscape
2:00	S1.3 <b>Thogmartin, W.</b> ; Extinction risk estimated for every bird adequately surveyed by the North American Breeding Bird Survey	S2.3 <b>Renfrew, R.</b> ; Migration of Bobolinks from across the breeding range	S3.2 <b>Langston, R.</b> ; Birds and Offshore Wind Farms: a UK perspective	W11.3 <b>Alessi, S.</b> ; Delayed dispersal and family living weakly influence kin-structuring in the neotropical Buff-breasted wren ( <i>Cantorchilus leucotis</i> ) in Gamboa, Panama	W12.3 <b>Arnold, T.</b> ; Collision Mortality in North American Birds
2:15	S1.4 <b>Roy, C.</b> ; Using the Waterfowl Breeding Population and Habitat Survey to identify spatial population dynamics in boreal ducks	S2.4 <b>Tøttrup, A.</b> ; Year-round tracking reveals delayed spring arrival as a result of drought at African stopover sites in long-distance migratory songbirds		W11.4 <b>Moulton, L.</b> ; Evidence of genetic introgression found in last remaining "pure" population of Golden-winged Warblers	W12.4 <b>Machtans, C.</b> ; How Many Birds Die Every Year in Canada From Collisions with Buildings?
2:30	S1.5 <b>Fink, D.</b> ; The challenges of using continental-scale data to aid local decision-making	S2.5 <b>MacDonald, C.</b> ; Range-wide patterns of migratory connectivity in an arctic-breeding passerine, the Snow Bunting ( <i>Plectrophenax nivalis</i> ), revealed using band recoveries, geolocators and stable isotope analysis	S3.3 <b>Paton, P.</b> ; Assessing the potential impacts of offshore wind facilities on birds: in the beginning	W11.5 <b>Kennedy, K.</b> ; Examining the modes of selection maintaining the Pheucticus Great Plains hybrid zone using genomic cline analysis of AFLP data	W12.5 <b>Alsip, R.</b> ; Preventing avian mortality using externally applied film markers.
2:45	S1.6 <b>Cumming, S.</b> ; Integrating avian habitat models and conservation planning across North America's boreal forest	S2.6 <b>McFarland, K.</b> ; Migratory movements and winter distribution of Bicknell's Thrush ( <i>Catharus bicknelli</i> ): gaining insights from geolocators		W11.6 <b>Toews, D.*</b> ; Introgression in the yellow-rumped warbler species complex: can variation in migratory behaviour explain differences in mitochondrial genotype and phenotype in a cryptic hybrid zone?	W12.6 <b>Loss, S.</b> ; The impact of feral and free-ranging house cats on birds in the United States

**WEDNESDAY, 15 AUGUST – Early Afternoon Sessions, W13 – W17**

<b>Buchanan A104</b>	<b>Buchanan A201</b>	<b>Buchanan A202</b>	<b>Chemistry B150</b>	<b>Chemistry B250</b>	<b>Room</b>
<b>W13: Conservation</b>	<b>W14: Foraging</b>	<b>W15: Evolution</b>	<b>W16: Models and methods</b>	<b>W17: Habitat relationships</b>	<b>Session</b>
W13.1 <b>Leonard, M.L.</b> ; Ambient noise disrupts nestling begging responses in Tree Swallows	W14.1 <b>Wiley, A.</b> ; A millennial-scale record of foraging ecology in the endangered Hawaiian Petrel: Isotopic evidence of recent human impact to pelagic food webs	W15.1 <b>Beckman, E.</b> ; Sorting the South American siskins: the role of ecology in a rapid continental radiation	W16.1 <b>Conkling, T.</b> ; Discrepancy in nest survival estimates between search methods for grassland birds	W17.1 <b>Tremblay, J.A.</b> ; A case study of the interaction between landscape configuration and habitat use at a wind facility by Golden Eagles ( <i>Aquila chrysaetos</i> )	<b>1:30</b>
W13.2 <b>Francis, C.</b> ; Anthropogenic noise alters key ecological services provided by birds	W14.2 <b>Bonter, D.</b> ; Cache economy: Inter-annual variability in reliance on supplemental food revealed by "smart" feeders	W15.2 <b>Clark, A.</b> ; Wanderers, colonists and urban dwellers: DRD4 gene and phenotypic variation among American crows ( <i>Corvus brachyrhynchos</i> )	W16.2 <b>Crewe, T.</b> ; Effect of random variation and sampling intensity on the use of raptor migration count data for population monitoring	W17.2 <b>Nuse, B.</b> ; On the feasibility of predicting effects of sea level rise on tidal wetland birds: Examples from the Georgia coast.	<b>1:45</b>
W13.3 <b>Myles, F.</b> ; Are Bank Swallow populations eroding away?	W14.3 <b>Hanson, M.</b> ; Changes in the food habits of Breeding Bald Eagles ( <i>Haliaeetus leucocephalus</i> ) in Florida Bay, Everglades National Park	W15.3 <b>Harvey, M.*</b> ; Phylogeographic discord in the comparative genomics history of Neotropical birds	W16.3 <b>Guerrero, M.</b> ; Modeling breeding habitat preferences of Black capped Vireo in Mexico at different spatial scales	W17.3 <b>LeBeau, C.</b> ; Short-Term Impacts to Greater Sage-Grouse from Wind Energy Development	<b>2:00</b>
W13.4 <b>Dibala, R.</b> ; Conspecific Social Cues Strongly Influence Male Cerulean Warbler Settlement Patterns	W14.4 <b>Lyons, D.</b> ; Comparative foraging ecology of two sympatric piscivorous waterbirds in the Columbia River estuary, USA	W15.4 <b>Stryjewski, K.*</b> ; Speciation Genomics of an Extraordinary Avian Radiation, the <i>Lonchura Munias</i> in Papua New Guinea	W16.4 <b>Crampton, L.</b> ; Occupancy surveys for a critically endangered, highly cryptic, single island endemic, the Puaiohi	W17.4 <b>Esler, D.</b> ; Winter Site Selection by Surf Scoters Reflects Continental-Scale Trade-Offs	<b>2:15</b>
W13.5 <b>Poole, A.</b> ; Is the Caribbean Osprey at risk?	W14.5 <b>Craig, E.</b> ; Do winter foraging decisions affect breeding condition of Double-crested Cormorants? Exploring seasonal interactions in a migratory waterbird.	W15.5 <b>Bitton, P-P.*</b> ; Sympatry and plumage evolution in the genus Trogon	W16.5 <b>Nolte, E.</b> ; Raptors present, yet unobserved: Detectability at a western migration watch-site and its effect on trend analysis	W17.5 <b>Porzig, E.*</b> ; A time series meets a habitat model: Evaluating the influence of habitat change and population process on songbird abundance	<b>2:30</b>
W13.6 <b>Mortensen, J.</b> ; The role of social behavior in buffering populations from extinction: persistence of the endangered cooperatively breeding White-breasted Thrasher on St. Lucia	W14.6 <b>Danner, R.</b> ; Experimental support for adaptive mass regulation in a temperate migrant	W15.6 <b>Jones, M.</b> ; Immunogenetic adaptation and reproductive isolation along elevational gradients in Rufous-collared Sparrows	W16.6 <b>Brown, S.</b> ; Singing Rates of Radiotagged Bachman's Sparrows	W17.6 <b>Routhier, D.</b> ; Wetland Occupancy and Productivity Patterns of Grebes in Prairie Canada: Effects of Interspecific Competition, Wetland Structure and Landscape Composition	<b>2:45</b>

WEDNESDAY, 15 AUGUST – Late Afternoon Sessions, S1 – W12

Room	Hennings 200	Hennings 201	Hennings 202	Buchanan A102	Buchanan A103
Session	Symposium 1	Symposium 2	Symposium 3	W11: Molecular ecology	W12: Conservation
3:30	S1.7 <b>Matthews, S.;</b> Integrating pattern and process across spatial scales to assess the potential effects of climate change on forest birds	S2.7 <b>Gardali, T.;</b> Migratory connections of the Golden-crowned Sparrow and Swainson's Thrush: geography and strength	S3.4 <b>Gordon, C.;</b> Utility of high resolution imaging surveys for offshore wind bird risk/impact studies	W11.7 <b>Walsh, J.;</b> Introgression of morphological traits and neutral genetic variation in a hybrid zone between saltmarsh and nelson's sparrows	W12.7 <b>Lounsberry, Z.*;</b> Conservation status of buff-breasted sandpipers ( <i>tryngites subruficollis</i> ): a conservation genetic approach
3:45	S1.8 <b>Stralberg, D.;</b> Forest passerine distribution models and climate change projections for boreal North America: addressing challenges and uncertainties	S2.8 <b>Hallworth, M.;</b> Quantifying migratory connectivity for a Neotropical migratory bird using direct and indirect techniques		W11.8 <b>Wommack, E.;</b> Molecular analysis of a population decline in a long-standing breeding population of american kestrels in saskatchewan, canada	W12.8 <b>Wallace, S.*;</b> Determining population genetic variation of Cassin's Auklet: are multiple conservation units needed?
4:00	S1.9 <b>Veloz, S.;</b> Examining the tradeoffs between using citizen science data and standardized observations for modeling how climate change will affect the distribution and abundance of birds at regional scales	S2.9 <b>Bridge, E.;</b> Manipulating migration: experimental examination of carry over effects on molt and movement in Painted Buntings.	S3.5 <b>Mizrahi, D.;</b> Using marine radar to characterize avian movement dynamics in offshore marine environments: advantages, challenges and findings.	W11.9 <b>Jedlicka, J.;</b> Molecular Tools Reveal Diets of Insectivorous Birds from Predator Fecal Matter	W12.9 <b>Kapetanakos, Y.;</b> Filling in the gaps: Using non-invasive genetic mark-recapture to develop a comprehensive demographic assessment of critically endangered vultures in Cambodia
4:15	S1.10 <b>LaSorte, F.;</b> Migration dynamics of North American birds	S2.10 <b>Norris, R.;</b> Migratory connectivity and long-term demographics in Tree swallows		W11.10 <b>Lerner, H.;</b> Next generation sequencing for population and phylogenetic studies: reference free mitochondrial genome sequencing across the avian tree of life	W12.10 <b>Schulwitz, S.;</b> Isolated Population Of Greater Sage-Grouse In Northwest Wyoming Revealed By Microsatellite Data
4:30	S1.11 <b>Winkler, D.;</b> Patterns in the survival and demography of Tachycineta swallows across the Western Hemisphere	S2.11 <b>Smith, J.;</b> Exploring the annual cycle of Eastern Willets using geolocators and wet/dry activity loggers	S3.6 <b>Pérez Lapeña, B.;</b> Statistical power in testing seabird displacement due to an offshore wind farm: a case study off the coast of Rhode Island	W11.11 <b>Contina, A.;</b> Past, present, and future of the Painted Bunting: what can genetic markers tell us?	W12.11 <b>Bishop, C.;</b> Population biology, genetics and identification of critical habitat of the endangered population of the Western Yellow-breasted Chat ( <i>Icteria virens auricollis</i> ) in BC
4:45	S1.12 <b>DeSante, D.;</b> Using MAPS vital rates to identify demographic causes of population trends	S2.12 <b>McKinnon, E.*;</b> Testing proximate hypotheses for spring protandry in Wood Thrushes using geolocators		W11.12 <b>Goldstein, G.;</b> Possible effect of the species of bird, its behavioral ecology, and the sampling site on differences in the feather degrading gene of plumage bacteria from different species of songbirds.	End
<b>Poster Session 1 – Day One</b>					

**WEDNESDAY, 15 AUGUST – Late Afternoon Sessions, W13 – W17**

<b>Buchanan A104</b>	<b>Buchanan A201</b>	<b>Buchanan A202</b>	<b>Chemistry B150</b>	<b>Chemistry B250</b>	<b>Room</b>
<b>W13: Conservation</b>	<b>W14: Foraging</b>	<b>W15: Evolution</b>	<b>W16: Models and methods</b>	<b>W17: Habitat relationships</b>	<b>Session</b>
W13.7 <b>Bradley, D.;</b> Dialect-based assortative mating following translocation of the endangered North Island Kokako ( <i>Callaeas wilsoni</i> )	W14.7 <b>Sherry, T.;</b> High dietary overlap and opportunism consuming arthropods including coffee berry borer by five wood warbler species wintering in Jamaican shade coffee farms	W15.7 <b>Miller, M.;</b> Implications for the speciation process from a survey of secondary contact among Panamanian landbirds	W16.7 <b>Wiest, W.*;</b> The effects of survey effort, time, and frequency on occupancy, abundance, and detection probability estimates for salt marsh birds	W17.7 <b>DeLeon, E.;</b> Habitat associations and flock characteristics of Rusty Blackbirds ( <i>Euphagus carolinus</i> ) wintering in Louisiana	<b>3:30</b>
W13.8 <b>Bowman, R.;</b> Translocation of Florida Scrub-Jays increases local populations and reduces metapopulation extinction risk.	W14.8 <b>Espino, J.;</b> Hummingbird pollen deposition and fruit production in two <i>Salvia</i> species (Sages) that differ in the staminal lever mechanism.	W15.8 <b>Sari, E.*;</b> Molecular and morphological variation in the Galápagos flycatcher ( <i>Myiarchus magnirostris</i> )	W16.8 <b>Igl, L.;</b> Total-area counts versus point counts for surveying breeding birds in grasslands	W17.8 <b>Frey, S.;</b> Ups and downs: Long-term songbird population trends across an elevational gradient in the Hubbard Brook Experimental Forest, NH	<b>3:45</b>
W13.9 <b>Farmer, C.;</b> Translocation of Millerbirds from Nihoa to Laysan	W14.9 <b>Burle, M-H.;</b> Independent evolution of nectarivory: tuamotu sandpipers are nectar-feeders	W15.9 <b>Tarwater, C.E.;</b> Opposing viability and fecundity selection and the drivers of selection on onset of breeding in a tropical parrot	W16.9 <b>d'Entremont, M.;</b> Development of analytical protocols for bird migration data collected by radar $\zeta$ tools and techniques	W17.9 <b>Saab, V.;</b> Avian community responses to a mountain pine beetle outbreak in Montana	<b>4:00</b>
W13.10 <b>Newstead, D.;</b> A unique population of Red Knots wintering in south Texas and using Central Flyway	W14.10 <b>Sustaita, D.;</b> Integrating morphology, performance, and feeding ecology in Loggerhead Shrikes	W15.10 <b>Block, N.L.*;</b> Parasites reveal despeciation of deeply divergent lineages in a passerine	W16.10 <b>Dornak, L.;</b> Use of ecological niche models to determine extent of potentially suitable habitat for Henslow's Sparrows across their breeding distribution	W17.10 <b>Pruett, S.;</b> Components of productivity: The contribution of top-down versus bottom-up factors under differing landscape contexts.	<b>4:15</b>
W13.11 <b>Brisson, A.;</b> A Global Study of Color, Ornamentation, Song and Mimicry in Birds: Charismatic Species are more Vulnerable to Exploitation and Endangerment	W14.11 <b>Goldberg, J.;</b> Spatial patterns during the fledgling period: Parental foraging and provisioning strategies relative to fledgling dispersion	W15.11 <b>Stiles, G.;</b> Tomial Serrations in hummingbirds: distribution, form and possible functions	W16.11 <b>Styring, A.;</b> Avian detectability and community structure in a Bornean rainforest canopy: comparing simultaneous ground- and canopy-based surveys	W17.11 <b>Squires, K.;</b> Demise of a paradigm? Why 'habitat thresholds' don't tell us how much habitat is enough	<b>4:30</b>
End	W14.12 <b>Kirsch, E.;</b> Tree species preferences of foraging birds during spring migration in Upper Mississippi River floodplain forests	End	W16.12 <b>Ball, J.;</b> Using video monitoring to assess the accuracy of field-based estimates of songbird nest fate and nest productivity.	W17.12 <b>Turner, D.;</b> Nest-site habitat and its effects on daily survival rate of American Robins ( <i>Turdus migratorius</i> ) in the sub-Arctic	<b>4:45</b>
<b>Poster Session 1 – Day One</b>					

**THURSDAY, 16 AUGUST – Morning Sessions, T1 – T5**

Room	Hennings 200	Hennings 201	Hennings 202	Buchanan A102	Buchanan A103
Session	T1: Biogeography	T2: Urban ecology	T3: Migration and stopover	T4: Diseases and parasites	T5: Behaviour
10:30	T1.1 <b>Cuervo, A.M.*</b> ; Evolutionary assembly of the Andean avifauna: A comparative phylogeographic study of diversification and elevational distribution	T2.1 <b>Tomasevic, J.A.*</b> ; Are humans facilitating native secondary cavity nesting birds in suburban areas? Insights from the greater Seattle area.	T3.1 <b>Taylor, C.</b> ; Using network models to describe the population dynamics of migratory birds.	T4.1 <b>Keller, J.</b> ; <i>Campylobacter jejuni</i> , coli, and lari prevalence in agriculturally associated and migratory wild birds	T5.1 <b>MacDonald, E.</b> ; Songbird Incubation Dilemmas in the Alpine: Managing Parent-Offspring Tradeoffs in a Variable Thermal Environment
10:45	T1.2 <b>Seeholzer, G.</b> ; Extreme geographic variation in body size as a mechanism of local adaptation: bergmann's rule in the high andes	T2.2 <b>Rodewald, A.</b> ; Demographic consequences of altered bird-plant networks in urbanizing landscapes.	T3.2 <b>Mitchell, G.*</b> ; Timing of breeding carries over to influence migratory departure in a songbird: an automated radiotracking study	T4.2 <b>Lombardo, M.P.</b> ; Chewing Lice and Tree Swallow Biology	T5.2 <b>Ryder, T.</b> ; The ecological-evolutionary interplay: density-dependent sexual selection in a migratory songbird
11:00	T1.3 <b>Cibois, A.</b> ; Landbird colonization of the Pacific Ocean: molecular phylogenetics and biogeography of the fruit-doves ( <i>Ptilinopus</i> )	T2.3 <b>Kearns, L.</b> ; Do patterns of nest predator activity predict nest locations and survival in urbanizing landscapes?	T3.3 <b>La Puma, D.</b> ; Weather Radar Identifies Importance of Bottomland Forests and Coastal Mosaic for Migrating Landbirds in Southeastern U.S.	T4.3 <b>O'Brien, E.</b> ; Host sex predicts susceptibility to parasitism and influences parasite population size within avian broods	T5.3 <b>Collar, S.</b> ; There goes the neighborhood: site fidelity and group adherence at a Caspian Tern ( <i>Hydroprogne caspia</i> ) colony facing habitat reduction and increased predation
11:15	T1.4 <b>Oswald, J.</b> ; The effect of Andean uplift and Pleistocene climate change on distributions of passerines in tropical dry forests	T2.4 <b>Chiavacci, S.</b> ; Factors affecting the nest success of shrubland birds in rural and urban landscapes of Illinois	T3.4 <b>Delmore, K.*</b> ; Tracking Swainson's thrushes along divergent migratory pathways using light-level geolocators	T4.4 <b>Silverio, C.</b> ; The Effects of Avian Malaria on Fitness, Extra Pair Paternity and Migration: a Medication Experiment	T5.4 <b>Barton, D.*</b> ; Timing and proximate causes of mortality in wild bird populations: testing Ashmole's Hypothesis
11:30	T1.5 <b>Kirschel, A.</b> ; The extent of trait similarity at contact zones influences range overlap and the trajectory of multidimensional character displacement in African tinkerbirds ( <i>Pogoniulus</i> spp.)	T2.5 <b>Sumasgutner, P.*</b> ; Nest-site selection and habitat use of urban Kestrels: Are buildings ecological traps?	T3.5 <b>Duerr, A.</b> ; Weather drives migratory flight behavior of Golden Eagles: implications for understanding wind-wildlife interactions and climate change effects on migratory behavior	T4.5 <b>Knutie, S.</b> ; The impact of introduced <i>Philornis</i> nest flies on Galapagos mockingbirds	T5.5 <b>Yao, M-C.</b> ; Use of mammalian dung and its potential functions in nesting Fairy Pitta ( <i>Pitta nympha</i> )
11:45	T1.6 <b>James, H.</b> ; The Geography and Chronology of Decline in Breeding Seabirds in the Main Hawaiian Islands	T2.6 <b>Williams, C.</b> ; Reproductive Success of the Western Burrowing Owl ( <i>Athene cunicularia hypugaea</i> ) in Agricultural and Urban Habitats of Dona Ana County, New Mexico	T3.6 <b>Valdez-Juarez, S.</b> ; Winter habitat effects on the individual condition and territoriality of Yellow warblers ( <i>Setophaga petechia</i> ) in natural and agricultural habitats in Jalisco, Mexico	T4.6 <b>Urban, E.*</b> ; The Role of Oropharyngeal pH in the Persistence of <i>Trichomonas gallinae</i> in Cooper's Hawks ( <i>Accipiter cooperii</i> )	T5.6 <b>Wiebe, K.</b> ; Young titmice acquire prey preferences and foraging behaviours through social learning



THURSDAY, 16 AUGUST – Morning Sessions, T6 – T10

<b>Buchanan A104</b>	<b>Buchanan A201</b>	<b>Buchanan A202</b>	<b>Chemistry B150</b>	<b>Chemistry B250</b>	<b>Room</b>
<b>T6: Songs and vocalizations</b>	<b>T7: Physiology and hormones</b>	<b>T8: Conservation</b>	<b>T9: Ecology</b>	<b>T10: Mating systems</b>	<b>Session</b>
T6.1 <b>Kenyon, H.;</b> Can Song Discriminate between MacGillivray's and Mourning Warblers in a Narrow Hybrid Zone?	T7.1 <b>DeVries, S.;</b> Elevated testosterone might not be necessary to support female aggression in incubating Northern Cardinals ( <i>Cardinalis cardinalis</i> )	T8.1 <b>Tarr, N.;</b> The Gap Analysis Program: National databases for enhancing bird conservation	T9.1 <b>Rourke, J.;</b> Factors influencing Sandhill Crane Site Selection and Habitat Use during Fall-Staging Prior to Southward Migration, Lower Mainland, BC	T10.1 <b>Kramer, P.;</b> Benefits of extra-pair mate choice: are extra-pair young more fit than within-pair young?	<b>10:30</b>
T6.2 <b>Grava, A.;</b> Character displacement in dawn chorusing behaviour of sympatric black-capped and mountain chickadees.	T7.2 <b>Forsman, A.;</b> Experimentally increased bacterial load in tree swallow nests influences egg defenses and immune-based maternal effects, but not as expected	T8.2 <b>Cabrera, L.;</b> Putting acoustic monitoring science into practice: development, challenges and opportunities for Point Pelee National Park Monitoring Program	T9.2 <b>McCann, S.;</b> Do Red-throated Caracaras have a chemical wasp repellent?	T10.2 <b>Gill, S.;</b> Evolution and life-history correlates of long-term monogamy in North American passerines	<b>10:45</b>
T6.3 <b>Bolus, R.;</b> Common yellowthroat ( <i>Geothlypis trichas</i> ) song predicts habitat characteristics, arthropod abundance, and male quality	T7.3 <b>Fokidis, H.B.;</b> Food restriction induces social instability and rapid changes in circulating steroids in male Zebra Finches ( <i>Taeniopygia guttata</i> )	T8.3 <b>Davidson, P.;</b> Using citizen science data to test hypotheses on shorebird population change	T9.3 <b>Frye, G.*;</b> Effects of sagebrush chemical composition on diet selection and habitat use by an avian herbivore, the Greater Sage-Grouse	T10.3 <b>Reitsma, L.;</b> Extra-pair paternity in a Canada Warbler population in central New Hampshire	<b>11:00</b>
T6.4 <b>Poesel, A.;</b> Delayed song maturation and territorial aggression in a songbird	T7.4 <b>Thomas, N.;</b> Metabolic rates of Least and Pectoral sandpipers at a stopover site during spring migration.	T8.4 <b>Seavy, N.;</b> Incorporating birds into a market for ecosystem services: A case study from Central California	T9.4 <b>Tringali, A.;</b> Shared Genes, Shared Environments: Using an animal model to estimate the influences of genetics and environment on plumage color in Florida Scrub-Jays	T10.4 <b>Kus, B.;</b> Female-biased sex ratio and facultative polygyny in a declining population of the endangered Southwestern Willow Flycatcher	<b>11:15</b>
T6.5 <b>Baldo, S.*;</b> More than meets the ear: the relationship between snow bunting song, oxidative stress, and reproductive performance	T7.5 <b>Prior, N.;</b> Neuroendocrinology of pair-maintenance behavior in a social songbird, the zebra finch	T8.5 <b>Loring, P.;</b> Phenology and habitat use of Black Scoters wintering in Southern New England - New York Bight in relation to proposed offshore wind facilities	T9.5 <b>Walker, L.;</b> Recreation Changes the Use of a Wild Landscape by Corvids: Local Effects and Ecosystem Repercussions	T10.5 <b>Liu, I.;</b> The role of mating system in sperm competition and protein evolution in <i>Agelaius</i> blackbirds	<b>11:30</b>
T6.6 <b>Wright, S.*;</b> Song learning preferences differ between two closely related chickadee species	T7.6 <b>Zanette, L.;</b> Food use by songbirds is affected by the experience of nest predation: implications for indirect predator effects on clutch size	End	T9.6 <b>Pavlacky, D.;</b> Landscape change promotes asymmetric dispersal and limits regional patch occupancy in a spatially structured rainforest bird population	End	<b>11:45</b>

**THURSDAY, 16 AUGUST – Early Afternoon Sessions, S4 – T12**

Room	Hennings 200	Hennings 201	Hennings 202	Buchanan A201	Buchanan A202
Session	Symposium 4	Symposium 5	Symposium 6	T11: Ecology	T12: Breeding biology
1:30	S4.1 <b>Francis, C.</b> ; Opportunities and challenges for integrating acoustic technologies into continental bird monitoring programs	S5.1 <b>Carling, M.</b> ; Introgression on a genomic scale: Harnessing the power of next-generation sequencing to investigate hybridization between <i>Passerina amoena</i> and <i>Passerina cyanea</i>	S6.1 <b>Kellerman, J.</b> ; Phenological synchrony, habitat breadth, and responses to climatic variation of bird migration in the Madrean Archipelago and the American southwest	T11.1 <b>Morrison, K.W.</b> ; Does a migration carryover effect underlie individual variation in extreme egg-size dimorphism in Eastern Rockhopper Penguins?	T12.1 <b>Newbrey, J.</b> ; A Comparison of Breeding Bird Habitat Quality between Natural and Restored Wetlands Using a Novel Yolk Carotenoid Approach
1:45	S4.2 <b>Rempel, R.</b> ; Acoustic techniques to improve the power of songbird monitoring data: treating policy as hypothesis		S6.2 <b>van Riper III, C.</b> ; The Influence of plant phenological patterns on migrating neotropical migrant warblers in western North America	T11.2 <b>Bortolotti, L.</b> ; *U; Hydrogen isotope variability in food webs of Prairie landscapes: implications for studies of migratory connectivity	T12.2 <b>Holberton, R.</b> ; Body Condition in Adult Auks in Response to Annual Variation in Environmental Conditions at Machias Seal Island in the Gulf of Maine
2:00	S4.3 <b>Drake, K.</b> ; Using digital recordings to estimate occupancy patterns of secretive marsh birds	S5.2 <b>Ruegg, K.</b> ; Population genomics of the Swainson's thrush, <i>Catharus ustulatus</i>	S6.3 <b>Fontaine, T.J.</b> ; The interplay of climate and land-use change: Implications for a long distance migrant	T11.3 <b>Freeman, B.</b> ; Interspecific competition explains bimodal distribution of a New Guinean songbird along an elevational gradient	T12.3 <b>Berkunsky, I.</b> ; Breeding Ecology of the Blue Fronted Parrot ( <i>Amazona aestiva</i> ) in the Argentinean Chaco
2:15	S4.4 <b>Powers, M.</b> ; Using acoustic monitoring for targeted species monitoring—a case study with Whip-poor-wills		S6.4 <b>Inouye, D.</b> ; Asynchronous changes in phenology of migrating Broad-tailed Hummingbirds and their early-season nectar resources	T11.4 <b>Beerens, J.</b> ; Modeling wading bird foraging trade-offs to guide restoration planning	T12.4 <b>Kwon, E.</b> ; Changes in breeding phenology and reproductive success of long-distance migratory shorebirds: comparative study over two decades
2:30	S4.5 <b>Dawson, D.</b> ; Estimating bird population densities using microphone arrays	S5.3 <b>Chen, N.</b> ; Evolutionary inference from genome-wide SNP assays of the long-studied Florida Scrub-Jay	S6.5 <b>Carlise, J.</b> ; Exploring climate impacts on migration timing and energetic condition of autumn migrant raptors and passerines in southwestern Idaho	T11.5 <b>Smith, K.</b> ; Nesting ecology of the black-capped vireo in southwest texas	T12.5 <b>Treen, G.</b> ; Reproductive allocation trade-offs are related to nest characteristics in tree swallows ( <i>tachycineta bicolor</i> )
2:45	S4.6 <b>Borker, A.</b> ; Acoustic activity as an index of relative abundance at seabird colonies: a low-cost and scalable tool for measuring conservation outcomes		S6.6 <b>Kasper, T.</b> ; Timing of migration within and between seasons	T11.6 <b>Frei, B.</b> ; Red-headed Woodpeckers Exhibit Non-Ideal Habitat Selection in a Human-Modified Landscape	T12.6 <b>Kendrick, S.</b> ; Eastern Wood-Pewee breeding demography across a savanna-woodland-forest gradient in the Missouri Ozarks

Buchanan A102	Buchanan A103	Buchanan A104	Chemistry B150	Chemistry B250	Room
T13: Phylogeography	T14: Conservation	T15: Conservation	T16: Ecotox/Pollution	T17: Movements and dispersal	Session
T13.1 <b>Sanchez, C.;</b> Origin and phylogeography of the endemic avifauna of the Pacific rainforest of Costa Rica and western Panama	T14.1 <b>Sheehan, J.;</b> Breeding songbird response to conventional and unconventional oil and natural gas development in West Virginia	T15.1 <b>Claassen, A.;</b> Breeding Success and Conservation of Sandbar-nesting Birds along the Mekong River in Cambodia	T16.1 <b>Johnson, E.;</b> An independent assessment of oiling frequency in birds following the BP Deepwater Horizon oil disaster	T17.1 <b>Gratto-Trevor, C.;</b> Connectivity of Piping Plovers, a species at risk, from a previously unknown major wintering area, The Bahamas	1:30
T13.2 <b>Perktas, U.;</b> Phylogeny, phylogeography and species limits in the turacos (musophagidae)	T14.2 <b>Mahoney, A.;</b> Indirect Effects of Wind Energy Development on Breeding Grassland Birds	T15.2 <b>Bardo, L.;</b> Comparisons of adult morphology, nest success and nestling growth between captive-bred, first-generation captive and wild American kestrels ( <i>Falco sparverius</i> )	<b>Withdrawn</b>	T17.2 <b>Suzuki, Y.;</b> Demography and Inter-colony Movements of Caspian Terns in the Pacific Coast Region of North America	1:45
T13.3 <b>Barrowclough, G.;</b> Phylogeography and species-limits in the Spruce Grouse complex.	T14.3 <b>Lie Dahl, E.;</b> Population effects from a wind power plant on the White-tailed eagle ( <i>Haliaeetus albicilla</i> )	T15.3 <b>Aldinger, K.;</b> Conservation of Golden-winged Warblers on pasturelands in West Virginia	T16.3 <b>Evers, D.;</b> Assessing mercury in songbirds: A new concern for bird conservation	T17.3 <b>Noel, B.;</b> Does high annual survivorship result in habitat saturation, and ultimately delayed dispersal of Pileated Woodpeckers?	2:00
T13.4 <b>Andersen, M.J.;</b> Phylogeography in the southwest Pacific: systematics, biogeography, and species limits in the Golden Whistler ( <i>Pachycephala pectoralis</i> ) complex	T14.4 <b>Katzner, T.;</b> Topography drives migratory flight altitude of golden eagles: implications for wind energy development	T15.4 <b>Raphael, M.;</b> Conservation of the marbled murrelet in the Pacific Northwest, USA	T16.4 <b>Tozer, D.;</b> Common Loon reproductive success in Canada: the west is best but not for long	T17.4 <b>Haché, S.;</b> Estimating natal dispersal of Ovenbirds ( <i>Seiurus aurocapilla</i> ) using d2H and d34S isoscapes	2:15
T13.5 <b>Mauck III, W.M.;</b> Phylogeography of the Red-Shouldered Hawk ( <i>Buteo lineatus</i> ): A case of multiple refugia in the eastern United States	T14.5 <b>Dwyer, J.;</b> A Logistic Regression Model to Predict Avian Electrocution Risk	T15.5 <b>Hodum, P.;</b> Conservation threats to, and status of, the seabird community of the Juan Fernández Islands, Chile	T16.5 <b>Jackson, A.;</b> Do high levels of mercury really matter to birds? Reduction in Carolina wren nest success and implications for conservation	T17.5 <b>Scobie, C.;</b> Influence of Sound on Burrowing Owl Nocturnal Space-Use	2:30
T13.6 <b>Peters, J.;</b> Population structure and gene flow in Holarctic ducks: Evidence from a genomic transect	T14.6 <b>Harness, R.;</b> Avian Electrocutions in Western Rajasthan, India	T15.6 <b>Conover, R.;</b> Demographic responses of the Dickcissel to early-succession management practices in Mississippi	T16.6 <b>Frederick, P.;</b> Does mercury exposure affect avian survival?	T17.6 <b>Green, M.C.;</b> Movement and gene flow throughout the breeding range of North Americas rarest heron, the Reddish Egret ( <i>Egretta rufescens</i> )	2:45

**THURSDAY, 16 AUGUST – Late Afternoon Sessions, S4 – T12**

Room	Hennings 200	Hennings 201	Hennings 202	Buchanan A201	Buchanan A202
Session	Symposium 4	Symposium 5	Symposium 6	T11: Ecology	T12: Breeding biology
3:30	S4.7 <b>Celis-Murillo, A.</b> ; An experimental evaluation of the performance of acoustic recording systems for estimating avian species richness and abundance	S5.4 <b>McCormack, J.</b> ; Next-generation phylogenomics of 416 loci provides further resolution to the avian tree of life	S6.7 <b>Rockwell, S.*</b> ; Winter drought precedes later spring arrival dates, reduced reproductive success, and lower survivorship in the endangered Kirtland's warbler	T11.7 <b>Diamond, A.</b> ; Seabird diets reflect bottom-up changes to quantity and quality of a keystone prey species in the Bay of Fundy	T12.7 <b>Fisher, R.</b> ; Extreme weather events influence reproductive output of Burrowing Owls in Canada
3:45	S4.8 <b>Desrochers, A.</b> ; Networking Automated Recording Units using wireless technology		S6.8 <b>Ellwood, L.</b> ; Migration phenology in Thoreau's Concord over 150 years	T11.8 <b>Streby, H.</b> ; Thinking outside the nest: the importance of full-season research for understanding productivity and habitat associations of migratory songbirds	T12.8 <b>Graves, E.</b> ; Female-specific plumage traits in Wood Ducks ( <i>Aix sponsa</i> ): Indicators of individual quality?
4:00	S4.9 <b>McKown, M.</b> ; A wireless acoustic sensor network for detecting rare and elusive seabird species: Monitoring Ashy Storm-petrels ( <i>Oceanodroma homochroa</i> ) on Southeast Farallon Island	S5.5 <b>Balakrishnan, C.</b> ; Songbird transcriptomics: linking the genome and social behavior	S6.9 <b>Lany, N.</b> ; Spring leaf phenology, insect availability, and the timing of breeding by a migratory songbird in a North American temperate forest	T11.9 <b>Olalla, A.</b> ; Winter ecology of the long-billed curlew ( <i>numenius americanus</i> ) in the southeast portion of the chihuahuan desert, méxico: first step towards its conservation.	T12.9 <b>Sheppard, J.</b> ; Timing of breeding and reproductive effort in wild mallards ( <i>Anas platyrhynchos</i> ) is related to both female and male quality
4:15	S4.10 <b>Wimmer, J.</b> ; Analysing Acoustic Sensor Data – Methods to Tame the Data Deluge		S6.10 <b>Zuckerberg, B.</b> ; The early bird gets earlier: analyzing shifts in the migration phenology of spring migrants using citizen science	T11.10 <b>Lanctot, R.</b> ; What happens when you remove an apex predator from an Arctic ecosystem? Findings from a 9-year study at Barrow, Alaska.	T12.10 <b>Hatt, J.</b> ; Influence of insect availability on fledgling survival of Black-throated Blue Warblers
4:30	S4.11 <b>Damoulas, T.</b> ; Machine Learning Techniques for Automated Flight Call Detection	S5.6 <b>Chevron, Z.</b> ; Genomic insights into high-altitude adaptation in Rufous-collared Sparrows ( <i>Zonotrichia capensis</i> ) revealed by deep RNA-sequencing	S6.11 <b>Wood, E.</b> ; Variations in climate affect ecosystem services provided by birds during spring migration	End	T12.11 <b>Terhune, T.</b> ; Golden-winged Warbler Rangeside Fecundity and Nesting Habitat Management Strategies
4:45	S4.12 <b>Betts, M.</b> ; Acoustic classification of multiple simultaneous bird species: a multi-instance multi-label approach		S6.12 <b>Wood, E.</b> ; Frontiers in avian phenological monitoring and research: trends, advances, and next steps		T12.12 <b>Burger, J.</b> ; Using geolocator data to reveal incubation periods and breeding biology in red knots ( <i>calidris canutus rufa</i> )

**Poster Session 1 – Day Two**

**THURSDAY, 16 AUGUST – Late Afternoon Sessions, T13 – 17**

<b>Buchanan A102</b>	<b>Buchanan A103</b>	<b>Buchanan A104</b>	<b>Chemistry B150</b>	<b>Chemistry B250</b>	<b>Room</b>
<b>T13: Phylogeography</b>	<b>T14: Conservation</b>	<b>T15: Conservation</b>	<b>T16: Ecotoxicology Pollution</b>	<b>T17: Movements and dispersal</b>	<b>Session</b>
T13.7 <b>Williford, D.</b> ; Species relationships and phylogeography of the bobwhites	T14.7 <b>Craig, E.</b> ; Use of predictive models to describe golden eagle winter distribution in the western United States relative to wind-power development projects	T15.7 <b>Garcia-Perez, B.</b> ; Differential patterns of decline in Barn Swallow ( <i>Hirundo rustica</i> ) breeding in North America: potential effects of stressors on breeding and wintering grounds	T16.7 <b>Eng, M.</b> ; Effects of early exposure to a brominated flame retardant on behaviour and development in birds	T17.7 <b>Cornett, C.</b> ; Movement Ecology of Endangered Hawaiian Goose	<b>3:30</b>
T13.8 <b>Hosner, P.</b> ; Testing the pleistocene aggregate island complex (paic) diversification model in co-distributed avian lineages	T14.8 <b>Johnston, N.</b> ; Wind-energy development along a Golden Eagle ( <i>Aquila chysaetos</i> ) migration route in the eastern Rocky Mountains of Canada: higher flight altitudes post-construction places eagles at lower risk of turbine collision.	T15.8 <b>Burke, D.</b> ; Does logging create ecological traps for Yellow-bellied Sapsuckers?	T16.8 <b>Carlson, J.</b> ; Effects of mercury on flight performance and molt in European Starlings ( <i>Sturnus vulgaris</i> )	T17.8 <b>Stumpf, K.</b> ; Movement patterns and genetic analyses reveal different patterns of population structuring of southwestern willow flycatchers	<b>3:45</b>
T13.9 <b>Dhami, K.</b> ; The influence of interspecific hybridization on the heterogeneity of genetic diversity in Gadwalls and Falcated Ducks	T14.9 <b>Coulton, D.</b> ; Raptor Occupancy and Productivity Near a Barren-ground Diamond Mine, Northwest Territories	T15.9 <b>Elphick, C.</b> ; Does tidal marsh restoration benefit globally vulnerable birds?	T16.9 <b>Cruz, L.</b> ; Emissions from the Athabasca Oil Sands and their Effects on Wild Birds	T17.9 <b>Wheeler, H.</b> ; Movement patterns of breeding Chimney Swifts in relation to landscape features and social attraction	<b>4:00</b>
T13.10 <b>Lait, L.</b> ; From coast to coast: the population genetic structure of the boreal chickadee	T14.10 <b>Leston, L.</b> ; Does shallow gas well development adversely affect daily nest survival of Chestnut-collared longspurs ( <i>Calcarius ornatus</i> ) and other prairie songbirds?	T15.10 <b>Roby, D.</b> ; Double-crested Cormorants in the Pacific Northwest: Status, Conservation, and the Pressure to Control	T16.10 <b>Buck, K.*</b> ; Evaluating the Potential for Adaptive Response to Mercury in Captive-dosed Zebra Finches	T17.10 <b>Wu, J.</b> ; Native and non-native frugivore movement patterns and implications for seed dispersal in Hawaii	<b>4:15</b>
T13.11 <b>Dohms, K.</b> ; Two continents, two species, similar population genetic structure: A peek into nutcracker ( <i>Nucifraga</i> spp.) phylogeography	T14.11 <b>Gaudet, C.</b> ; Grassland songbirds are influenced by natural gas development in southwestern Saskatchewan	T15.11 <b>Borneman, T.</b> ; Effects of human activity on American Oystercatchers breeding at Cape Lookout National Seashore, North Carolina	T16.11 <b>Nocera, J.</b> ; Historical insecticide applications dramatically altered the diet of aerially-foraging insectivorous chimney swifts	T17.11 <b>Rushing, C.</b> ; Quantifying the reproductive consequences of long-distance natal dispersal in a migratory bird, the American redstart	<b>4:30</b>
T13.12 <b>Moyle, R.</b> ; Denser sampling of Pacific monarchs reveals unexpected relationships but clearer biogeographic patterns.	T14.12 <b>Furfey, B.</b> ; Nesting and Foraging Ecology of Black Skimmers ( <i>Rynchops niger</i> ) in Coastal Louisiana following the BP Oil Spill	End	T16.12 <b>States, S.</b> ; Variation in pathogen distribution across hosts drives infection rates in House Finches ( <i>Carpodacus mexicanus</i> ) by the bacterium <i>Mycoplasma gallisepticum</i>	T17.12 <b>Miller, T.</b> ; Seasonal and intraspecific drivers of movement ecology of a migratory avian predator	<b>4:45</b>
<b>Poster Session 1 – Day Two</b>					

**FRIDAY, 17 AUGUST – Morning Sessions, F1 – F5**

Room	Hennings 202	Hennings 200	Hennings 201	Chemistry B150	Buchanan A202
Session	F1: Models and methods	F2: Population biology	F3: Conservation	F4: Tropical ecology	F5: Community ecology
10:30	F1.1 <b>Bird, D.</b> ; Applications of Unmanned Vehicle Systems to Bird Studies	F2.1 <b>McKim-Louder, M.*</b> ; First-year survival in a Neotropical migratory passerine is lower than expected	F3.1 <b>Stewart, L.R.</b> ; The Impact of a Forest Pathogen on the Endangered Golden-cheeked Warbler	F4.1 <b>Kresnik, R.</b> ; Arrival ecology and behavior of wintering ovenbirds ( <i>Seiurus Aurocapilla</i> ): Understanding territory acquisition and space use strategies	F5.1 <b>Stoleson, S.</b> ; Ghosts of herbivory past: Legacy effects of white-tailed deer on forest birds communities
10:45	F1.2 <b>Junda, J.</b> ; Use of a Rotary-winged Remotely Piloted Aerial System (RPAS) to Determine Nest Contents of Raptorial Birds	F2.2 <b>Hurley, V.</b> ; Lifetime reproductive success in Peregrine Falcons across an urban gradient in Australia	F3.2 <b>Botero-Delgado, E.</b> ; The importance of defining distribution patterns to determine the conservation status of Andean populations of <i>Pyrrhura</i> parakeets in north-western South America	F4.2 <b>Dauphine, N.S.</b> ; Avifauna declines in West African logging concessions	F5.2 <b>Ungvari-Martin, J.</b> ; Mosaic of communities: birds in forests of Western Amazonia
11:00	F1.3 <b>Stenhouse, I.</b> ; Super high-definition video aerial surveillance and analysis: Capabilities and results for offshore mid-Atlantic waters	F2.3 <b>Harriman, V.</b> ; Seasonal patterns of offspring quality and survival rates are related to parental and environmental quality in tree swallows ( <i>Tachycineta bicolor</i> ): results of short-term experiments and mark-recapture analyses of long-term data.	F3.3 <b>Hall, L.</b> ; Trash and contaminants in the Motagua River of Guatemala: implications for bird species of the region	F4.3 <b>McDermott, M.</b> ; Ecology of mixed-species flocks in shaded monocultures and silvopastures in the colombian andes	F5.3 <b>Wyman, K.</b> ; Now you see them, now you don't: site occupancy dynamics of Great Lakes colonial waterbirds
11:15	F1.4 <b>Berres, M.E.</b> ; WeBIRD: Connecting people to birds through mobile technology	F2.4 <b>Giroux, J-F.</b> ; What is limiting temperate breeding Canada geese?	F3.4 <b>Sánchez-González, L.A.</b> ; State of the birds of Mexico, a preliminary assessment	F4.4 <b>Hamel, P.</b> ; Mixed Species Migratory Warbler Flocks on Cuba with and without the Nuclear Species Yellow-headed Warbler ( <i>Teretistris fernandinae</i> )	F5.4 <b>Robles, H.</b> ; Qualities of a keystone cavity facilitator for secondary cavity-nesting songbirds: excavator abundance, cavity quality and habitat selection
11:30	F1.5 <b>Williams, K.</b> ; Comparison of banding, acoustic, and NEXRAD radar data for studying passerine migration in upstate New York: A complementary approach	F2.5 <b>Schmutz, J.</b> ; Disease as a Demographic Constraint on a Bering Sea Endemic: the Emperor Goose	F3.5 <b>Chin, A.</b> ; Assessing the Performance of Bird Communities as Indicators of Coastal Wetland Health: The Effect of Great Lakes Water Levels	F4.5 <b>Ruiz-Gutierrez, V.</b> ; Survival of resident neotropical birds: considerations for sampling and analysis based on 20 years of bird banding efforts in Mexico	F5.5 <b>Banko, P.</b> ; Response of a Subalpine Hawaiian Forest Bird Community to Prolonged Drought and Habitat Degradation by Feral Ungulates
11:45	End	F2.6 <b>Lukacs, P.</b> ; Unsustainably low breeding season survival of Kittlitz's Murrelets in Icy Bay, Alaska	F3.6 <b>Hammerly, S.</b> ; An evaluation of inbreeding and possible fitness consequences associated with immunocompetence and survival of the critically endangered Attwater's Prairie-chicken	F4.6 <b>Boyce, A.</b> ; The fight for space: Does interspecific competition or physiological tolerance limit elevational distributions of tropical birds?	F5.6 <b>Edworthy, A.</b> ; The dynamic lives of tree cavities: community-level use patterns of tree cavities by cavity-nesting birds

**FRIDAY, 17 AUGUST – Morning Sessions, F6 – YIA1 & 2**

<b>Buchanan A102</b>	<b>Buchanan A103</b>	<b>Buchanan A104</b>	<b>Chemistry B250</b>	<b>Buchanan A201</b>	<b>Room</b>
<b>F6: Parental care</b>	<b>F7: Physiology, hormones</b>	<b>F8: Sexual selection</b>	<b>F9: Migration and stopover</b>	<b>COS – Young Investigator Award</b>	<b>Session</b>
F6.1 <b>Grunst, M.</b> ; Context-dependent reproductive allocation rules with respect to male quality in the biparental songbird <i>Melospiza melodia</i>	F7.1 <b>King, M.</b> ; Activation of the immune systems incurs energetic costs but produces no thermogenic tradeoffs in House Sparrows ( <i>Passer domesticus</i> ) undergoing cold stress.	F8.1 <b>Grunst, A.</b> ; Sexual coloration, antioxidant status, and reproductive strategies in Yellow Warbler ( <i>Setophaga petechia</i> ): Linked via individual quality or alternative allocation decisions?	F9.1 <b>Linkhart, B.</b> ; Migration path and wintering area of flammulated owls breeding in Colorado	YIA1 <b>Naka, L.</b> ; Timing of avian diversification and the role of Amazonian rivers in the speciation process	<b>10:30</b>
F6.2 <b>Doumas, L.</b> ; The intensity of carotenoid-based nestling mouth coloration is negatively associated with ectoparasite density in house sparrow broods	F7.2 <b>Kouwenberg, A-L.*</b> ; Corticosterone and stable isotopes in feathers identify carry-over effects in Atlantic puffins	F8.2 <b>Gammie, K.</b> ; Sexy dads and cryptic moms: iridescence, sexual dimorphism, and mating systems in the Galliformes	F9.2 <b>Smith, S.</b> ; Seasonal and site differences in refueling rates of songbirds during migration stopover near the south shore of Lake Ontario		<b>10:45</b>
F6.3 <b>Gow, E.</b> ; Trade-offs in parental care decisions of male and female northern flickers during the post-fledging period	F7.3 <b>Smit, B.</b> ; Body temperature regulation during the heat of the day in free-living White-browed Sparrow-Weavers in the Kalahari Desert	F8.3 <b>Saranathan, V.</b> ; Signal Content of Structural Colours: A Synchrotron Nanostructural Study of UV-Reflective Blue Tit Plumage	F9.3 <b>Covino, K.*</b> ; Not Just a Breeding Hormone? Testosterone Production in Songbirds throughout Spring Migration.	YIA2 <b>Tingley, M.</b> ; Grinnell's legacy: Effects of a century of climate change on species occurrence and community composition in the Sierra Nevada	<b>11:00</b>
F6.4 <b>Peer, B.</b> ; Adaptive Modulation of Cowbird Host Defensive Behavior in Relation to its Costs and Likelihood of Parasitism	F7.4 <b>Milenkaya, O.</b> ; Condition indices among Crimson Finches are repeatable but do not predict reproductive success or survival.	F8.4 <b>Taff, C.*</b> ; Breeding density and spatial distribution of nests constrain the strength of sexual selection in a warbler.	F9.4 <b>Bayly, N.</b> ; Preparing to cross the Caribbean Sea ζ the spring stopover of the Gray-cheeked Thrush <i>Catharus minimus</i> in northern Colombia		<b>11:15</b>
F6.5 <b>Sorenson, M.</b> ; Extraordinarily Divergent, Host-Specific mtDNA Lineages in Greater Honeyguide and Cuckoo Finch: Implications for the Genetics of Host-Specific Adaptation	F7.5 <b>Schoech, S.</b> ; Corticosterone and behavioral phenotype in Florida scrub-jays: links among stress, personality, and life span	F8.5 <b>O'Brien, E.</b> ; Temporal partitioning of environmental effects on the quality and plasticity of a melanin-based plumage signal in great tits	F9.5 <b>Stanley, C.*</b> ; Repeat tracking of individual Wood Thrush ( <i>Hyllocichla mustelina</i> ) reveals consistent migration timing but flexibility in route	End	<b>11:30</b>
End	F7.6 <b>Butler, M.</b> ; Differential Effects of Early- and Late-Life Access to Carotenoids on Adult Immune Function and Ornamentation in Mallard Ducks ( <i>Anas platyrhynchos</i> )	F8.6 <b>Parker, T.</b> ; What do we really know about the signaling role of plumage color in blue tits? A case study of impediments to progress in evolutionary biology	F9.6 <b>Dale, C.</b> ; Reproductive consequences of alternative migratory strategies in a partially migratory passerine		<b>11:45</b>

FRIDAY, 17 AUGUST – Early Afternoon Sessions, S7 – F11

Room	Hennings 200	Hennings 201	Hennings 202	Buchanan A201	Buchanan A202
Session	Symposium 7	Symposium 8	Symposium 9	F10: Behaviour	F11: Breeding biology
1:30	S7.1 <b>Joy, J.;</b> Constructing and dating the evolutionary tree of all birds	S8.1 <b>Navarro-Sigüenza, A.G.;</b> Ornithology in Mexico: where have we been and where should we go	S9.1 <b>Buler, J.;</b> Factors that influence the distributions of migratory birds during stopover in a coastal setting	F10.1 <b>Eichholz, M.;</b> Is current nest site selection of grassland nesting birds maladaptive?	F11.1 <b>Hepp, G.;</b> Incubation temperature influences apparent survival and recruitment of female Wood Ducks
1:45		S8.2 <b>Rojas-Soto, O.R.;</b> What's in a species? The importance of species limits in avian conservation		F10.2 <b>Davros, N.;</b> Keeping up with the Joneses: Breeding male Prothonotary Warbler ( <i>Protonotaria citrea</i> ) responses to increased conspecific density	F11.2 <b>Desnoyers, N.;</b> Changes in nesting substrate use by San Clemente Loggerhead Shrikes in a recovering landscape and implications for recovery
2:00	S7.2 <b>Jetz, W.;</b> The diversity of all birds in space and time		S9.2 <b>Lightfoot, H.;</b> Patterns of fall songbird migration around the Bay of Fundy and Gulf of Maine	F10.3 <b>Lorenz, T.;</b> Long-distance seed transport and cache site selection by Clark's nutcracker: investigating the role of nutcrackers as ecosystem engineers	F11.3 <b>Davis, J.;</b> Local and Landscape Factors Influencing Nest Survival and Productivity of Western Burrowing Owls ( <i>Athene cunicularia hypugaea</i> ) Across Great Plains Grasslands
2:15		S8.3 <b>Enriquez-Rocha, P.L.;</b> Progresses and challenges in raptor and owl research in Mexico		F10.4 <b>Miller, A.;</b> Migratory shorebird stop-over sites: habitat and prey associations in Oregon estuaries	F11.4 <b>Ortiz-Maciél, S.G.;</b> Maroon-fronted Parrot ( <i>Rhynchopsitta terrisi</i> ) productivity at the two main nesting colonies in the Sierra Madre Oriental, Mexico: 1997-2011.
2:30	S7.3 <b>Thomas, G.;</b> Testing complex models of trait evolution across all birds		S9.3 <b>Depp, J.;</b> Tracking the movement and survival of intercontinental migrants across the Gulf of Mexico	F10.5 <b>Reudink, M.;</b> Multiple stable-isotopes (dD, d13C, d15N) indicate long-distance dispersal facilitates gene flow and genetic panmixia in a continentally-distributed waterbird	F11.5 <b>Cruz-Nieto, J.;</b> Nesting characterization and reproductive biology of Thick-billed Parrot ( <i>Rhynchopsitta pachyrhyncha</i> ) in five regions of Sierra Madre Occidental, Chihuahua, Mexico
2:45		S8.4 <b>Palacios, E.;</b> Challenges and perspectives in shorebird research and conservation in Mexico (30 Minutes)		F10.6 <b>Brussee, B.;</b> Nest survival of Black-crowned Night-Herons as related to incubation behavior and nest predators based on video-monitoring at Alcatraz Island, San Francisco, California	F11.6 <b>Lawonn, J.;</b> Searching For a Shadow's Shadow: Kittlitz's Murrelets Nesting in Unglaciated Alpine Habitat on Kodiak Island, Alaska



**FRIDAY, 17 AUGUST – Early Afternoon Sessions, F12 – F16**

<b>Buchanan A102</b>	<b>Buchanan A103</b>	<b>Buchanan A104</b>	<b>Chemistry B150</b>	<b>Chemistry B250</b>	<b>Room</b>
<b>F12: Climate</b>	<b>F13: Conservation</b>	<b>F14: Conservation</b>	<b>F15: Life histories</b>	<b>F16: Habitat relationships</b>	<b>Session</b>
F12.1 <b>DeLuca, W.;</b> Blackpoll warbler ( <i>Setophaga striata</i> ) breeding ecology along an elevation gradient: consequences of temporal and spatial variation in climate	F13.1 <b>Koper, N.;</b> Effects of management across Canada on Sprague's pipits and chestnut-collared longspurs, two threatened grassland songbirds	F14.1 <b>Britt, C.;</b> Isolated and under threat: Scarlet Macaws in Belize and Guatemala	F15.1 <b>Dillon, K.G.;</b> Changes in breeding phenology and elevational gradients in clutch size of red-faced warblers: effects of climate, nest predation, and food.	F16.1 <b>Akresh, M.*;</b> Demographic response of prairie warblers to habitat creation, succession, and disturbance in a 'shifting mosaic' landscape	<b>1:30</b>
F12.2 <b>Schmidt, A.;</b> Breaking up long-term relationships: How the North Pacific Gyre Oscillation may be overtaking El Niño as the dominant driver of seabird productivity in central California	F13.2 <b>Bednarz, J.;</b> Evaluation of experimental fungal inoculations to establish heart-rot and promote cavity nests and wildlife habitat in managed forests in Washington	F14.2 <b>Paxton, E.;</b> Koa restoration forests: quality habitat for native Hawaiian forest birds?	F15.2 <b>Stocking, J.J.;</b> Comparison of nest success and chick growth on traditional and non-traditional island sites for the American Oystercatcher in North Carolina	F16.2 <b>Weldon, O.;</b> Landscape scale analysis of vegetation structure preference by early successional and mature forest breeding birds using lidar	<b>1:45</b>
F12.3 <b>Heath, J.;</b> Changes in American Kestrel migration and wintering are associated with warmer winter temperatures in western North America	F13.3 <b>VanderWerf, E.;</b> Evolution of Nest Height in the Endangered Oahu Elepaio in Response to a Non-native Predator	F14.3 <b>Heindl, B.;</b> Nest Site Limitation in the Puaiohi or Small Kauai Thrush ( <i>Myadestes palmeri</i> ): Using Nest Boxes to Expand the Range of an Endangered Species	F15.3 <b>Riordan, M.;</b> Examining what life stage male bias arises in Mountain Plovers ( <i>Charadrius montanus</i> )	F16.3 <b>Correll, M.;</b> Predicting Tidal Marsh Bird Populations via Remote Sensing: A potential tool for coastal conservation	<b>2:00</b>
F12.4 <b>Hass, T.;</b> Climate change, heightened hurricane activity, and extinction risk for an endangered tropical seabird, the Black-capped Petrel <i>Pterodroma hasitata</i>	F13.4 <b>Galla, S.;</b> Exploring the evolutionary distinctiveness of the critically endangered Attwater's Prairie-chicken using coalescent multi-locus analyses	<b>Withdrawn</b>	F15.4 <b>Elliott, K.*;</b> Fixed reproductive investment in a long-lived bird: evidence for an energy ceiling	F16.4 <b>Farrell, S.;</b> Developing high-resolution, fine-scale, occupancy models for endangered songbirds using LIDAR	<b>2:15</b>
F12.5 <b>Wethington, S.;</b> Delayed timing of molt and changes in migration stopover sites: Possible responses by Broad-tailed Hummingbirds ( <i>Selasphorus platycercus</i> ) to extreme cold temperatures on their wintering grounds	F13.5 <b>Ellison, K.;</b> Grassland Birds as Indicators of the Ecological Recovery of Bison.	F14.5 <b>Cadman, M.;</b> Nesting success of Bank Swallows in aggregate pits	F15.5 <b>Martin, M.;</b> Latitudinal variation in life history traits of Yellow Warblers	F16.5 <b>Henderson, A.;</b> Does a working prairie landscape work for wildlife?: Linking bird abundance and range health in Saskatchewan, Canada	<b>2:30</b>
F12.6 <b>Wolf, B.;</b> Heat waves - challenges for desert bird communities	F13.6 <b>Panjabi, A.;</b> Habitat use and capacity estimates for wintering grassland birds	F14.6 <b>Burle, M-H.;</b> Ocean swell drives unexpected population crash in the endangered Tuamotu Sandpiper suggesting earlier consequences of future sea-level rise	F15.6 <b>Cooper, C.;</b> Latitudinal, Seasonal, and Photoperiodic trends in clutch size: the importance of peripheral clocks in songbirds	F16.6 <b>Nol, E.;</b> Eastern Wood-pewee nest survival in pine plantations and deciduous forests	<b>2:45</b>

FRIDAY, 17 AUGUST – Late Afternoon Sessions, S7 – F11

Room	Hennings 200	Hennings 201	Hennings 202	Buchanan A201	Buchanan A202
Session	Symposium 7	Symposium 8	Symposium 9	F10: Behaviour	F11: Breeding biology
3:30	S7.4 <b>Moors, A.</b> ; Measures of evolutionary isolation and conservation of birds	S8.5 <b>Ruvalcaba-Ortega, I.</b> ; Use of agricultural areas by wintering birds in northeastern Mexico	S9.4 <b>Leppard, A.</b> ; Characterizing Spatial and Temporal Patterns of Landbird Migrants in the Gulf of Maine Region.	F10.7 <b>MacLean, S.*U.</b> ; Real danger or crying wolf? Auditory and visual threat recognition in gulls	F11.7 <b>Gurney, K.</b> ; Seasonal patterns of offspring diets and survival in lesser scaup in relation to temporal fluctuations in aquatic food resources in northern boreal ecosystems
3:45				F10.8 <b>Boggie, M.</b> ; Spatial Ecology and Mate Interactions of Cooper's Hawks in the Non-Breeding Season	F11.8 <b>Hipfner, M.</b> ; Sea-surface temperature affects breeding density of a rocky intertidal predator, the Black Oystercatcher
4:00	S7.5 <b>Jankowski, J.</b> ; A phylogenetic perspective on elevational gradients as drivers of species turnover and diversification in Andean birds	S8.6 <b>MacGregor-Fors, I.</b> ; Urbanization and exotic invaders in the tropics	S9.5 <b>Cohen, E.</b> ; Movement ecology of an intercontinental migratory bird in relation to endogenous and exogenous factors during spring stopover	F10.9 <b>Kelly, J.</b> ; Post-breeding Public Information in a Ground-nesting Songbird Community	F11.9 <b>Klucsarits, J.</b> ; Spatial-temporal distribution of nest box usage and productivity for American Kestrels nesting in Eastern Pennsylvania
4:15				F10.10 <b>Krebs, B.</b> ; Spatio-temporal patterns in communal roosting behavior of American Robins ( <i>Turdus migratorius</i> ) in an urban setting	F11.10 <b>Newell, P.</b> ; Survivorship and Landscape Use of Breeding and Post-breeding Rusty Blackbirds in Northern New Hampshire
4:30	S7.6 <b>Ricklefs, R.</b> ; What fundamental things can a tree of all birds (not) tell us?	S8.7 <b>Renton, K.</b> ; Challenges for conserving threatened endemic species: the case of parrots in Mexico	S9.6 <b>Woodworth, B.</b> ; Migration strategies of individual songbirds at a major ecological barrier and their relationship to weather	End	End
4:45					
<b>Poster Session 2 – Day One</b>					

**FRIDAY, 17 AUGUST – Late Afternoon Sessions, F12 – F16**

<b>Buchanan A102</b>	<b>Buchanan A103</b>	<b>Buchanan A104</b>	<b>Chemistry B150</b>	<b>Chemistry B250</b>	<b>Room</b>
<b>F12: Climate</b>	<b>F13: Conservation</b>	<b>F14: Conservation</b>	<b>F15: Life histories</b>	<b>F16: Habitat relationships</b>	<b>Session</b>
F12.7 <b>Cox, W.A.</b> ; High temperatures reduce avian productivity in high quality habitat	F13.7 <b>Arizmendi, M.</b> ; Hummingbird Conservation: mutualistic interaction with plants needed!	F14.7 <b>Benson, T.J.</b> ; Patch size is not a reliable predictor of grassland bird nest survival: a synthesis of past studies	F15.7 <b>Boyle, A.</b> ; Life-histories of birds along elevational gradients: a meta-analysis	F16.7 <b>Stanton, R.*</b> ; Range extension and habitat restoration: does 'Hilden's Principle' apply to resident birds?	<b>3:30</b>
F12.8 <b>Hanley, D.</b> ; How have long-term changes in climate and ocean practices influenced Atlantic Puffin diet and bill coloration?	F13.8 <b>Beckmann, C.</b> ; Impacts of the invasive cane toad on a ground-nesting bird in tropical Australia	F14.8 <b>Zarones, L.</b> ; Population status and nesting success of the critically endangered Aga or Mariana Crow ( <i>Corvus kubaryi</i> ) on Rota, Mariana Islands, Micronesia	F15.8 <b>Becker, P.H.</b> ; Lifelong individual development as an important life history component in the Common Tern <i>Sterna hirundo</i>	F16.8 <b>Percy, K.</b> ; Effects of Prescribed Burning on Golden-winged Warbler ( <i>Vermivora chrysoptera</i> ) Habitat and Populations in the Cumberland Mountains, Tennessee	<b>3:45</b>
F12.9 <b>Auer, S.</b> ; Indirect effects of climate change on nest site use and overlap among coexisting wood warblers	F13.9 <b>Ernst, S.</b> ; Increases in Avian Abundance and Changes in Aspen Woodland Vegetation During 12 Years After Livestock Removal in the Great Basin	F14.9 <b>Canales, R.</b> ; Population status, demographic history, and viability of the Mexican endangered Sparrow: <i>Spizella wortheni</i> .	F15.9 <b>Ghalambor, C.</b> ; Resolving the contrasting influences of life histories and breeding density on avian reproductive strategies	F16.9 <b>Fierro, K.</b> ; Environmental factors affecting the distribution of territories in four ground-nesting birds over time	<b>4:00</b>
F12.10 <b>Senner, N.</b> ; Luck of the draw: two hudsonian godwit populations differentially respond to climate change	F13.10 <b>Levandoski, G.</b> ; Influences of habitat characteristics on winter survival of Vesper Sparrow ( <i>Pooecetes gramineus</i> ) in the Chihuahuan Desert of Mexico	F14.10 <b>Neal, M.</b> ; Project Black Hawk: Year 1 results of an unconventional study focused on the breeding season habitat use by migratory Common Black Hawk ( <i>Buteogallus anthracinus</i> ) in southwest New Mexico	F15.10 <b>Evenson, J.</b> ; Surf scoter ( <i>melanitta perspicillata</i> ) winter phenology and inter-annual site philopatry to wintering areas along the Pacific Coast	F16.10 <b>Germain, R.</b> ; Habitat preference and nesting success under exotic plant invasion in island song sparrows	<b>4:15</b>
F12.11 <b>Courter, J.</b> ; Predicting avian nesting dates using growing degree-days	F13.11 <b>Kern, R.*</b> ; The effects of prescribed fire and habitat loss on Seaside Sparrow population viability in Maryland, USA	F14.11 <b>Ehlers, S.</b> ; Quantifying survival and indentifying predators of the threatened island-endemic San Clemente Sage Sparrow	F15.11 <b>Beissinger, S.R.</b> ; Variation in the risk of infection in avian eggs between temperate and tropical environments	F16.11 <b>Hunt, P.</b> ; Habitat use by the Eastern Whip-poor-will ( <i>Caprimulgus vociferus</i> ) in managed forest landscapes	<b>4:30</b>
End	End	F14.12 <b>McFarland, T.</b> ; Range-wide variation in black-capped vireo breeding ecology: Implications for conservation and management	F15.12 <b>Terrill, R.</b> ; A phylogenetic context for molt strategies in birds	End	<b>4:45</b>
<b>Poster Session 2 – Day One</b>					

**SATURDAY, 18 AUGUST – Morning Sessions, SAT1 – SAT5**

Room	Hennings 200	Hennings 201	Hennings 202	Buchanan A103	Buchanan A202
Session	SAT1: Evolution	SAT2: Population biology	SAT3: Movements and dispersals	SAT4: Urban ecology	SAT5: Behaviour
10:30	SAT1.1 <b>Langin, K.*</b> ; Divergence with gene flow: local adaptation in bill morphology within a single-island endemic, the Island Scrub-Jay	SAT2.1 <b>Grinde, A.</b> ; Metapopulation Dynamics and Characteristics of Wood-Warblers in the Western Great Lakes Region.	SAT3.1 <b>Weseloh, D.V.C.</b> ; Site-fidelity, roosting and migration of colour-marked Great Egrets from southern Ontario	SAT4.1 <b>Shiple, A.</b> ; Residential edges as ecological traps: postfledging survival of Spotted Towhees in a forested urban park	SAT5.1 <b>Kobiela, M.</b> ; Does mercury contamination affect risk-taking behaviors? Tradeoffs between eating and being eaten
10:45	SAT1.2 <b>DuBay, S.*</b> ; Diversification by local adaptation to altitude in Andean Tit-tyrants	SAT2.2 <b>McClain, D.</b> ; Nest site selection of a cavity nesting species as a function of habitat quality	SAT3.2 <b>Masse, R.J.</b> ; Testing the foraging-benefit and predation-risk hypotheses to explain summer commutes by american woodcock	SAT4.2 <b>Rondon-Rivera, J.</b> ; Urban green spaces: traps or havens for migratory birds?	SAT5.2 <b>Barton, G.</b> ; Ecological correlates of long-term changes in the seasonal phenology of migratory songbirds
11:00	SAT1.3 <b>Brown, C.*</b> ; Evolutionary patterns and likely causal factors in hummingbird migration	SAT2.3 <b>Hill, J.</b> ; Population ecology of grassland sparrows in woody grasslands: an experimental test of structure on reclaimed surface mine grasslands	SAT3.3 <b>Boyd, S.</b> ; Using satellite telemetry to describe the population structure of sea ducks	SAT4.3 <b>Rega, C.</b> ; Soil, snails, and breeding birds in urban forest fragments	SAT5.3 <b>Behney, A.</b> ; Ecological factors influencing foraging behavior of birds during spring migration in the wabash river floodplain
11:15	SAT1.4 <b>Lank, D.</b> ; Genes producing 'female mimic' males also shrink female ruffs ( <i>Philomachus pugnax</i> ), and may alter sex ratios	SAT2.4 <b>Monroy Ojeda, A.</b> ; Population Trends of Six Species of Neotropical Migratory Birds. A nine years study in Oaxaca, Oaxaca, Mexico.	SAT3.4 <b>Trefry, S.*</b> ; Wing marker woes: a case study and meta-analysis of the impacts of wing and patagial tags	SAT4.4 <b>Thieme, J.</b> ; Linking grassland bird density to predator activity in urban parks	SAT5.4 <b>Lanzone, M.</b> ; Flight Responses by a Migratory Soaring Raptor to Changing Meteorological Conditions
11:30	SAT1.5 <b>Cooke, R.</b> ; Molecular data contradicts the accepted origin of the Lord Howe Island Masked Owl, implications for management	SAT2.5 <b>Vernouillet, A.</b> ; Selection harvesting negatively affects Ovenbird survival: a 6-year study	SAT3.5 <b>Laughlin, A.</b> ; Radar and Radios reveal roost sites and between-roost movements of wintering Tree Swallows ( <i>Tachycineta bicolor</i> )	SAT4.5 <b>VanBeek, K.</b> ; Effects of alternative tillage practices on bird populations in Illinois	SAT5.5 <b>Williams-Sieg, K.</b> ; Habitat Disturbance and the Role of Behavioral Plasticity in Mediating Life History Trade-offs
11:45	SAT1.6 <b>Greenberg, R.</b> ; The influence of the california marine layer on bill size in a generalist songbird	SAT2.6 <b>LaManna, J.*</b> ; Spring migration precipitation influences annual survival of migratory songbirds	SAT3.6 <b>Ulman, S.</b> ; Stable isotopes infer origins of shorebirds utilizing an alaskan estuary during migration	End	SAT5.6 <b>Katsnelson, E.</b> ; Individual-learning ability predicts social-foraging strategy in house sparrows ( <i>Passer domesticus</i> )

**SATURDAY, 18 AUGUST – Morning Sessions, SAT6 – SAT10**

<b>Buchanan A203</b>	<b>Chemistry D200</b>	<b>Chemistry D300</b>	<b>Chemistry B150</b>	<b>Chemistry B250</b>	<b>Room</b>
<b>SAT6: Breeding biology</b>	<b>SAT7: Climate</b>	<b>SAT8: Migration and stopover</b>	<b>SAT9: Ecology</b>	<b>SAT10: Ecotox/pollution</b>	<b>Session</b>
SAT6.1 <b>Corkery, C.</b> ; Testing the mismatch hypothesis in Churchill, Manitoba: does food for a sub-Arctic breeding plover peak at hatch?	SAT7.1 <b>Kaiser, S.A.</b> ; Sex-specific parental responses to weather-induced variability in food resources across a climate gradient	SAT8.1 <b>Wunderle, J.</b> ; Sex and age differences in site fidelity, food resource tracking, and response of body condition to rainfall in wintering Kirtland's Warblers ( <i>Setophaga kirtlandii</i> ) in The Bahamas may have drought year consequences that carry over to the breeding grounds.	SAT9.1 <b>Hostetler, J.</b> ; A quantitative approach for assessing avian climate change vulnerability	SAT10.1 <b>St. Clair, T.</b> ; Investigating Sources and Risk of Metal Exposure to Dunlins ( <i>Calidris alpina</i> ) in the Fraser River Delta, British Columbia	<b>10:30</b>
SAT6.2 <b>Stahl, J.</b> ; The benefits of earlier nesting in the San Clemente Loggerhead Shrike	SAT7.2 <b>Ralph, C.J.</b> ; Tropical birds are a sensitive indicator of climate change: Thirteen Years of Bird Banding and the Influence of the El Niño Southern Oscillation on the Demography and Condition of several Migrant and Resident Birds in Northeastern Costa Rica	SAT8.2 <b>Stutzman, R.*</b> ; Stopover behavior of migratory shorebirds: Are agricultural fields an avian Qwik-E-Mart?	SAT9.2 <b>Li, X.</b> ; Climate change vulnerability of 63 Galliformes species in China	SAT10.2 <b>Avery-Gomm, S.</b> ; Northern fulmars as biological monitors of trends in plastic pollution: Evidence of increasing plastic ingestion by northern fulmar in the Northeast Pacific.	<b>10:45</b>
SAT6.3 <b>Salafsky, S.</b> ; The influence of food limitation on goshawk reproduction in northern Arizona	SAT7.3 <b>Byrd, A.</b> ; Understanding common loon ( <i>gavia immer</i> ) biogeography and viability in an era of climate change	SAT8.3 <b>Smith, R.</b> ; The influence of intrinsic and extrinsic factors on arrival timing and seasonal reproductive performance in Field Sparrows ( <i>Spizella pusilla</i> ).	SAT9.3 <b>Stouffer, P.</b> ; They breed all the time; does it matter? Aseasonal breeding by understory birds in central Amazonian Brazil	SAT10.3 <b>Morrissey, C.</b> ; Pacific Salmon as a source of persistent organic pollutants to American dippers	<b>11:00</b>
SAT6.4 <b>Cooper, R.</b> ; Estimating food abundance for insectivorous birds.	SAT7.4 <b>Townsend, A.</b> ; Warm spring linked to higher fecundity, lower survival, and stable populations of Black-throated Blue Warblers	SAT8.4 <b>MacPherson, M.</b> ; The physiological ecology of long-distance bird migration: A comparative approach contrasting austral and Nearctic-Neotropical migration	SAT9.4 <b>Brawn, J.</b> ; Population growth rates in tropical understory birds and their prospects under climate change	SAT10.4 <b>Brasso, R.</b> ; Penguin feathers as a predictive tool for assessing mercury exposure in marine food webs throughout the Southern Hemisphere	<b>11:15</b>
SAT6.5 <b>Roche, E.</b> ; Survival of Piping Plover and Least Tern chicks in mixed-species nesting aggregations on the Missouri River	SAT7.5 <b>McKinnon, L.</b> ; Optimizing shorebird breeding phenology in a changing arctic environment	End	SAT9.5 <b>Heiss, R.</b> ; An exploration of age, oxidative damage and survival in the Florida Scrub-jay ( <i>Aphelocoma coerulescens</i> )	SAT10.5 <b>Camilleri, S.*</b> ; Provisioning of chicks by Leach's Storm-Petrels: Insights into energy content, lipid content, and contaminants of stomach oils.	<b>11:30</b>
SAT6.6 <b>Joos, C.</b> ; Fitness Consequences of Territory Selection and Habitat Quality in Bell's Vireos	End		SAT9.6 <b>Ton, R.</b> ; A comparative field test of the metabolic rate hypothesis for nestling growth rates among temperate and tropical Passerines	SAT10.6 <b>Elliott, J.</b> ; Rodenticides: ongoing problems with contamination and poisoning of raptors	<b>11:45</b>

**SATURDAY, 18 AUGUST – Early Afternoon Sessions, S10 – SAT12**

Room	Hennings 200	Hennings 201	Hennings 202	Chemistry D200	Buchanan A103
Session	Symposium 10	Symposium 11	Symposium 12	SAT11: Systematics, taxonomy	SAT12: Sexual selection
1:30	S10.1 <b>Williams, T.</b> ; Integrating avian physiology and ecology: introduction to the symposium	S11.1 <b>Jankowski, M.</b> ; Heterogeneous viral shedding in birds: potential causes and consequences of this consistent phenomenon	S12.1 <b>Rosenberg, K.</b> ; Filling knowledge gaps to enhance full life-cycle bird conservation: Partners in Flight's Tri-National vision	SAT11.1 <b>Wright, N.*</b> ; Ecological determinants of flight muscle size across birds	SAT12.1 <b>Guindre-Parker, S.</b> ; Alula Size in an Arctic-breeding Passerine: Condition-dependent Achromatic Signalling of a Rarely Studied Plumage Trait
1:45	S10.2 <b>Madliger, C.</b> ; Linking individual variation in physiology during reproduction with fitness			SAT11.2 <b>Benham, P.*</b> ; Topographic complexity in the Andes shapes diversification patterns in the hummingbird genus <i>Metallura</i>	SAT12.2 <b>Webster, M.S.</b> ; Spatial decoupling of cultural and genetic traits generates novel phenotypes across a zone of secondary contact
2:00	S10.3 <b>Guglielmo, C.</b> ; Physiological variation among individuals and its effects on migration performance	S11.2 <b>Adelman, J.</b> ; Heterogeneous responses to infection among house finches: mechanistic causes and transmission consequences	S12.2 <b>Tonra, C.</b> ; The nexus of non-breeding, migratory, and breeding life history stages in migratory songbirds	SAT11.3 <b>Escalante, P.</b> ; DNA barcoding efforts for the bird fauna of Mexico	SAT12.3 <b>Berzins, L.</b> ; Do male tree swallows ( <i>Tachycineta bicolor</i> ) adjust their investment in parental care in relation to experimentally altered female ornamentation?
2:15	S10.4 <b>Swanson, D.</b> ; Mechanisms and Fitness Correlates of Seasonally Flexible Metabolic Phenotypes in Small Birds	S11.3 <b>Brown, J.</b> ; Understanding avian influenza virus infection in gulls		SAT11.4 <b>Sigurdsson, S.</b> ; A new phylogeny of the Nightjars ( <i>Caprimulgidae</i> ) casts light on new phylogenetic species and a complex history of diversification in the New World.	SAT12.4 <b>Safran, R.</b> ; Geographic variation in sexual signaling: causal evidence that different traits underlie sexual selection in closely related populations of barn swallows
2:30	S10.5 <b>Duckworth, R.</b> ; Adaptive variation in behavior: evolutionary insights from developmental mechanisms	S11.4 <b>Garvin, M.</b> ; Volatile components of uropygial gland secretions and community-level interactions in disease transmission	S12.3 <b>Sillett, S.</b> ; Recent advances in understanding the limitation and regulation of migratory passerine populations throughout the annual cycle	SAT11.5 <b>Cracraft, J.</b> ; How to classify birds: the Howard & Moore Checklist of Birds	SAT12.5 <b>Buchholz, R.</b> ; Immunogenic exposure impacts mating-related personality traits in female wild turkeys.
2:45		S11.5 <b>Huyvaert, K.</b> ; Ecological factors influencing prevalence of avian blood parasites in wild birds in northern Vietnam		SAT11.6 <b>James, F.</b> ; Is there a continuum of phenotypes between birds and dinosaurs?	SAT12.6 <b>Dunn, P.</b> ; MHC variation is related to a sexually-selected ornament, survival and parasite resistance in common yellowthroats

**SATURDAY, 18 AUGUST – Early Afternoon Sessions, SAT13 – SAT17**

<b>Buchanan A202</b>	<b>Buchanan A203</b>	<b>Chemistry D300</b>	<b>Chemistry B150</b>	<b>Chemistry D250</b>	<b>Room</b>
<b>SAT13: Songs and vocalizations</b>	<b>SAT14: Conservation</b>	<b>SAT15: Evolution</b>	<b>SAT16: Migration and stopover</b>	<b>SAT17: Habitat relationships</b>	<b>Session</b>
SAT13.1 <b>Gough, D.</b> ; Effects of chronic noise on the singing behaviour of Pacific Wrens ( <i>Troglodytes pacificus</i> ) in the Pacific Northwest	SAT14.1 <b>Powell, L.</b> ; Recovery of Avian Movement Along the Interface of Primary and Secondary Amazon Rainforest	SAT15.1 <b>Seneviratne, S.</b> ; Phenotypic and genetic variation across hybrid zones between three allospecies of sapsuckers	SAT16.1 <b>Elbin, S.</b> ; Powerful Light Effects Birds Migrating over New York City on September 11	SAT17.1 <b>Gawlik, D.E.</b> ; Hydrologic Variability as a Global Driver of Colonial Waterbird Nesting	<b>1:30</b>
SAT13.2 <b>Moseley, D.</b> ; Female preferences are influenced by early experience and male vocal performance	SAT14.2 <b>Will, T.</b> ; Redirecting conservation: Golden-winged and Blue-winged warblers, species blinders, and concept tetanus	SAT15.2 <b>Alcaide, M.</b> ; Genomics of a ring species, the greenish warbler <i>Phylloscopus trochiloides</i>	SAT16.2 <b>Cabrera-Cruz, S.A.</b> ; Nocturnal bird migration in Mexico: first records	SAT17.2 <b>Latta, S.</b> ; Is there a carry-over effect from the breeding grounds to the wintering grounds?	<b>1:45</b>
SAT13.3 <b>Sandoval, L.</b> ; Do all vocal signals encode the same amount of information for species recognition? A case study using White-eared Ground-sparrows	SAT14.3 <b>Slater, G.</b> ; Reintroduction of a short-distance migrant, the Western Bluebird, to North Puget Sound, Washington	SAT15.3 <b>Winker, K.</b> ; Heteropatric speciation in a duck	SAT16.3 <b>Goodrich, L.</b> ; Energy-minimization flight strategy revealed for autumn-migrating accipiters in the Central Appalachians, Pennsylvania.	SAT17.3 <b>Craig, C.</b> ; Multi-scale habitat selection and nest success of Black-backed and American Three-toed Woodpeckers in managed, conifer forests of northern New Brunswick	<b>2:00</b>
SAT13.4 <b>Schwarz, B.</b> ; Does song function in territorial defense in the Western Sandpiper? An experimental approach.	SAT14.4 <b>Bédard, S.</b> ; Remnant habitats of managed landscape satisfy the ecological requirements of the Yellow-bellied Sapsucker in Québec boreal mixedwood.	SAT15.4 <b>Billerman, S.</b> ; Spatio-temporal Change in the Red-breasted/Red-naped Sapsucker Hybrid Zone in Oregon and California	SAT16.4 <b>Slager, D.</b> ; Habitat-dependent stopover duration in the Northern Waterthrush ( <i>Parkesia noveboracensis</i> )	SAT17.4 <b>Botson, B.A.</b> ; Quantifying the effect of water level fluctuations on nest effort of White Ibis, Wood Storks and Great Egrets	<b>2:15</b>
SAT13.5 <b>Harlow, Z.</b> ; Song type use during countersinging and the function of duetting in the White-Breasted Wood-Wren ( <i>Henicorhina leucosticta</i> ) using simulated intrusion playback experiments and microphone sensor array localization	SAT14.5 <b>Coe, S.</b> ; Response of avian species abundance to wildfire fuel reduction in riparian woodland	SAT15.5 <b>Duffie, C.</b> ; Hybridization in island birds: a case study of the Jamaican endemic Streamertails	SAT16.5 <b>Drever, M.</b> ; Hydrological flow models can inform migration ecology of shorebirds	SAT17.5 <b>Reiley, B.</b> ; Effects of a Large Catastrophic Flood on Understorey Habitat, Prey Abundance, and Presence of Swainson's Warblers	<b>2:30</b>
SAT13.6 <b>Rush, A.</b> ; The role of innate song as an isolating mechanism in Empidonax flycatchers	SAT14.6 <b>Thompson, S.</b> ; Response of grassland songbirds to large-scale tree removal	SAT15.6 <b>Kingston, S.</b> ; Hybridization, gene flow, and differentiation among towhees in Mexico: genome-wide sequence analysis	<b>Withdrawn</b>	SAT17.6 <b>Keyel, A.</b> ; Testing the role of patch openness as a causal mechanism for apparent area sensitivity in a grassland specialist	<b>2:45</b>

**SATURDAY, 18 AUGUST – Late Afternoon Sessions, S10 – SAT11 & SAT18**

Room	Hennings 200	Hennings 201	Hennings 202	Chemistry D200	Buchanan A103
Session	Symposium 10	Symposium 11	Symposium 12	<b>SAT11: Systematics, taxonomy</b>	<b>SAT18: Molecular ecology</b>
<b>3:30</b>	S10.6 <b>Angelier, F.</b> ; What is the role of stress physiology in mediating "carry over" and "silver spoon" effects?	S11.6 <b>Kilpatrick, M.</b> ; Biodiversity and disease risk: dilution effect or simply habitat change?	S12.4 <b>Irwin, D.</b> ; Technological advances in the study of conservation genetics and seasonal connectivity of long-distance migrants: an exciting future	SAT11.7 <b>DaCosta, J.</b> ; RAD Phylogenetics: Harnessing Next-Generation Sequencing for Molecular Systematics of Parasitic Finches (Viduidae)	SAT18.1 <b>Bowser, K.</b> ; Sequencing a seabird food chain - Next generation sequencing of the feces of Atlantic puffin and the stomach contents of their major prey, Atlantic herring
<b>3:45</b>		S11.7 <b>Soos, C.</b> ; Emergence of avian cholera in the eastern Canadian Arctic: investigating origins, reservoirs, spread, impacts, and risk factors		SAT11.8 <b>Shearer, J.</b> ; The Superb Bird-of-paradise: a phylogeographic study of a New Guinean passerine	SAT18.2 <b>Taylor, S.</b> ; Specialization to cold water upwellings facilitates gene flow in seabirds: additional evidence from the Peruvian Pelican, <i>Pelecanus thagus</i> (Aves: Pelecanidae)
<b>4:00</b>	S10.7 <b>Ryan, C.</b> ; Testing the prolactin-based model for avian clutch-size determination ....	S11.8 <b>LaPointe, D.</b> ; Mosquito-borne avian disease in Hawaiian forest birds: Individual to landscape effects	S12.5 <b>Vidal, R.</b> ; Designing a Neotropical landscape for migrants and residents: applying research results for on-the-ground conservation	SAT11.9 <b>McKay, B.</b> ; Using digital photography to investigate plumage coloration	SAT18.3 <b>McCracken, K.</b> ; Three intriguing examples of hybridization between two common species of South American ducks
<b>4:15</b>	S10.8 <b>Newman, A.</b> ; Effects of early-life conditions during nestling development on adult plasma corticosterone levels .....			End	SAT18.4 <b>Barr, K.</b> ; Urban Landscape Genetics of a Protected Songbird
<b>4:30</b>	S10.9 <b>Vitousek, M.</b> ; Exploring the mechanisms linking individually consistent differences in stress responsiveness with reproductive success .....	S11.9 <b>Owen, J.</b> ; Avian disease ecology: from the individual to the landscape	S12.6 <b>Davidson, I.</b> ; A hemispheric perspective on Neotropical migratory bird conservation: Where do we go from here?		SAT18.5 <b>Braun, M.</b> ; Early Bird Update: The Avian Tree of Life Based on 28 Genes and 203 Taxa
<b>4:45</b>	S10.10 <b>Garcia, V.</b> ; What factors contribute most to lifetime fitness in Red-cockaded Woodpeckers?				SAT18.6 <b>Kimball, R.</b> ; Independent Corroboration of the Avian Tree of Life
<b>Poster Session 2 – Day Two</b>					



**SATURDAY, 18 AUGUST – Late Afternoon Sessions, SAT13 – SAT17**

<b>Buchanan A202</b>	<b>Buchanan A203</b>	<b>Chemistry D300</b>	<b>Chemistry B150</b>	<b>Chemistry D250</b>	<b>Room</b>
<b>SAT13: Songs and vocalizations</b>	<b>SAT14: Conservation</b>	<b>SAT15: Evolution</b>	<b>SAT16: Migration and stopover</b>	<b>SAT17: Habitat relationships</b>	<b>Session</b>
SAT13.7 <b>Demko, A.</b> ; Two singing modes in a wood-warbler with a complex repertoire, the Canada Warbler ( <i>Cardellina canadensis</i> )	SAT14.7 <b>Culp, L.</b> ; Roads in Tidal Salt Marshes: Are Tidal Restrictions a Concern for Nesting Sharp-tailed Sparrows?	SAT15.7 <b>Chesser, R.T.</b> ; The evolution of nesting in the ovenbirds, family Furnariidae	SAT16.7 <b>Mackenzie, S.</b> ; Initial site selection influences behaviour and landscape use by a migratory passerine during stopover	SAT17.7 <b>VanZandt, M.</b> ; The Nesting Habitat and Spatial Distribution of Lana'i's Endangered Hawaiian Petrel ( <i>Pterodroma sandwichensis</i> ).	<b>3:30</b>
SAT13.8 <b>Narango, D.</b> ; Variation in Signal Information within Urban Bird Song	SAT14.8 <b>Smetzer, J.*</b> ; Science-based management of shrubland birds using dynamic optimization on Vermont's green mountain national forest	SAT15.8 <b>Uy, J.A.</b> ; The genetic basis of convergent plumage color among populations of an island flycatcher	SAT16.8 <b>Wehtje, W.</b> ; Migration directionality of European starlings ( <i>Sturnus vulgaris</i> ) in Europe predicts the species - North American migration patterns	SAT17.8 <b>McClung, M.</b> ; The response of breeding bird populations to ice damage in the Ozark Mountains, Arkansas	<b>3:45</b>
SAT13.9 <b>Montgomerie, R.</b> ; Why birds sing at dawn	SAT14.9 <b>Lituma, C.M.</b> ; Spatially Balanced Monitoring for Priority Grassland Birds in the Central Hardwoods BCR	SAT15.9 <b>Johnson, J.A.</b> ; Timing of breeding covaries with plumage color among breeding Gyrfalcons in central-west Greenland	SAT16.9 <b>Henkel, J.</b> ; Migration Ecology of Shorebirds on the Northern Gulf of Mexico	SAT17.9 <b>Campbell, M.</b> ; Using breeding bird atlas data to conserve species at risk in industrially managed Atlantic forests	<b>4:00</b>
SAT13.10 <b>Rector, M.</b> ; Begging and boasting: Atlantic puffin chick calls signal need and quality	SAT14.10 <b>Ruskin, K.</b> ; Testing for Stability in the Sharp-tailed Sparrow Hybrid Zone: 130 Years of Plumage Comparisons	SAT15.10 <b>Maley, J.</b> ; Using morphological and genetic characters to infer selection against hybrid clapper and king rails	SAT16.10 <b>Olson, B.</b> ; Migration Ecology of the Marbled Godwit in North America	SAT17.10 <b>Preston, K.</b> ; Using ecological minimum requirements to model greater sage-grouse habitat across their western range, U.S.A.	<b>4:15</b>
End	SAT14.11 <b>Docherty, T.</b> ; The conservation value of degraded habitats for bird communities in the lowland rainforests of Borneo	End	SAT16.11 <b>Newhouse, M.</b> ; Migration monitoring in an urban ecosystem: a comparison of two years of acoustic and banding data	SAT17.11 <b>Mathewson, H.</b> ; Variation in the Range-wide Distribution, Abundance and Productivity of a Habitat Specialist Songbird	<b>4:30</b>
			End	End	<b>4:45</b>
<b>Poster Session 2 – Day Two</b>					

## POSTER SESSION 1 – WEDNESDAY 15 & THURSDAY, 16 AUGUST

### Topic: Behaviour

- PS1.1 **Maldonado, E.**; Phylogeography of the blue bunting, *Cyanocompsa parellina* (Aves: Cardinalidae)
- PS1.2 **Nightingale, A.**; Nest Aggression in Pacific Wren (*Troglodytes pacificus*) on Vancouver Island, BC
- PS1.3 **Rivers, J.**; Divergent responses to an extreme stressor in two sympatric *Tachycineta* swallows.
- PS1.4 **Sosa-Lopez, J.R.**; The vocal behaviour of the Brown-throated Wren (*Troglodytes aedon brunneicollis*): complex songs and insights on the use of syntactic rules
- PS1.5 **Dickinson, M.**; Sparrow Nest-site Selection on Great Duck Island, Maine: influences of habitat and predation
- PS1.6 **Beason, B.**; Behavioral responses of waterfowl to red and green lasers
- PS1.7 **Hucks, K.**; Dietary diversity of Barn Owls in Oklahoma
- PS1.8 **Brownson, A.**; Mate Guarding vs. Mate Choice: Reproductive Skew in Polyandrous Acorn Woodpecker (*Melanerpes formicivorus*) Groups
- PS1.9 **Elliott, K.**; Thyroid hormones as mediators of energy adjustments within aging charadriiform birds
- PS1.10 **LeClair, D.\***; Examining effects of food and temperature during different stages of the breeding period on the reproductive success of a migratory bird
- PS1.11 **Lukianchuk, K.\***; Social hierarchy and the development of dancing ability in young long-tailed manakins
- PS1.12 **Ellison, A.** \*U; Testing Problem Solving in Turkey Vultures (*Cathartes aura*) Using the String-Pulling Approach
- PS1.13 **Campbell, G.**; Bicknell's Thrush - 10 years of monitoring a rare songbird in New Brunswick and Nova Scotia, results and next steps.
- PS1.14 **Middleton, H.**; Response of wintering ducks to disturbance at anthropogenic edges in Delta, BC
- PS1.15 **Soberanes, J.M.**; The Green Macaw (*Ara militaris*), and its ecological function in the consumption of seeds and fruits
- PS1.16 **Olsen, A.**; Predicting Beak Dynamics: Testing Hypotheses on the Relationship Between Skull Shape and Beak Behaviors in Anseriformes
- PS1.17 **Alamshah, A.**; The effect of maintenance behavior on the plumage microbiology of House Sparrows (*Passer domesticus*)
- PS1.18 **López-Segoviano, G.**; Territorial behavior and preferences of foraging migrant hummingbird *Selasphorus rufus* in a winter site
- PS1.19 **Krakauer, A.**; Lateral bias in inter- and intra-sexual behaviors by lekking male greater sage-grouse
- PS1.20 **Patterson, A.**; Assessing Foraging Conditions at Caspian Tern Restoration Sites
- PS1.21 **Armstrong, T.**; Female vocalizations correlate with the short-term fitness of male and female Red-winged blackbirds
- PS1.22 **Bayard, T.**; Broadcasting auditory cues to test for conspecific attraction in an obligate saltmarsh bird: Can social cues be used to facilitate restoration?

### Topic: Biogeography

- PS1.23 **Hargrove, L.**; A Century of Biogeographic Shifts in the Avifauna of Southern California under Rapid Climate Change (San Jacinto Mountains 1908-2008)
- PS1.24 **Macdonald, C.**; Geographic variation in sex-ratios of wintering Snow Buntings (*Plectrophenax nivalis*).
- PS1.25 **Ríos-Muñoz, C.**; An analysis of biogeographic affinities in the avifauna of the Mexican Transition Zone
- PS1.26 **McCracken, K.**; Multilocus coalescent analysis reveals stepwise colonization of South America by Ruddy Ducks dispersing from North America, first to high altitude in the northern Andes followed by low altitude in the southern Andes

- PS1.27 **Novitch, N.** \*U; Migration of Willow Flycatcher (*Empidonax traillii*) and Alder Flycatcher (*E. alnorum*) through the Tuxtla Mountains, Veracruz Mexico
- PS1.28 **Sanin, C.\***; How much spatial variance in species richness of of subspecies in South America can be accounted for by diversification rates?

### Topic: Breeding biology

- PS1.29 **Ritchison, G.**; Effect of nestling sex ratio on the provisioning behavior of Eastern Bluebirds
- PS1.30 **Halkin, S.L.**; Placement of Objects of Different Colors Around Satin Bowerbird Bowers
- PS1.31 **Cancellieri, S.**; An experimental Investigation of Nest Reuse in an Open-cup Nesting Passerine
- PS1.32 **Kennedy, E.D.**; Relative contributions of early and late nests to breeding success of House Wrens
- PS1.33 **Lai, J.**; First Description of the nest of Long-billed Woodcreeper, *Nasica longirostris*
- PS1.34 **Miller, S.**; Use of Video-Monitoring to Study Partial Incubation and Clutch-initiation Behavior of Red-shouldered Hawks (*Buteo lineatus*)
- PS1.35 **Hill, J.**; Saltmarsh Sparrows and Male-biased Nestling Sex Ratios
- PS1.36 **Warkentin, I.**; Selection pressures on body size by age and sex in Merlins
- PS1.37 **Warkentin, I.**; Effects of browsing by hyper-abundant moose on a forest bird community
- PS1.38 **Lamle, A.**; Nest Structure and Composition of Scissor-tailed Flycatchers Across a Landscape Gradient
- PS1.39 **Shlepr, K.** \*U; Impact of Bald Eagle (*Haliaeetus leucocephalus*) Predation on Herring Gull (*Larus argentatus*) Survivorship in Maine, USA
- PS1.40 **Pérez Sánchez, C.E.**; Detail description of the nest, eggs, and nesting habitat of the micro-endemic, near threatened Rosebellied bunting (*Passerina rositae*)
- PS1.41 **Ferretti, V.**; Historical variation in hatching success in a moving hybrid zone of Carolina and Black-capped chickadees (*Poecile carolinensis* and *P. atricapillus*)
- PS1.42 **Long, A.**; Effects of Prescribed Burning on Avian Nest Survival in the Southern Great Plains
- PS1.43 **Varner, D.**; Nesting Ecology of Florida Mottled Ducks using Altered Habitats
- PS1.44 **Jamieson, S.**; Factors influencing breeding success of wild North Island Brown Kiwi

### Topic: Brood parasitism

- PS1.46 **Pinney, T.**; Predator Abundance, Host Abundance, and Landscape Variables are not Consistent Predictors of Brown-headed Cowbird Presence across Years

### Topic: Climate

- PS1.47 **Batdorf, K.\***; Are all birds moving poleward? Understanding distributional shifts in Ohio's breeding birds
- PS1.48 **Feria, T.**; Future distribution of *Turdus grayi* in 2050
- PS1.49 **James, D.**; Gulf Hurricane Birds Inland: Swept Clean vs. Blown Through Hypotheses
- PS1.50 **Valencia-Herverth, J.**; Effect of climate change on nocturnal raptors at Hidalgo State, Mexico
- PS1.51 **Olsen, B.**; Toxin Load Decreases the Capacity of Common Loons to Adapt to Climate Change
- PS1.52 **Smith, K.**; Spring arrival of 8 species in Fayetteville, Arkansas 1844-1886, with special reference to Ruby-throated Hummingbirds today

### Topic: Community ecology

PS1.53 **Anderson, J.**; Colony collapse in Herring and Great black-backed Gulls: an assessment of possible causes and consequences.

PS1.54 **Robinson, S.**; Size-abundance relationships in Bird communities

PS1.55 **McGuire, S.**; Interspecific competition shapes grassland bird communities in southern Ontario agro-ecosystems.

PS1.56 **Heung, M.**; The effects of soil moisture on avian insectivores

PS1.57 **Toms, J.\***; Interspecific competition between migratory American Redstarts (*Dendroica ruticilla*) and resident Adelaide's Warblers (*D. adelaidae*)

PS1.58 **DeLap, J.**; Community Dynamics in Suburbanizing Forestlands of the Pacific Northwest

PS1.59 **Almazán Núñez, R.C.**; The distribution of the frugivorous bird community in a dry forest successional gradient of southwestern Mexico

#### **Topic: Conservation**

PS1.60 **King, D.**; Establishing quantitative habitat targets for non-breeding Golden-cheeked Warblers

PS1.61 **Hethcoat, M.**; Increased nest predation and natural gas development; what's coming down the pipe for sagebrush obligate songbirds?

PS1.62 **Stewart, B.**; From Data to Conservation: Using "citizen science" monitoring and research to advance stewardship and conservation action in the Maritime Provinces

PS1.63 **Diemer, K.**; Evaluating agro-ecosystem management options to benefit grassland bird reproduction

PS1.64 **Lu, N.**; Species-specific habitat fragmentation assessment, considering the ecological niche requirements and dispersal capability

PS1.65 **Koford, R.**; Canada Goose foraging near an Iowa wind farm

PS1.66 **Doster, R.**; Black Oystercatchers in California: A first large-scale survey effort

PS1.67 **Beaudry, F.**; The loss of forest birds habitats resulting from projected land use under alternative economic policy scenarios

PS1.68 **Ludwig, E.**; Reproductive Ecology of Eastern Wild Turkey Hens in an Agricultural Landscape

PS1.69 **Knight, E.**; Grassland songbird productivity: Does the edge effect on nest predation vary between agricultural types?

PS1.70 **Doyle, F.I.**; Why has the Sooty Grouse population declined on Haida Gwaii, British Columbia, Canada?

PS1.71 **Doyle, F.I.**; Using multiple approaches to study the Threatened Haida Gwaii Northern Saw-whet Owl

PS1.72 **Kyle, K.**; Incorporating Pest Control by Birds into Agricultural Landscapes: the ecosystem service value of bird-friendly farm management

PS1.73 **Robertson, H.**; The SCSCB Caribbean Birding Trail: Promoting Conservation and Sustainable Livelihoods through Bird and Nature Tourism

PS1.74 **Mounce, H.**; Contemporary genetic diversity and translocation plans for an endangered Hawaiian honeycreeper, the Kiwikiu (Maui Parrotbill; *Pseudonestor xanthophrys*)

PS1.75 **Warren, M.**; A simple method for preventing the entrapment and death of cavity-nesting species in vault toilets

PS1.76 **Parrish, C.**; Assessing potential impacts of wind development on breeding populations of the Bicknell's Thrush in northern New Hampshire

PS1.77 **Gill, C.**; Night Birds Returning: a collaborative effort to restore seabird nesting habitat in Gwaii Haanas National Park Reserve and Haida Heritage Site

PS1.78 **Elliott-Smith, E.**; The 2011 international piping plover census: population status and discovery of an important wintering area

PS1.79 **Walker, J.**; Habitat Suitability Modelling for the Yellow-breasted Chat (*Icteria virens virens*) in Anders Field Complex, Point Pelee National Park.

PS1.80 **Calderón-Parra, R.**; Environmental education proposal based on the bird species distribution in La Ciénega Grande de Xochimilco, Federal District, Mexico.

PS1.81 **Hiriart-Bertrand, L.**; Considerations for Creating a Marine Protected Area for Spheniscus Penguins in southern Chile

PS1.82 **Tozer, D.**; Population trends of wetland birds in the Great Lakes basin: 1995 to 2011

PS1.83 **Sustaita, Z.**; Possible change in distribution of Elf Owl, *Micrathene whitneyi*

#### **Topic: Diseases and parasites**

PS1.84 **Villar, C.**; Prevalence and lineages of Plasmodium and Haemoproteus in Wood Stork Nestlings in Three Regions of the American Continent

PS1.85 **Carbó Ramírez, P.**; Occurrence of blood parasites in bird communities from two sites with different degree of urbanization in central Mexico

PS1.86 **Ballard, J.**; Lesions Associated with Wellfleet Bay Virus in Common Eiders (*Somateria mollissima*)

PS1.87 **Potter, B.**; Eggshell Microstructure and Temperature Fluctuation Facilitate Microbial Invasion during Incubation

#### **Topic: Ecological models and survey methods**

PS1.88 **Cabrera-Cruz, S.**; Using theoretical flight speeds to discriminate birds from insects in radar studies

PS1.89 **Moulton, C.**; Assessment of peak detection periods for surveying secretive marsh birds in Idaho

PS1.90 **Hager, S.**; Scavenging affects persistence of avian carcasses resulting from window collisions in an urban landscape

PS1.91 **Weeber, R.**; Monitoring Colonial Waterbirds in Canada's Boreal Forest: Survey development and patterns of distribution and abundance.

PS1.92 **Macchia, E.**; Does sampling underneath guy wires underestimate the loss of birds at communication towers?

PS1.93 **Darveau, M.**; Using pre-existing surveys to answer new questions about birds

PS1.94 **Jansen, E.**; Method for estimating raptor flight height to calculate collision risk prior to the development of a wind energy facility.

PS1.95 **Fletcher, D.**; Testing assumptions of an avian double-sampling area search method on riparian birds of the Lower Colorado River

PS1.96 **Gahbauer, M.**; Assessing avian mortality rates due to power line collisions

PS1.97 **Bosley, J.**; It's good to have neighbors: developing an occupancy model for a declining nesting population of Bald Eagles in Florida Bay, Everglades National Park

#### **Topic: Ecotoxicology and pollution**

PS1.98 **Edmonds, S.**; Metals in feathers of Rusty Blackbirds from breeding and wintering areas with comparison to breeding co-inhabiting songbirds

PS1.99 **Rowse, L.**; Exposure of songbirds to heavy metal contaminants across an urban to rural landscape

PS1.100 **LÓPEZ ISLAS, M.**; Hepatic biomarkers to assess health condition in American Coots (*Fulica americana*) from two wetlands in the Basin of Mexico: Tecocomulco, Hidalgo and Xochimilco, Mexico City

PS1.101 **Townsend, J.**; Mercury concentrations in tropical resident and migrant songbirds vary with geography and feeding guild on hispaniola

PS1.102 **Adams, E.**; Estimating Risk of Mercury Exposure to Migratory Birds in the Pacific Flyway  
PS1.103 **Stratford, J.**; No evidence of contamination from natural gas drilling in terrestrial birds  
PS1.104 **Keller, R.**; Calcium limitation in high elevation birds in the southern appalachians

**Topic: Evolution**

PS1.105 **Friesen, V.**; How Do Sympatric Seasonal Populations of Band-Rumped Storm-petrels Arise? Testing Mechanisms of Evolution  
PS1.106 **Harris, R.**; Evolution of nesting behavior in Megapodes.  
PS1.107 **Gowen, F.**; A genetic portrait of divergence and gene flow among two lineages of Western Scrub-Jay (*Aphelocoma californica*) based on mitochondrial and nuclear markers  
PS1.108 **Spellman, G.**; Insights into the shared evolutionary history of birds and their gut microbiota  
PS1.109 **Deane, P.**; Conspecific song preference in *Melospiza* sparrows: A transcriptome of candidate neural genes  
PS1.110 **Burg, T.**; Asymmetrical hybridization in sapsuckers  
PS1.111 **Curry, C.**; Evolution of song variation across a complex hybrid zone in Tufted and Black-crested titmice  
PS1.112 **Hubbard, J.**; Do candidate genes associated with melanin pigmentation underlie plumage differences between two recently diverged subspecies of barn swallow (*Hirundo rustica*)  
PS1.113 **Mason, N.\***; Evolutionary patterns and correlates of avian vocalizations in a continent-wide radiation of songbirds (*Thraupidae*).  
PS1.114 **Weir, J.**; Diversity Dependent Cladogenesis and Trait Evolution in the Adaptive Radiation of the Auks (*Aves: Alcidae*)

**Topic: Foraging**

PS1.115 **Mancuso, K.**; The effect of selection logging on sapwell tree selection by the yellow-bellied sapsucker in Algonquin Provincial Park  
PS1.116 **Alicia, A.**; The Effect of Supplemental Feed on Northern Bobwhite Quail Chick Survival in the Texas Rolling Plains  
PS1.117 **Bobowski, M.**; Foraging behavior and decision strategies by overwintering Red-tailed Hawks (*Buteo jamaicensis*) and American Kestrels (*Falco sparverius*) in northeastern Arkansas  
PS1.118 **Newberry, G.**; Differences in diet composition of coexisting Violet-green and Tree Swallows during offspring provisioning  
PS1.119 **Klassen, J.**; Prey switching by wading birds as an alternative foraging strategy in unpredictable environments  
PS1.120 **Walsh, R.**; A (relatively) rapid method for compound specific stable isotope analysis of feather amino acids, and its applications  
PS1.121 **Walsh, R.**; Access to aquatic resource subsidies affects tree swallow diet and breeding

**Topic: General ecology**

PS1.122 **Paleczny, N.**; Estimating Abundance and Prey Demand of Common Loon (*Gavia immer*) using Distance Sampling on Lake Opeongo, Algonquin Provincial Park, Canada  
PS1.123 **Butler, C.**; Winter ecology of Yellow Rails in Oklahoma  
PS1.124 **Carnochan, S.**; A glance at the effects of a 1-in-300 year flood on the nesting success of mixed-grass prairie songbirds in Southwestern Manitoba  
PS1.125 **Haynam, R.**; GPS Transmitter Bias of Greater Sage-Grouse Survival

PS1.126 **Hitch, A.**; Comprehensive Avian Surveys in the Masembo watershed of the Mekongga Mtns. region in Southeast Sulawesi, Indonesia  
PS1.127 **Rader, J.**; Exploring phenotype-environment correlations in South American Cinclodes ovenbirds  
PS1.128 **O'Shaughnessy, R.**; Testing the ideal free distribution of spring migratory waterfowl along the Wabash River, Illinois.  
PS1.129 **Weber, W.C.**; 50 Years of Change in the Avifauna of the Vancouver Area, British Columbia

**Topic: Habitat relationships**

PS1.130 **Mahony, N.**; Assessing the utility of a habitat monitoring scheme in developing species-habitat relationships along BBS routes.  
PS1.131 **Hubbard, L.**; The Road Ahead: characteristics of roadside right-of-ways that influence avian abundance and diversity in agricultural landscapes  
PS1.132 **Burt, B.**; A Habitat Management Model Based on Foraging Red-cockaded Woodpecker Habitat Use and Avoidance  
PS1.133 **Amundson, C.**; Hierarchical Models of Distribution and Abundance of Birds across Coastal Parks of Southwestern Alaska  
PS1.134 **Cunningham, J.**; Effects of experience on male and female breeding habitat selection in Arctic-breeding shorebirds  
PS1.135 **Buxton, V.**; Making the most of what remains: examining the quality of urban grasslands for conservation-priority birds in Illinois  
PS1.136 **Bailey, B.**; Migratory birds in tropical agro-ecosystems: Assessing the influence of patch and landscape factors on habitat quality.  
PS1.137 **Hockman, E.**; Bachman's Sparrow population, habitat requirements, and detectability in oak savannas at Fort Campbell, Tennessee-Kentucky  
PS1.138 **Nelson, S.K.**; Breeding Ecology of Marbled Murrelets in Port Snettisham, Southeast Alaska  
PS1.139 **Yanco, S.**; Home-range and habitat use by Flammulated Owls (*Otus flammeolus*) following a large-scale forest fire in central Colorado  
PS1.140 **Smith, J.**; A habitat model to assist in the conservation of Crested Caracara  
PS1.141 **Solomon, L.**; Territory selection by Puaiohi: Influence of food abundance, nest sites, and forest composition and structure  
PS1.142 **Peterson, S.**; Nest Site Characteristics of Least Bitterns in an Urban Wetland  
PS1.143 **Setash, C.**; Wing morphology and foraging stratification in forest-dwelling birds  
PS1.144 **Yantachka, J.**; Relationships among Adirondack Songbird Communities, Calcium Availability, and Acidic Deposition  
PS1.145 **Dale, B.**; Does distance to wetlands influence upland grassland birds?

**Topic: Landscape ecology**

PS1.146 **Lee, M.**; Assessing scale dependencies in avian species in a pine forest, agriculture and urban matrix  
PS1.147 **Niccoli, M.**; Are Occupancy Models Feasible Alternatives to Collecting Demography Data?  
PS1.148 **Lin, F-Y.**; Are fragments always islands? Influence of habitat specialization on macroecological patterns of forest birds in fragmented landscapes, Taiwan  
PS1.149 **Merkord, C.**; Projecting long-term landscape change along the Missouri River: implications for cottonwood forests and bird populations

PS1.150 **Lockhart, J.**; Assessing the relative effects of habitat fragmentation and habitat loss on grassland bird communities in south west Manitoba

PS1.151 **Halstead, K.**; Regional influences on local bird diversity in oak communities of the Rogue Basin, Oregon

PS1.152 **Paprocki, N.**; Making Regional Management Decisions in a Time of Global Change: What Can We Learn From a Historical Comparison of Wintering Raptors in Southwest Idaho?

**Topic: Life histories**

PS1.153 **Soto-Rojas, O.**; Life history attributes of a breeding population of the loggerhead shrike (*Ianius ludovicianus*) from Central Mexico.

PS1.154 **Russell, J.**; Comparative Growth and Development Rates of Boreal Owl Nestlings Based on Sex

**Topic: Mating systems**

PS1.155 **Armiger, J.**; Group composition and site-fidelity in the facultatively cooperative Yucatan Wren (*Campylorhynchus yucatanicus*)

PS1.156 **Landoll, D.\***; Annual and Environmental Variation in Extra-pair Paternity in a Socially Monogamous Savannah Nesting Passerine

**Topic: Migration and stopover biology**

PS1.157 **Johnson, P.**; Migratory stopover of landbirds within the Western Lake Erie Basin: exploring how landscape features influence migrant abundance to inform conservation.

PS1.158 **McLaren, J.**; Modelling stopover scheduling and reaction to wind among nocturnal migrants in a spatial context

PS1.159 **Carter, J. \*U**; Changes in migration timing of twelve passerine species over a 45-year interval in the High Plains.

PS1.160 **Paxton, K.\***; Connecting the Dots: Understanding Migration in the Context of Other Periods of the Annual Cycle

PS1.161 **Crewe, T.**; The Canadian Migration Monitoring Network - Réseau canadien de surveillance des migrations: Advancing migratory bird research across Canada.

PS1.162 **Cardenas, L.**; Species richness and relative abundance of migratory landbirds during spring and fall migration in the Darién of Colombia

PS1.163 **Stutchbury, B.**; Using geolocators to link fine scale seasonal connectivity to population declines in the Wood Thrush

PS1.164 **millikin, R.**; Migration Corridors; a study of frame bias in the migration monitoring of landbirds

PS1.165 **Horton, K.**; Wood-warbler vocalizations in response to flight calls

PS1.166 **Ballard, B.**; Migration routes and wintering sites of Reddish Egrets breeding in Texas

PS1.167 **DeSando, S.**; Nutritional value of native and invasive fruits for migrating songbirds in the western Finger Lakes region of New York

PS1.168 **Shipley, J.R.\***; Monitoring Continental-scale Bird Phenology using NEXRAD

PS1.169 **Casbourn, G.**; Tracking the migration of declining Ontario Wood Thrush (*Hyllocichla mustelina*) using geolocators

PS1.170 **Bierregaard, R.**; Navigation and Orientation in Migrating Ospreys: Insights from Satellite Telemetry.

PS1.171 **Moran, A.**; Swollen ankles: can tarsal swelling be used to distinguish between Rufous hummingbirds that are actively nesting and those that are passing through?

PS1.172 **Sanders, C.E.**; Acoustic Monitoring of Nocturnal Migrants over the Western Basin of Lake Erie

PS1.173 **Jahn, A.**; Using geolocators to track migration of Tyrannus flycatchers in South America

PS1.174 **Diehl, R.**; Is the airspace a habitat?

PS1.175 **Zelt, J.**; Illuminating Shifting Migratory Bird Patterns Using A Legacy Citizen Science Project

PS1.176 **Rasmussen, R.**; Diurnal Short and Long Distance Passerine Migrants

PS1.177 **Gautreaux, J.**; Examination of spring stopover of migratory landbirds in an urban coastal landscape: a multi-scaled approach.

PS1.178 **English, P.**; Determining wintering and stopover locations of Ontario's eastern whip-poor-wills

PS1.179 **Aborn, D.**; Mass Changes of Autumn Migrants at an Urban Stopover in Tennessee

PS1.180 **Jehl, J.**; The spectacular migration of eared grebes that has never been seen: a ghost of the passenger pigeon

PS1.181 **Zenzal, T.\***; Stopover of Ruby-throated Hummingbirds: sex-dependent autumn migration on the Gulf Coast

**Topic: Molecular ecology**

PS1.182 **Campbell, K.**; Geographic distribution of within-species genetic variation among 14 species of Philippine birds.

PS1.183 **Bubac, C.**; How habitat connectivity shapes genetic structure during range expansion: insights from Virginia's Warbler in the Black Hills

PS1.184 **Jellen, J.**; A genetic study of osprey (*Pandion haliaetus*) in the Greater Yellowstone Ecosystem: Creating novel genetic markers to explore polyandry, pedigree, and the effect of familial relationships on nest usage

PS1.185 **Rivera-Ortiz, F.A.**; Diversity Genetic of Military Macaw (*Ara militaris*) in México.

**Topic: Movements and dispersal**

PS1.186 **Girault, C.**; Post-breeding movements and habitat use by ring-billed gulls: a diversity of strategies

PS1.187 **Eason, D.**; Tree Swallow (*Tachycineta bicolor*) nest success, site fidelity, and spatial movement at Red Slough WMA

PS1.188 **Engler, J.**; Population genetics reveal the role of long distance dispersal and allele surfing in contact zone movement in two parapatric distributed Hippolais sister species

PS1.189 **Humple, D.**; Within- and between-winter movements of Western and Clark's Grebes

PS1.190 **Bolduc, F.**; Consistency in the distribution of molting scoters and common eiders in the estuary and Gulf of St. Lawrence in 1998 and 2010

**Topic: "Other"**

PS1.191 **Gow, E.**; Offspring demands and body condition influence sex-specific parental provisioning patterns in the Northern Flicker (*Colaptes auratus*)

PS1.192 **Borstad, G.**; A "Remote Sensing Awareness Tutorial" for ornithologists

PS1.193 **Hof, D.**; Escalation of aggressive signals in black-throated blue warblers: A sequential playback study

PS1.194 **Balasubramaniam, P.**; Patterns of life history variation in a breeding bird community along an elevational gradient

PS1.195 **Whitfield, M.**; Bird mortalities in open-top pipes

PS1.196 **Fitzgerald, T.**; Habitat loss is not a primary factor limiting northern Chimney Swift populations

PS1.197 **Friesen, M.**; Close relatives with different odors: A Comparison of feather odor signatures between Tricolored (*Agelaius tricolor*) and Red-winged (*Agelaius phoeniceus*) Blackbirds

PS1.198 **Sekercioglu, C.**; The effects of climate change on tropical birds

PS1.199 **Lankau, H.**; Ovenbird (*seiurus aurocapilla*) response to regenerating seismic lines

PS1.200 **del Hoyo, J.**; Unveiling the Future of the Handbook of the Birds of the World (HBW) Project

PS1.201 **Herrera Alsina, L.\***; Wind turbines and birds: A phylogenetic and morphological approach  
 PS1.202 **Bergman, C.**; Black Oystercatchers as a sentinel species in the recovery of Northern Abalone, or... top predator in a pit of no return?  
 PS1.203 **St. Clair, C.C.**; Spatial and temporal correlates of mass bird mortality in the oil sands of Alberta  
 PS1.204 **Rodriguez-Contreras, V.**; Expansion of the Breeding Bird Survey Program to Mexico  
 PS1.205 **Lipshutz, S.**; Hybridizing Jacanas: A polyandrous perspective  
 PS1.206 **Chesney, T.**; IBA Canada Poster for NAOC  
 PS1.207 **Dorman, W.**; Egg characteristics in relation to nesting microenvironment in captive Southern Rockhopper Penguins, *Eudyptes chrysocome*  
 PS1.208 **Garcia, R.**; Status of the wild scarlet macaw population in Guatemala  
 PS1.209 **Knowlton, J.**; First confirmed record of hybridization in the Hawaiian honeycreepers: *Īiwi* ( *Vestiaria coccinea*) x *Āpapane* (*himatione sanguinea*)  
 PS1.210 **Erickson, A.\***; Demographic Responses of grassland songbirds to a patch-burn grazing management in the Flint Hills

**Topic: Parental care**

PS1.211 **Morrison, A.**; Structural plumage colouration as an indicator of direct reproductive benefits in the Mountain Bluebird (*Sialia currucoides*)  
 PS1.212 **Volker, C. \*U**; Male Carolina Chickadees provide more parental care  
 PS1.213 **Halley, M.**; Multiple Male Feeders at Nests of the Veery (*Catharus fuscescens*)  
 PS1.214 **Minioletti, A.**; Time investment in parental care of the Chilean Hawk (*Accipiter chilensis*) in a white oak (*Nothofagus macrocarpa*) forest of Central Chile

**Topic: Phylogenetics**

PS1.215 **Oliveros, C.**; Reconstructing the biogeographic history of Philippine whistlers reveals complex scenarios of colonization history and a distinct Palawan taxon  
 PS1.216 **Rodriguez-Flores, C.**; Phylogenetic structure of hummingbird communities in Mexico  
 PS1.217 **Garcia, G.**; A review of the Green-fronted hummingbird *Amazilia viridifrons* (Aves: Trochilidae) using mitochondrial and nuclear genes.

**Topic: Phylogeography**

PS1.218 **Williford, D.**; Phylogeography of the Scaled Quail  
 PS1.219 **Cavazos, A.**; Phylogeography of the olive sparrow (*Arremonops rufivirgatus*) and the green-backed sparrow (*A. chloronotus*) in México.

**Topic: Physiology, hormones, and immunology**

PS1.220 **Kelly, K.**; Is the Colour of Atlantic Puffin Bills and Feet an Honest Signal of Condition?  
 PS1.221 **Reichart, L.**; Baseline Measurements of Fecal Corticosterone in Nestling Red-winged Blackbirds  
 PS1.222 **Guindre-Parker, S.**; Characterizing Variation and Repeatability in Acquired Humoral Immunity: the Effect of Age, Diet Quality and Body Condition on Immunoglobulin Y Levels  
 PS1.223 **Jenkins, B.**; Heritability of the physiological stress response in the North American barn swallow *Hirundo rustica erythrogastrer*  
 PS1.224 **Fronstin, R.**; Eggshell colour, biliverdin and sexual signalling in the European starling (*Sturnus vulgaris*): a physiological perspective

PS1.225 **Bosque, C.**; Survival and energy turnover rates are negatively related across species of passerines  
 PS1.226 **Madliger, C.\***; Applying stress hormones to conservation: considering the repeatability of corticosterone levels  
 PS1.227 **Ardia, D.**; A Research Coordination Network in Ecological Immunology (RCNE)  
 PS1.228 **Chastant, J.**; Wading bird stress response to prey availability in a managed lake ecosystem  
 PS1.229 **Rose, E.**; Using artificial-egg heart rate monitors to assess the physiological response of American Oystercatchers (*Haematopus palliatus*) to anthropogenic activity.  
 PS1.230 **Hatch, M.**; A comparison of differential leukocyte counts between five species of songbird captured at a southern migratory stopover site and a northern breeding site  
 PS1.231 **Fairhurst, G.**; Post-breeding feather corticosterone from Tree Swallows (*Tachycineta bicolor*) predicts subsequent switching between two types of nest boxes  
 PS1.232 **Skrade, P.\***; Age-specific breeding probabilities of Mountain Plovers in Montana  
 PS1.233 **Skrade, P.**; Variation in circulating prolactin in incubating Mountain Plovers  
 PS1.234 **Zhang, Y.\***; Metabolic Rates in Swallows: Do Energetically Expensive Lifestyles Affect Metabolic Capacities in Birds?

**Topic: Population biology**

PS1.235 **Foster, K.**; Monitoring Avian Productivity and Survivorship in the Alberta Oil Sands Region  
 PS1.236 **Moore, D.**; Breeding site tenacity and productivity of Common Terns nesting in the North Channel of Lake Huron.  
 PS1.237 **Pearse, A.**; Evaluating transmitter effects on sandhill cranes: implications for whooping crane research  
 PS1.238 **Hennig, J.**; Implementing a new aerial survey method to estimate abundance of spring-migrating waterfowl  
 PS1.239 **Unfried, T.**; Investigating potential source-sink dynamics of Song Sparrows in the fragmented urban landscape around Seattle, WA  
 PS1.240 **Shriver, W.G.**; Annual variation in wood thrush population size and survival from 1974 - 2011  
 PS1.241 **Rodríguez Hernández, K.M.**; Richness and abundance of the birds of San Juan Coyula, Oaxaca, México  
 PS1.243 **Roche, E.**; Increased exposure to mist nets leads to net avoidance in cliff swallows  
 PS1.244 **Hillman, M.**; Abundance, survival, and movement rates of Least Terns (*Sterna antillarum*) at Cape Lookout National Seashore, North Carolina  
 PS1.245 **Takats Priestley, L.**; The Alberta Nocturnal Owl Survey, 10 years, 100 Routes, and Counting

**Topic: Sexual Selection**

PS1.246 **Gañán, N.**; Is skin colour a sexual signal in the Brown Booby (*Sula leucogaster*)?

**Topic: Song and vocalizations**

PS1.247 **Doolittle, E.**; A Music Theoretical Approach to the Study of Bird Song  
 PS1.248 **García, N.**; Intra and inter-specific vocal variation in three species of Grosbeaks (Passeriformes: Cardinalini) and its relationship with body mass.  
 PS1.249 **Karin, B.**; Song Comparison of two *Amphispiza belli* subspecies  
 PS1.250 **Miller, E.H.**; Systematic value of snipe sounds  
 PS1.251 **Benedict, L.**; Variable and stable elements of learned bird song across a large geographic distance

PS1.252 **Kelemen, E.**; The two-song repertoire of Carolina Chickadees (*Poecile carolinensis*): potential implications for mate choice during hybridization  
PS1.253 **LaZerte, S.**; Vocal adjustment by black-capped and mountain chickadees in urban and noisy habitats  
PS1.254 **Hale, J.**; Role of Vocal Characteristics in Individual Recognition Among Male Greater Prairie-Chickens, *Tympanuchus cupido*

**Topic: Systematics, taxonomy, and morphology**

PS1.255 **VanderWerf, E.**; Ecogeographic Patterns of Morphological Variation in *Elepaios* (*Chasiempis* Spp.): Bergmann's, Allen's, and Gloger's Rules in a Microcosm  
PS1.256 **Cicero, C.**; Vertebrates in the cloud (vertnet.org): Are we there yet?  
PS1.257 **Lara, C.**; A new species of wren (Troglodytidae) from a dry inter-Andean valley of Colombia  
PS1.258 **Venkatraman, M.** \*U; Divergence among cloud forest isolates of the Unicolored Jay (*Aphelocoma unicolor*) in the Middle American highlands  
PS1.259 **ESCALANTE, P.**; Mitochondrial phylogeography of the White-bellied Wren (*Uropsila leucogastra*)

**Topic: Tropical Ecology**

PS1.260 **Rotenberg, J.**; A long-term banding study in the Maya Mountains of Belize: four-years and counting.  
PS1.261 **Contreras-González, A.M.**; Seed dispersal and seed predation by birds that eating fruits of endemic columnar cactus from semi-arid region of central Mexico

PS1.262 **Dauphine, N.S.**; Common Myna (*Acridotheres tristis*) introductions, impacts, and management on islands: a global review with an emphasis on the tropical Pacific  
PS1.263 **Garcia, W.**; Monitoring juvenile Harpy Eagle behaviors in Belize: from nestling, fledgling, adopted bird, and beyond

**Topic: Urban and agricultural ecology**

PS1.264 **Thomas, A.**; State Acres for Wildlife Enhancement program and grassland birds: implications for the role of America's farmland in conservation.  
PS1.265 **Lesak, A.**; Very low housing density negatively affects forest songbird nesting success  
PS1.266 **Palmer, C.**; Use of barn owl nest / roost site occupancy and productivity data to design mitigations against highway collision effects, Delta, BC.  
PS1.267 **Thorngate, N.**; Relating turbine-associated migratory bird fatality rates to nocturnal movement patterns and local landscape features at the Montezuma Hills Wind Resource Area in central coastal California  
PS1.268 **Fidorra, J.**; Habitat selection and the importance of human-constructed wetlands for two populations of Great Egrets in the Southeastern USA.  
PS1.269 **Job, J.**; Can you hear me now?: Chipping sparrows (*Spizella passerina*) alter their songs in the presence of urban noise  
PS1.270 **Sherburne, J.**; You are what you eat: Polybrominated Diphenyl Ether (pbde) levels in the eggs of two species of wild birds exposed to pbde-laden biosolids

## POSTER SESSION 2 – FRIDAY, 17 & SATURDAY, 18 AUGUST

**Topic: Behaviour**

PS2.1 **Derrickson, K.**; Birds Do Not See Their Eggs  
PS2.2 **Peluc, S.**; Food availability or nest predation risk during incubation and nestling stages. Can a single factor explain all the variability in reproductive behavior?  
PS2.3 **Desrosiers, M.**; The social context of extra-pair paternity and intraspecific aggression in breeding Island Scrub-Jays  
PS2.4 **McGowan, K.**; Everybody Poops: a review of defecation behavior in birds  
PS2.5 **Hentze, N.**; Flight Characteristics of Over-ocean Flocking Dunlin (*Calidris alpina pacifica*) at Boundary Bay, British Columbia  
PS2.6 **Lam, C.**; Nesting behaviour of resident Anna's Hummingbirds (*Calypte anna*) in Southern Vancouver Island, British Columbia  
PS2.7 **Parker, L.**; Female ornamentation and egg colour signal maternal reproductive investment in the American robin  
PS2.8 **Palestis, B.**; Behavioral Responses of Common Tern Chicks to Feather Sample Removal  
PS2.9 **Leal-Sandoval, A.**; Parental care and transition to the independence in the Blue-footed Booby (*Sula nebouxii*)  
PS2.10 **Bribiesca, R.**; Effect of floral abundance and intra/heterospecific interactions in territorial behavior on the White-eared Hummingbird (*Hylocharis leucotis*).  
PS2.11 **Boves, T.**; Information content and habitat contingency of multiple plumage ornaments in a canopy-dwelling songbird, the Cerulean Warbler  
PS2.12 **Shaffer, J.**; Avoidance of wind generators by breeding grassland birds

PS2.13 **Salinas-Melgoza, A.**; Behavioral plasticity in a Neotropical parrot  
PS2.14 **Lindstrom, J.**; Effect of Cover Type on Bird Behavior During Spring Migration  
PS2.15 **Borowski, A.**; Do heterospecific size and demeanor influence visitation behavior of birds at urban foraging patches?  
PS2.16 **Johnson, L.S.**; The process of fledging in the Mountain Bluebird (*Sialia currucoides*)  
PS2.17 **Andrews, J.**; Heterospecific attraction in grassland birds: Who is listening to whom?  
PS2.18 **Mumme, R.**; Response of Captive Raptors to Avian Mobbing Calls: the Roles of Mobber Size and Raptor Experience  
PS2.19 **Hynes, D.**; Vocalizations of Red Crossbills (*Loxia curvirostra*) in Newfoundland  
PS2.20 **Grava, T.**; Habitat quality affects the perception of dominant males based on their relative song structure  
PS2.21 **Casady, M.**; Differences in behavior of wild whooping cranes (*Grus americana*) using natural and suburban winter habitat.  
PS2.22 **Saunders, S.**; Innate anti-predator behavior in captive-reared Great Lakes Piping Plovers  
PS2.23 **Montes-Medina, A.C.**; Individual variation in nesting vocalizations of the lilac-crowned parrot (*Amazona finschi*) in Mexico  
PS2.24 **Bogrand, A.**; Nest defense by Carolina Wrens (*Thryothorus ludovicianus*) in natural and urban environments.  
PS2.25 **Rothstein, S.**; Singing tough and sexy: cowbird song repertoire use

PS2.26 **Aidala, Z.**; Physiological and fitness effects of nest reuse in the Eastern Phoebe (*Sayornis phoebe*)

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PS2.27 **Kobelkowsky, T.**; Biogeographic patterns of the avifauna of the Sierra Madre Occidental, Mexico

PS2.28 **Ham Dueñas, J.G.**; Biogeography of Lampornis (*Aves: Trochilidae*): Neogene diversification across Mexican and Central American highlands

PS2.29 **Chua, V.**; Biogeographic position of Palawan from the perspective of the Rufous-tailed Tailorbird. (*Orthotomus sericeus*)

PS2.30 **Scott, A.**; Breeding Distribution and Biogeography of Endangered and Extinct Landbirds in the Southwest Pacific

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PS2.31 **Reitsma, L.**; Older male Canada Warblers have more robust plumage and are more fit

PS2.32 **Corbani, A.**; Estimation of songbird nesting success over an entire boreal forest landscape

PS2.33 **Drolet, B.**; Estimating bird's nests chronology to describe the breeding phenology of birds in Canada using the R package Rnest

PS2.34 **Deaner, L.**; Sex Roles in Breeding Wilson's Plovers and their Implications for Diet, Habitat Use, and Reproductive Success

PS2.35 **Buckley, S.**; Using motion-triggered trail cameras to document nest predation in the declining Rusty Blackbird (*Euphagus carolinus*): A novel nest-monitoring technique for forest passerines

PS2.36 **McDonald, M.V.**; Grassland, Shrub, and Forest Edge Birds Population Trends Influenced by Invasive Plants

PS2.37 **Tarvin, K.**; Hatching asynchrony occurs independent of the onset of incubation in American Goldfinches

PS2.38 **Koczur, L.**; Nest success and chick survival of american oystercatchers in texas

PS2.39 **McClintock, M.**; Cost of incubation: using nest microclimate to understand tradeoffs during early season breeding in Wood Ducks (*Aix sponsa*). M.E. McClintock, G.R. Hepp, Auburn Univ., Auburn, Alabama, USA; R.A. Kennamer Savannah River Ecology Lab, Aiken, South Carolina, U

PS2.40 **Wynia, A.**; Comparison of Nest-site Vegetation Characteristics Among Three Understory-dwelling Passerines: Swainson's Warblers, Northern Cardinals, and Indigo Buntings

PS2.41 **Hanley, D.**; Eggshell conspicuousness and paternal brood patch development in the American Thrashers

PS2.42 **Olbert, J.**; Determining Reasons of Nesting Failure and Brood Reduction at Snail Kite (*Rostrhamus sociabilis plumbeus*) Nests on the Kissimmee Chain of Lakes in Florida

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PS2.44 **Augustine, J.**; A three-year study of House Wren reproduction and feeding rates in three habitats representing varying levels of human disturbance

PS2.45 **Wails, C.**; Improving Accuracy and Efficiency of Common Tern Productivity Estimates: A Tool for Aging Chicks in the Field

PS2.46 **Barber, C.**; Role of parental age on European starling (*Sturnus vulgaris*) brood sex ratios

PS2.47 **Skipper, B.**; Effects of weather on nesting success of urban and exurban Mississippi kites

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PS2.49 **Hallman, T.**; Speckling Pattern Analysis as a Tool for Monitoring Brown-headed Cowbird Population and Parasitic Behavior

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PS2.52 **Feria, T.**; Research on climate change and its influence on bird distributions at the country level: the case of Mexico

PS2.53 **Gates, R.**; The arctic shorebird demographics network: understanding causes of shorebird declines

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PS2.55 **Alexandra, A.**; Population response to climate change: does assortative mating facilitate earlier nesting?

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PS2.58 **Blanc, L.**; An experimental test of the Red-cockaded Woodpecker's "keystone" effect on other cavity nesting species.

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PS2.61 **Korte, A.**; Avian Species Richness and Abundance Along an Urbanized River Corridor.

PS2.62 **Savoca, M.**; Evidence for a marine tri-trophic interaction: examining 50+ years of diet data in a Southern Ocean seabird assemblage.

PS2.63 **Altamirano, T.A.**; Southern temperate forest cavity-nest web structure: species richness and the role of tree decay in Patagonia, Chile

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PS2.65 **Rohrbaugh, R.**; A Rangewide Approach to Stabilizing and Reversing Golden-winged Warbler Population Declines

PS2.66 **Smits, J.**; Final effort to save Canadian populations of Greater Sage Grouse (*Centrocercus urophasianus*): An international, interdisciplinary recovery effort

PS2.67 **Jorgensen, C.**; If you build it will they come?: Managing grassland bird populations in tomorrow's landscapes

PS2.68 **MacKay, A.**; Forty year-old spruce plantations are not ecological surrogates for natural conifer stands for several dead wood associated bird species.

PS2.69 **Green, M.**; Results of Monitoring the American Peregrine Falcon since Delisting in the U.S.

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PS2.96 **Salgado-Ortiz, J.**; Prevalence and abundance of blood parasites and its effect on body condition of individuals of the loggerhead shrike (*Ianius ludovicianus*) from Central Mexico

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PS2.168 **Weseloh, D.V.C.**; Oshawa Second Marsh: Premier spring staging area for North American Little Gulls

PS2.169 **Buler, J.**; Radar analysis of bird distributions during fall migratory stopover in the northeastern U.S.

PS2.170 **Kim, D.**; Different breeding populations of Eastern Kingbirds (*Tyrannus tyrannus*) display similar migratory pathways, but distinct wintering areas.

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PS2.175 **McCabe, J.**; Defining critical habitat for migratory songbirds in the Gulf of Maine

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PS2.180 **Fristoe, T.**; Energy use by migrants in North American breeding bird communities

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PS2.195 **Ortega-Álvarez, R.**; Birds, people, and conservation: Experiences and opportunities on the integration of local human communities in avian monitoring programs in Mexico

PS2.196 **Arnaiz-Villena, A.**; Major histocompatibility complex allele persistence in Eurasian and American genus *Carduelis* during million years

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PS2.215 **Brackett, C.**; Reproductive ecology of the king rail, *Rallus elegans*, with implications for east coast population dynamics

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PS2.217 **Williams, C.**; Influence of land-use on productivity of temperate-nesting Canada geese in New Jersey

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 PS2.235 **Phillips, J.**; The Effects of Urban Noise on Song Structure in a Long Distance Migrant, Gambel's White-crowned Sparrow (*Zonotrichia leucophrys gambelii*)

**Topic: Systematics, taxonomy, and morphology**

PS2.236 **Cortes-Ramirez, G.**; Ecomorphological distribution of the Tyrannides in Mexico  
 PS2.237 **Lovell, S.**; Warbling Vireos in Alberta - one or two species? - Revisited 27 years later  
 PS2.238 **vanOordt, F.**; Wing shape differences and character displacement among Pacific Boobies  
 PS2.239 **Low, K.**; Cryptic sexual dimorphism in Carolina Chickadees (*Parus carolinensis*): Implications for hybridization with Black-capped Chickadees (*P. atricapillus*)?  
 PS2.240 **Szabo, I.**; Free downloadable manual on avian specimen preparation including pictorial instructions on how to collect internal morphological data available at: <http://beatymuseum.ubc.ca/research/birds>  
 PS2.241 **Szabo, I.**; Method used to Fabricate Northern Spotted Owl (*Strix occidentalis caurina*) Feeding Surrogate Puppets from Salvaged Owls

**Topic: Tropical ecology**

PS2.242 **Delgado-Carrillo, O.**; Effect of forest fragmentation on bird community consuming fruits of three species of tropical trees in Michoacán

**Topic: Urban and agricultural ecology**

PS2.243 **Dustin, P.**; Urban Green Roofs as Migratory and Breeding Bird Habitat  
 PS2.244 **Appelt, C.**; Characteristics Of Nesting Substrates Used By Exotic Monk Parakeets In the Chicago Area  
 PS2.245 **Appelt, C.**; Relationships Between Avian Communities and Presence of Exotic Monk Parakeets In the Chicago Area  
 PS2.246 **Robinson, D.**; Antibiotic resistance in bacteria from suburban and rural nestling American Crows in Iowa and New York  
 PS2.247 **Jones, J.**; The importance of old-field habitats to birds in a suburban-urban landscape  
 PS2.248 **Whitney, S.**; A Comparison of Nesting Success and Chick Productivity between Developed and Rural Bald Eagle Nests in South Carolina (1977-2007)  
 PS2.249 **Malpass, J.**; The influence of anthropogenic resources on nest predator activity and nest survival in suburban yards  
 PS2.250 **Neudorf, D.**; Do Carolina Wren fledglings experience lower survival in an urban ecosystem?

## MEETING ABSTRACTS—ALPHABETICALLY BY AUTHOR

**PS1.179 Aborn, David,** (University of Tennessee at Chattanooga, Chattanooga, United States);

### MASS CHANGES OF AUTUMN MIGRANTS AT AN URBAN STOPOVER IN TENNESSEE

Understanding the suitability of urban stopover sites is critical to the protection and management of migratory birds. Urban stopovers may initially appear suitable from a migrant's perspective, but such things as exotic species, pesticides, habitat homogenization, and increased predation may make urban stopovers unsuitable for fat deposition, rest, and survival. I have been mist netting migrants at Greenway Farms park in Chattanooga, TN. Overall, migrants tended to lose mass over the course of the day. Migrants did not differ in body condition between woods and overgrown field habitats, but tended to lose more mass in the overgrown field, although species specific differences were noted. The results suggest that Greenway Farms is not a suitable stopover for many migrants. The specific factors responsible for the unsuitability need to be determined and mitigated.

**PS2.225 Adam, Smith,** (Environment Canada, Ottawa, Canada); Hudson, Marie-Anne; Downes, Constance; Francis, Charles (Environment Canada, Ottawa, ON, Canada)

### ANALYSING CHANGES IN BARN SWALLOW POPULATION TRENDS OVER TIME USING DATA FROM THE BREEDING BIRD SURVEY

Understanding how populations are changing over time (population trend) and whether the rate of change varies is important for setting appropriate conservation priorities, as well as evaluating possible causes of population change. However, challenges arise if different methods of analysis produce different results. Currently, the Breeding Bird Survey (BBS) provides the best available data for estimating population status and trend for 65% of regularly occurring Canadian landbirds. Environment Canada's Canadian Wildlife Service (CWS) is working to improve BBS-trend estimates for Canada by adopting a Hierarchical Bayes (HB) modelling technique similar to that currently used by the USGS Patuxent Wildlife Research Centre. These models have several potential advantages, including more robust parameter estimates, but as with any change in analytical models, they also have the potential to produce different results and conclusions. Here, we present a case study of the Barn Swallow in Canada, where the new HB analysis and the previous CWS analysis generate different quantitative estimates of long-term trends and patterns in annual indices over time. The previous analysis showed an essentially stable population in the early years, followed by steep declines beginning in the mid-1980s. By contrast, the new HB model suggests a continuous long-term decline starting in the early 1970s. These differences have important consequences for identifying and understanding the factors that may be responsible for the declines. Using Barn Swallow data from the Canadian BBS, we compared results from the previous CWS analysis, the new HB analysis and a variety of models specifically developed to estimate changes in population trends over time. These include a "breakpoint" model that allows for separate trends before and after an unknown year, instead of a continuous long-term trend, and a year-effects model which imposes a hierarchical structure on annual indices across regional strata instead of on the long-term trend across years. We also evaluated models using sub-samples of Canadian BBS data to evaluate the impacts of changing sample sizes over time on the estimates (e.g., from 34 routes in 1966 to 518 in 2011).

These new models allow us to estimate, in a more robust manner, whether or not population trend has changed over time. They also us to evaluate the reliability of long-term trend estimates if the true underlying trend has changed over time.

**PS1.102 Adams, Evan,** (Biodiversity Research Institute, Gorham, United States); Jackson, Allyson (Biodiversity Research Institute, Gorham, ME, United States); Eagles-Smith, Collin (USGS, Corvallis, OR, United States); Spence, Sandra; Berkley, Jim (US EPA, Denver, CO, United States); Evers, David (Biodiversity Research Institute, Gorham, ME, United States)

### ESTIMATING RISK OF MERCURY EXPOSURE TO MIGRATORY BIRDS IN THE PACIFIC FLYWAY

Mercury (Hg) is a potent neurotoxin and endocrine disruptor that has become a global pollutant which poses a significant risk to many avian populations. However, determining the spatial distribution and the taxa that are most threatened by this toxin is complicated by numerous landscape and species-specific factors that still are not fully understood. In particular, the toxicological risk of Hg is directly related to its propensity for conversion to methylmercury, which is its most bioavailable and toxic form. While it has been difficult to monitor and elucidate the methylation process, recent published work has begun to model ecosystem sensitivity to mercury, providing a tool to assess risk over a large spatial scale. This is especially valuable for evaluating risk to migratory birds because of their broad space use and the conservation concern that methylmercury presents to these species. Many migratory bird populations have been declining over the past 40 years often without clear explanations as to how these populations are limited. The objectives of this paper are to use currently available tools and databases to determine those migratory bird species that are at greatest risk to mercury exposure across the Pacific Flyway. In this analysis we use Mercury Deposition Network data to estimate the total amount of atmospheric deposition across the flyway and Avian Knowledge Network and Breeding Bird Survey Data to estimate bird abundance during breeding, wintering, and migration seasons. Species will be selected using a sensitivity matrix that ranks their risk of methylmercury exposure based on their foraging guild, foraging habitat, and migratory strategy. Our results will highlight coarse areas within the flyway where Hg deposition and expected methylation are both high and where migratory bird densities are also high. In the future we hope to expand this analysis to other flyways in the United States and use these results to generate and test hypothesis about Hg exposure in birds across the continent.

**PS2.186 Adams, Rachael,** (University of Lethbridge, Lethbridge, Canada); Burg, Theresa (University of Lethbridge, Lethbridge, AB, Canada)

### POPULATION STRUCTURE OF A NORTH AMERICAN SONGBIRD, THE BLACK-CAPPED CHICKADEE (POECILE ATRICAPILLUS)

Physical barriers (e.g. mountains, geographic distance) often restrict population connectivity and dispersal causing a reduction in gene flow and resulting in genetically isolated populations. Dispersal barriers can also be non-physical (e.g. behaviour) and occur at smaller geographic scales (e.g. changes in vegetation). Although birds have high dispersal potential, evidence suggests dispersal is restricted by barriers. One major concern lies with the increasing susceptibility of birds to changes in the environment through land use change and

subsequent habitat fragmentation. Assessment of the geographical area or landscape is therefore critical when measuring gene flow and making inferences about barriers as cryptic barriers may exist. The black-capped chickadee (*Poecile atricapillus*) is a common, resident, North American songbird whose range encompasses a number of dispersal barriers and consequently, a reduction in gene flow is evident in this species. Here, microsatellite markers were used to assess allelic variation and population differentiation in the black-capped chickadee. Populations were sampled across the species' range at both large and small geographical scales. This sampling regime allows us to test for breaks in the genetic structure and to precisely locate where these discontinuities exist, thereby providing a platform for determining whether the sudden breaks identified correspond to changes in habitat, vegetation, physical barriers or other factors.

**PS2.26 Aidala, Zachary**, (The Graduate Center, CUNY, New York, United States); Hauber, Mark (Hunter College, CUNY, New York, United States)

#### PHYSIOLOGICAL AND FITNESS EFFECTS OF NEST REUSE IN THE EASTERN PHOEBE (*SAYORNIS PHOEBE*)

Altricial birds expend varied types and enormous amounts of parental care to provide for dependent young. Nest building is a major behavioral component of parental investment, as nests serve to house, thermoregulate, and protect eggs and nestlings from predators. Because nest building is costly in time and energy, reusing nests may increase fitness whereas losing a nest and subsequently having to rebuild it may lower reproductive output for the next breeding bout. In the Eastern Phoebe (*Sayornis phoebe*) experimentally induced nest loss between breeding seasons specifically results in a shorter breeding season with fewer second clutches. Here we investigated the potential breeding impacts caused by nest loss between first and second clutches within breeding season. We experimentally removed phoebe nests during the 2011 breeding season in a wild population of Eastern Phoebes in and around Ithaca, NY, USA and collected morphological indices of both nestling and adult quality throughout the breeding season. The likelihood of initiating a second clutch was contingent on timing of the initial onset of breeding in that later first clutch initiation dates resulted in fewer second clutches, irrespective of experimental nest loss or parasitism by the brood parasitic Brown-headed Cowbird (*Molothrus ater*); over 40% (18/38) nests monitored were abandoned after the first clutch in 2011. Second clutch nestlings had consistently lower morphological measurements than first clutch nestlings irrespective of nest treatment group. These pilot data suggest that female phoebes initiate a second clutch based on both timing and, perhaps with their own physiological condition, at the onset of initial breeding to ensure successful fledging. The results of this study also suggest that phoebes may engage in tradeoffs between current and future breeding attempts to maximize their future reproductive output.

**F16.1 Akresh, Michael\*** (University of Massachusetts Amherst, Amherst, United States); King, David; Brooks, Robert (U.S. Forest Service, Northern Research Station, Amherst, MA, United States)

#### DEMOGRAPHIC RESPONSE OF PRAIRIE WARBLERS TO HABITAT CREATION, SUCCESSION, AND DISTURBANCE IN A 'SHIFTING MOSAIC' LANDSCAPE

Early successional forests occur in a "shifting mosaic", in which available shrubland habitat changes both spatially and temporally in response to disturbance. Due to suppression of natural disturbances, most shrubland habitat currently consists of

habitat deliberately created and maintained in various forms by management: newly created shrubland habitat that matures over time (e.g., clearcuts), habitat that is persistent but disturbed on a continual basis (e.g., scrub oak barrens), or habitat that is persistent yet minimally disturbed through time (e.g., power line corridors). As shrubland bird populations decline, there is a critical need to understand the effects of habitat creation, succession, and disturbance, and to acquire knowledge of basic demographic parameters such as habitat-specific fecundity and dispersal that are keys to shrubland bird conservation. We studied a population of color-banded prairie warblers (*Setophaga discolor*) between 2008-2011 in a shifting mosaic 'meso-landscape' within a Massachusetts inland, pitch pine-scrub oak barren consisting of persistent, newly created, succeeding, and disturbed habitats. We found that the abundance and population structure at this site appears to be a function of colonization of newly created habitat by second-year birds, which are probably excluded from mature early-successional habitat by site-faithful older birds. Breeding season fecundity did not differ significantly between newly-created and mature habitats. Birds displaced by mowing or fire dispersed to nearby suitable habitat the following year. These displaced individuals did not affect pairing or reproductive success in adjacent areas. Our findings that newly created habitat is colonized by second-year birds who enjoy similar reproductive success as older-birds in mature habitat, and that reproductive success was similar for birds displaced by habitat disturbance are novel. Furthermore, these findings show that the short-term effects of shrubland management on shrubland birds are minimal and beneficial in the long-term by maintaining ephemeral shrubland habitat.

**PS1.17 Alamshah, Aubrey**, (Ohio Wesleyan University, Delaware, United States); Herder, Elizabeth (Ohio Wesleyan University, Delaware, OH, United States)

#### THE EFFECT OF MAINTENANCE BEHAVIOR ON THE PLUMAGE MICROBIOLOGY OF HOUSE SPARROWS (*PASSER DOMESTICUS*)

Preening is thought to serve many different functions in birds including feather alignment, cleaning, and spreading uropygial oil on the feathers. We suggest that preening may also serve the function of controlling for feather-degrading bacteria such as *Bacillus licheniformis* and *Bacillus cereus*, both of which have been observed to secrete keratinase enzymes which damage feathers. The bacteria may be controlled using the uropygial oil, or by the physical process of preening. In order to test whether it is the physical process of preening that controls microbial growth, we observed the behavior in House Sparrows held in an outdoor aviary. We caught ten House Sparrows in Ashley, Ohio and banded each bird with an aluminum band and a unique combination of color bands, measured the weight and wing length, examined condition of their feathers, and sampled their plumage for microorganisms. Half of the birds were fitted with collars which did not allow them to preen. The birds were observed for 2-3 hours each week and the preening behavior, including sequence, bout length, and position of the bird cleaned, was recorded. The birds were caught bi-weekly and the feathers on several different parts of the bird were tested for different types of microbial growth. Using selective media, we can test for specific microorganisms. The study is still in progress, but upon completion we will compare the number and type of bacteria sampled from each of the two groups of birds and perform statistical analysis to determine if there is a significant difference between the group with the collars from the group without the collars.

One theory for why uropygial oil may help to deter feather-degrading bacteria is that the oil forms a physical barrier

between the feather and the bacterium that is too viscous for the bacteria to travel through. Because bacteria have the ability to degrade feathers using the keratinase enzyme that hydrolyzes the beta-keratin of the feathers, they may also be attracted to some of the amino acids that are excreted from the feather during the feather degradation process. These *Bacillus* spp. have peritrichous flagella that allow them to be motile and follow these attractants to partially degraded feathers. To test this, we first measure the chemotactic responses of *Bacillus* spp. in a chemotactic assay using a low viscosity solution. Next, we worked with chemists to find the actual viscosity of uropygial oil. We found a medium that was similar to this without any nutritional components to run chemotactic assays in, because actual uropygial oil is in too small of quantities within the bird to actually test. These were compared against each other to find whether a correlation exists between viscosity of solution and chemotactic response. This study is also ongoing.

**SAT15.2 Alcaide, Miguel**, (UBC, VANCOUVER, Canada); Irwin, Darren E. (UBC, VANCOUVER, BC, Canada)  
**GENOMICS OF A RING SPECIES, THE GREENISH WARBLER PHYLLOSCOPUS TROCHILOIDES**

Ring species are extraordinary model systems in evolutionary biology since they illustrate how a single species can split into two different species even in the face of gene flow. Greenish warblers have accomplished a northward expansion that encircled the Tibetan Plateau and nearby deserts through two independent pathways, one to the west and one to the east. Two terminal forms, connected to the southern forms by a gradient in both genetic and phenotypic characteristics, coexist in central Siberia but do not interbreed. This reproductive isolation has been attributed to the accumulation of small differences in critical traits related to individual recognition and communication, such as song and plumage characteristics. Here, we use cutting-edge next-generation sequencing technologies in an effort to disentangle the relative roles of genetic drift and natural selection during speciation events. Several thousands of single-nucleotide polymorphisms (SNPs) were characterized through a genotyping-by-sequencing approach, and whole-genome sequencing was used to de-novo assemble a draft genome of the greenish warbler. Our first goal is to investigate whether the gradual change of nuclear genetic characteristics around the ring mostly follows an isolation-by-distance model, or if, on the contrary, there are sharp transitions such as those previously revealed by mtDNA markers. Secondly, we will search for peaks of increased or decreased genetic differentiation throughout the genome to ascertain the contribution of natural selection in shaping the geographic distribution of genetic variation and pinpoint genomic regions of evolutionary significance in the greenish warbler.

**T15.3 Aldinger, Kyle**, (West Virginia University, Morgantown, United States); Wood, Petra (U.S. Geological Survey West Virginia Cooperative Fish and Wildlife Research Unit, Morgantown, WV, United States)  
**CONSERVATION OF GOLDEN-WINGED WARBLERS ON PASTURELANDS IN WEST VIRGINIA**

The Golden-winged Warbler (*Vermivora chrysoptera*), a candidate for listing under the Endangered Species Act, is one of the most rapidly declining vertebrate species in eastern North America. Threats include habitat loss, Brown-headed Cowbird (*Molothrus ater*) brood parasitism, hybridization with Blue-winged Warblers (*Vermivora cyanoptera*), and potentially climate change. West Virginia is a population stronghold for the Appalachian region, a portion of the species' range that may be disconnected from the Upper Midwest population. We

monitored small populations of Golden-winged Warblers on range allotments on the Monongahela National Forest during 2008–2011. Habitat was manipulated during 2008–2009. To examine warbler response, we measured demographic rates as indices to habitat quality. Local declines in Golden-winged Warblers resembled those observed across the species' range using North American Breeding Bird Survey data. Overall, territory density decreased by almost 50% during the study, while territory size appeared to increase. Blue-winged Warblers and hybrids were rare but increased slightly during 2008–2011. From 2010 to 2011, Golden-winged Warbler territory density increased slightly, potentially demonstrating a delayed response to habitat management. Mayfield nest survival was 48% and decreased across years. The return rate for males was about 60% one year post-banding and decreased by about half each subsequent year. Birds banded as nestlings rarely returned to their hatch site. Our results highlight the dire situation facing this species and the potential importance of high-elevation pasturelands for their persistence.

**W11.3 Alessi, Sarah**, (Western Michigan University, Portage, United States); Vonhof, Maarten; Gill, Sharon (Western Michigan University, Kalamazoo, United States)  
**DELAYED DISPERSAL AND FAMILY LIVING WEAKLY INFLUENCE KIN-STRUCTURING IN THE NEOTROPICAL BUFF-BREASTED WREN (CANTORCHILUS LEUCOTIS) IN GAMBOA, PANAMA**

By shaping the spatial distribution of individuals across a geographic landscape, dispersal and social strategies may profoundly impact genetic diversity within populations. Juvenile buff-breasted wrens (*Cantorchilus leucotis*) delay dispersal, remaining with their parents on natal territories for up to a year, but they rarely breed cooperatively. Once they disperse, they often move short distances, which should lead to kin-structured populations in which relatives occupy neighboring territories. We investigated kin-structuring in buff-breasted wrens by determining whether related individuals occupy neighboring territories. We banded adult wrens and collected blood samples during 2010–11, used behavioral observations and microsatellite loci to characterize social and genetic relationships between individuals, and mapped territories. Both population and individual level spatial genetic analyses were used to detect population genetic structure and spatial clusters of relatives. Population level analyses revealed limited spatial genetic structure among territory holders within a distance of 150–200 m. Individual level analyses revealed the presence of spatial genetic clusters of relatives. Both of these results were found predominantly among males and were either weak or absent among females. Despite similar dispersal patterns observed among males and females, genetic analyses suggest that these patterns may differ slightly. Presence of kin-structure among males only corresponds with observed patterns of female-biased dispersal among birds. When subject to genetic drift and isolation by distance, kin-structuring may increase the probability of genetic structuring among behaviorally and geographically isolated populations. This study provides further insight into how dispersal and social strategies may shape the genetic composition of natural populations.

**PS2.83 Alfonso, Camilo**, (National University of Colombia, Bogota, Columbia); Cortes, Oswaldo; Acevedo, Orlando; Perez, Natalia; Cueva, Diego (National University of Colombia, Bogota, Columbia)  
**STUDY AND CONSERVATION OF BLACK INCA (COELIGENA PRUNELLEI) IN THE HIGH ANDES FROM**

## CUNDINAMARCA, COLOMBIA - STRATEGIES FOR EFFECTIVE CONSERVATION

*Coeligena prunellei* (Black inca) is a hummingbird species of Colombia listed as vulnerable VU in the IUCN Red list. This project seeks to characterize the habitat, determine population sizes and identify their diet to find the minimal requirements for the effective conservation of the species. We walked a linear transect in three different areas of Cundinamarca, on each transect we performed the characterization of the vegetation through five variables. The population density was determined by the number of surveyed individuals within the transects and data were analyzed with DISTANCE 3.5. We also documented reproductive data, foraging, vocalizations and interspecific interactions. We used three mistnets to evaluate the morphometry and identify the physical condition of the birds. Non-parametric tests were used for statistical analysis, the characterization of vegetation data were analyzed using Kruskal - Wallis test, variables which presented significant differences in this test were then analyzed with Tukey test and Spearman correlation. The population density data was analyzed with analysis of variance ANOVA. We note that *C. prunellei* associated with forest dominated by the oak species (*Quercus humboldtii*) with shrubs such as *Ocotea* sp. and herbaceous plants such as *Palicourea* sp. The Black Inca also prefers a vegetation cover from 70% to the 4-6 meters height, 15-65% coverage in 2-4 m height and 20-50% coverage for 0-2 m. The use of flowers during the study period was between 900-1600 flowers per transect. In the two areas most preserved the population density was from 1.2 to 0.6 Ind / ha, while the least conserved area density was not greater than 0.2 Ind / ha. The diet consists of 12-19 floral species of the Ericaceae, Rubiaceae, Bombacaceae, Gesneriaceae, Balsaminaceae and Malvaceae families. Males have fixed foraging territories, approximately 17 meters in radius, while the females forage by routing – traplining primarily. No molting or breeding data were observed during the study period. The population densities can be considered low compared with other species of hummingbirds, the highest densities seem to be associated with oak forests that retained high vegetation coverage and possess a greater amount of floral supply. Although populations are low, the records are not scarce and plans for sustainable management and larger protected areas may increase the population of this Hummingbird.

**PS1.116 Alicia, Andes**, (Texas Tech University, Lubbock, United States); Dabbert, Brad (Texas Tech University, Lubbock, TX, United States)

## THE EFFECT OF SUPPLEMENTAL FEED ON NORTHERN BOBWHITE QUAIL CHICK SURVIVAL IN THE TEXAS ROLLING PLAINS

There is a current paucity of scientific literature to adequately describe the first few months of the northern bobwhite quail (*Colinus virginianus*) life cycle and virtually no research to determine possible effects that management practices designed for adult quail inflict on chick demography. We postulated an increase in chick survival in response to the introduction of broadcasted supplemental feed as long as invertebrates did not limit the population. Hens were trapped, collared, released, tracked from October 2010 to March 2011 and monitored throughout the reproductive season. Chick survival checks were conducted with a thermal imaging camera at 4-5, 8-9 and 12-13 days old. Once fledging age was reached, night-netting was employed to catch the chicks and 1.2 g transmitters were applied to further determine survival. There were 18 broods consisting of 158 chicks within experimental supplemental feed areas compared to only 27 chicks within 3 broods located in control

areas without feed. There was no difference in the survival functions between experimental and control chicks  $\leq 13$  days old (control=14.8%, experimental= 13.3%,  $z= 0.222081$ ,  $p=0.4129$ ); however, survival rates for  $> 13$  days old chicks were immeasurable due to low survival, futile capture techniques and diminutive weights. The difference in the number of chicks produced between areas supplemented with and without feed suggested that this method increased chick production but not survival.

**W1.2 Allen, Marek**, (University of Western Ontario, London, Canada); Zanette, Liana (University of Western Ontario, London, ON, Canada); Clinchy, Michael (University of Victoria, Victoria, BC, Canada); White, Aija (University of Western Ontario, London, ON, Canada)

## A PATHWAY OF DESTRUCTION: DEMONSTRATING HOW ANTI-PREDATOR BEHAVIOURS CAN CARRY COSTS THAT CAUSE NESTLINGS TO DIE

Few experimental studies have demonstrated how anti-predator behaviours alone can carry costs that affect nestling condition and survival, in the absence of direct predation. We protected song sparrow (*Melospiza melodia*) nests from predators, thereby eliminating direct predation. We then manipulated predation risk by broadcasting the sounds of either predators or non-threatening species throughout the entire 130 day breeding season. We measured the anti-predator behaviours of parents in addition to nestling condition and survival. We then integrated our results into a path analysis which provided a heuristic model outlining how anti-predator behaviour can negatively affect offspring. Females in the predator playback treatment built their nests in denser and thornier vegetation which had cooler nest temperatures. Meanwhile, their nestlings were fed less, showed thermoregulatory stress, were lighter in mass, and died more often compared to nestlings in the non-threatening playback treatment. Our path analysis demonstrated that nest-site location influenced nest-site temperature, which influenced nestling thermoregulatory ability, which then ultimately affected nestling survival. A second pathway emerged whereby nestling mass was influenced both by parental feeding rates and nestling thermoregulatory ability, which also influenced nestling survival. Our path analysis highlighted the pivotal role that a frequently overlooked variable, nestling thermoregulatory ability, played in affecting nestling mortality. Overall, our results reveal all of the steps in the pathway from anti-predator behaviour to their costs to their effects on offspring survival.

**PS1.59 Almazán Núñez, Roberto Carlos**, (Universidad Autónoma Metropolitana, México, D.F., Mexico); Corcuera, Pablo (Universidad Autónoma Metropolitana, México, D.F., Mexico); Arizmendi, María del Coro; Eguiarte Fruns, Luis (Universidad Nacional Autónoma de México, México, D.F., Mexico)

## THE DISTRIBUTION OF THE FRUGIVOROUS BIRD COMMUNITY IN A DRY FOREST SUCCESSIONAL GRADIENT OF SOUTHWESTERN MEXICO

The influence of the composition and vegetation structure on the distribution of the frugivorous bird community was studied in three successional stages (early, intermediate and mature) of a tropical dry forest in southwestern Mexico in two contrasting seasons. The importance value of the woody plants ( $DBH \geq 10$  cm) and the relative abundance of the frugivorous birds were assessed in 41 circular plots in each successional stage. We obtained 16 vegetation variables analyzed using a principal component analysis (PC). The PC1 summarized the characteristics of advanced succession variables while the



second component represented early successional stages. During the dry season, species richness, abundance and diversity (Simpson) was higher in intermediate stages (Kruskall-Wallis test,  $P < 0.05$ ). In the wet season, there was no well-defined pattern related to the response of frugivorous birds to the successional stages. Regression and Canonical correspondence analysis showed that legitimate seed dispersers and seed predators were related to PC1 (advanced succession) in the dry season, while pulp consumers were associated with PC2 (early succession). These results are explained by the phenology of *Bursera* species, which produce highly consumed fruits during the dry season in dry ecosystems.

**W12.5 Alsip, Robert**, (Convenience Group Inc., Toronto, Canada);

#### PREVENTING AVIAN MORTALITY USING EXTERNALLY APPLIED FILM MARKERS.

An overview and current assessment of proven methods to prevent bird strikes on exterior glass for existing and new construction on both commercial and residential structures. Includes: properties of glass related to visibility to birds, effectiveness of markers based on location & spacing; owner acceptance regarding changes in building appearance; obtrusiveness to building occupants; and longevity & cost considerations.

Based on the wide range of studies on the subject, solutions have been developed that fit within the well documented criteria for effective bird deterrence. Human observation & actual bird collection data at a test facility, as well as actual residential and commercial building projects, were used for verification. Discussion of the factors that play a role in providing the necessary cues such that birds 'see' the glass including: marker size, colour & spacing as well as glass type and environment.

One case study focuses on the exterior application of full coverage films with varying degrees of obtrusion. The next two case studies focus on a more recent marker only solution that provides 98% clear viewing for building occupants.

**PS2.63 Altamirano, Tomás A.**, (Pontificia Universidad Católica de Chile, Santiago, Chile); Ibarra, José Tomás; Martin, Kathy (University of British Columbia, Vancouver, Canada); Bonacic, Cristián (Pontificia Universidad Católica de Chile, Santiago, Chile)

#### SOUTHERN TEMPERATE FOREST CAVITY-NEST WEB STRUCTURE: SPECIES RICHNESS AND THE ROLE OF TREE DECAY IN PATAGONIA, CHILE

Cavity-nesting communities exist within "nest webs" arranged hierarchically in nesting guilds in forest ecosystems where community composition and nidic structure are imposed by cavity availability and by intra- and interspecific interactions. During two breeding seasons (2010-2011, 2011-2012), we examined the components and structure of the cavity-nesting community in the Andean temperate forests of Patagonia, Chile, complementing our research with literature review. Cavity-nesting avian species ( $n=27$ ), including obligate and facultative cavity users, comprised a major component of the southern temperate forest bird community (53% of the avian community). Most cavity-using avian species ( $n=23$ ) are secondary cavity nesters and only four are primary cavity nesters (excavators). Despite the low species richness in our cavity-using community, there was comparable functional diversity to other cavity nesting community studies with two to three times more species. During both breeding seasons we found a total of 113 nests belonging to 15 bird species, including ten species endemic to Southern temperate forest, two song birds nesting in cavities which were

not previously described as cavity nesters, and three mammals (two rodents and one arboreal marsupial) breeding in tree cavities. Sixty-nine percent of nests were in tree-cavities created by natural processes (e.g. crevices, decay wood, broken branches), and the remaining 31% were cavities excavated mainly by the White-throated tree runner (*Pygarrhychas albogularis*). Dead trees or dead branches were the most common nest substrate (>50%). Similar to another cavity using community in Northern Argentina, we found that tree decay and physical damage processes were much more important for tree cavity formation compared to excavators in the Andean temperate forests of Patagonia. It is necessary, however, to explore species-specific site selection processes for determining the actual nest-site availability and the potential impacts of forest management on this community.

**PS1.133 Amundson, Courtney**, (USGS, Anchorage, United States);

#### HIERARCHICAL MODELS OF DISTRIBUTION AND ABUNDANCE OF BIRDS ACROSS COASTAL PARKS OF SOUTHWESTERN ALASKA

The Southwest Alaska Network comprises some of the largest national parks on the continent. Lake Clark National Park and Preserve, Katmai National Park and Preserve, and Aniakchak National Monument and Preserve straddle the backbone of the Alaska and Aleutian mountain ranges, spanning a distance of over five degrees of latitude. The rugged mountain ranges divide each of these coastal parks into maritime and continental portions, adding to the diversity of habitats and avifaunal assemblages that span the latitudinal and elevational gradients. Vegetation within these parks is constantly changing due to the natural forces of fire, glacial retreat, and vulcanism. Habitats are expected to change even more rapidly within this region as ecological processes are altered by climate change. The diverse habitats within these Parks provide important breeding areas for a vast array of bird species, including a unique complement of alpine-nesting species. Inventories of breeding birds were recently completed in each of these parks, with more than 7,000 detections of birds recorded at over 1,000 survey points. The surveys used distance-sampling and time-to-detection methods, which allow estimates of relative abundance that incorporate detection probabilities. We are using these bird survey data, in conjunction with physiographic and land-cover data, to build hierarchical models of bird distributions across the park landscapes. Such models incorporate not only detection probabilities but also the temporal and spatial correlation inherent in such bird survey data. We are constructing maps of predicted relative abundance and distribution for selected bird species in relation to current land cover and physiographic attributes. This modeling framework, extendable to other land units, should help resource managers make decisions from a landscape perspective and visualize potential broad-scale effects on avian populations from climate-driven changes to habitat.

**T13.4 Andersen, Michael J.**, (University of Kansas, Lawrence, United States); Nyári, Árpád S. (Oklahoma State University, Stillwater, OK, United States); Filardi, Christopher E. (American Museum of Natural History, New York, NY, United States); Moyle, Robert G. (University of Kansas, Lawrence, KS, United States)

#### PHYLOGEOGRAPHY IN THE SOUTHWEST PACIFIC: SYSTEMATICS, BIOGEOGRAPHY, AND SPECIES LIMITS IN THE GOLDEN WHISTLER (*PACHYCEPHALA PECTORALIS*) COMPLEX

A conspicuous element of island bird faunas, especially in the southwest Pacific, is the abundance of widespread 'polytypic' species. One of the most striking examples of polytypic species is the Golden Whistler *Pachycephala pectoralis*, which comprises ~65 subspecies spanning the Indo-Pacific. We generated a 10-gene dataset including complete DNA sequences of two mitochondrial coding genes and eight nuclear noncoding introns totaling 6,151 bp. We present a well-resolved phylogeny of the Pacific lineages of this textbook polytypic species complex including ~125 samples from two dozen islands across the Pacific. The results reveal several important aspects of the evolutionary history of *P. pectoralis*. First, the species is not monophyletic; *P. melanura* and *P. flavifrons* are closely related to subclades within *P. pectoralis*. Although at odds with current taxonomy, these relationships result in geographically cohesive clades. For example, *P. flavifrons*, a Samoan endemic, is closely related to nearby *P. pectoralis* populations in Fiji and Vanuatu. Similarly, *P. melanura*, from Australia and small islets around New Guinea, is closely related to Australian populations of *P. pectoralis*. In contrast, the three basic plumage types do not correspond to phylogenetic relationships; most subclades comprise all three plumage types. Most archipelagos received strong support for monophyletic radiations, however, support for a monophyletic Fijian radiation was equivocal. Samples from the main Fijian islands received strong support as a clade, but samples from the remote Lau Archipelago were in a polytomy with *P. flavifrons* and the main Fijian clade. Taken together, however, this relationship implies a single colonization of Polynesia by this complex. Our phylogenetic relationships highlight the fact that plumage patterns can be highly convergent, and consequently can be misleading when used for assessing evolutionary relatedness. Furthermore, we place this study in context by comparing phylogeographic patterns to other polytypic lineages of Pacific birds, including white-eyes and kingfishers. We observe a concordant pattern of rapid and widespread colonization with subsequent differentiation.

**PS2.55 Anderson, Alexandra**, (Boise State University, Boise, United States);

**POPULATION RESPONSE TO CLIMATE CHANGE: DOES ASSORTATIVE MATING FACILITATE EARLIER NESTING?**

Avian nesting phenology has been affected by climate change. Increasing numbers of birds are nesting earlier which may be expected because warmer winters permit earlier nesting, and, for most species, there is a strong seasonal decline in productivity. Birds that over-winter on or near breeding areas may have early access to mates and nests compared to non-residents, and assortative mating of over-winter residents and non-residents may be a mechanism for rapid population change and advances in nest initiation. This project will address 3 questions: 1) are winter resident birds more likely to mate with other winter residents and non-residents more likely to mate with non-resident birds? 2) do over-winter resident birds nest earlier in the breeding season compared to non-resident birds? and 3) are over-winter resident birds genetically dissimilar from non-residents?. I will mark winter resident American kestrels (*Falco sparverius*) during two winter seasons (2011/12 and 2012/13) and compare nest initiation dates of winter resident mated pairs and non-resident pairs. I will use blood samples to look for genetic differences between winter resident and non-resident mated pairs and their offspring using 6 microsatellite loci. In a pilot study last winter, 34% of over-wintering kestrels (n = 56) were recaptured in study area nest boxes, and their median date of nest initiation was significantly earlier than unmarked kestrels suggesting an advantage to over-wintering. Assortative mating

of winter residents could continue to advance nest initiation dates and result in rapid population changes for American kestrels.

**PS1.53 Anderson, John**, (College of the Atlantic, Bar Harbor, United States);

**COLONY COLLAPSE IN HERRING AND GREAT BLACK-BACKED GULLS: AN ASSESSMENT OF POSSIBLE CAUSES AND CONSEQUENCES.**

Herring and Black-backed Gull (*Larus argentatus* and *L. marinus*) populations in parts of the northeastern United States have declined significantly over the past quarter century. Aerial surveys conducted by the U.S. Fish and Wildlife Service in Maine in 1995-6 and 2008 suggest that this decline is non-uniform, with some colonies increasing while others decrease or are eliminated entirely. In general a pattern of near-shore losses is only partially compensated for by off-shore increases. Boat and nest counts of 7 colonies in mid-coast Maine indicate that this trend is continuing. Colonies recorded as healthy or even increasing in 2008 had been abandoned by 2011, or showed few or no fledglings. In some cases colonies that had persisted for decades were completely abandoned during the course of a single season, while others declined more gradually. Possible causes for these declines include increasing predation pressure from terrestrial mammals and Bald Eagles, loss of supplementary food sources including open land-fills and fish processing facilities, decline in herring, ale-wife and other in-shore fisheries, increased human disturbance, and the recycling of lobster bait. While gulls have been implicated in the destruction of tern (*Sterna*) nesting colonies and a decline affecting only gulls may obviate the need for active management, there is also evidence that Herring Gulls provide protection for Eider Ducks (*Somateria mollissima*) and Black Guillemots (*Cepphus grylle*). Both of these species are subject to egg predation from corvids, and it is possible that the loss of gulls may be accompanied by a chain of local extinction as predation levels rise. Of even greater concern is the possibility that the observed decline in gulls may indicate more general factors affecting multiple groups of seabirds. Gulls have received less attention than other seabird species in the recent past due to their seeming ubiquity and the perception that they are a "problem". The rapid decline of some of the Maine colonies suggests that a more intensive program of monitoring may be in order, along with systematic efforts to identify and possibly mitigate the causes of population change.

**PS2.17 Andrews, John**, (University of Illinois, Urbana, United States); Brawn, Jeffrey; Ward, Michael (University of Illinois, Urbana, IL, United States)

**HETEROSPECIFIC ATTRACTION IN GRASSLAND BIRDS: WHO IS LISTENING TO WHOM?**

Grassland birds are known to use conspecific cues during the breeding season but use of public information among grassland heterospecifics has not been investigated. While studying conspecific behavior in Grasshopper Sparrows (*Ammodramus savaannarum*) in Central Illinois in 2011, we observed significantly higher densities of Eastern Meadowlarks (*Sturnella magna*) in areas where Grasshopper Sparrows song was played suggesting heterospecific "eavesdropping" in grassland birds. We will conduct a controlled factorial experiment in Central Illinois to investigate whether Eastern Meadowlarks are used as a heterospecific cue for habitat selection by other grassland species. Heterospecific use of social information has been studied in other contexts, but not yet for habitat decisions in the onset of the breeding season, and especially not in grassland systems. Understanding heterospecific social cues grassland

species use when selecting habitat has implications for conservation and management at various scales.

**S10.6 Angelier, Frederic**, (Centre d'Etudes Biologiques de Chizé, CNRS, Villiers en Bois, France);

INTEGRATING AVIAN PHYSIOLOGY AND ECOLOGY: WHAT IS THE ROLE OF STRESS PHYSIOLOGY IN MEDIATING 'CARRY-OVER' AND 'SILVER SPOON' EFFECTS?

Why do birds differ in their performances? Several factors can account for this variability, but I will focus specifically on the potential for what are called "carry-over" and "silver-spoon" effects to explain this inter-individual variability in performances. These effects can be defined as the processes occurring in one season (or early life) that influence individual performances in a subsequent season (or later in life). Indeed, there is increasing evidence that these processes have huge consequences for individual fitness and population processes. However and surprisingly, almost no study has yet integrated avian stress physiology and ecology in the same framework to understand exactly how these processes mechanistically affect the fitness of birds. I believe that stress physiology is crucial to consider because it is known to mediate individual responses to environmental or energetic challenges and thus is often related to performances in birds. Indeed, by modifying individual phenotypes in response to environmental or energetic challenges, stress mechanisms orient individuals in specific ways that may modify their ability to respond effectively to environmental conditions during subsequent seasons or later in life.

In this talk, I will first review the links that exist between environmental conditions, stress physiology and performances in birds. I will demonstrate that specific events can have long-lasting effects on stress physiology and, therefore, stress physiology has the potential to explain the influence of "carry-over" and "silver spoon" effects on performances. Second, I will point out that all individuals are probably not equally affected by "carry-over" and silver spoon" effects, and I will emphasize that stress mechanisms may explain this variability. Because of varied stress physiology, individuals may indeed adopt different strategies in response to challenges and this can in turn affect their performances during subsequent seasons or later in life. I will illustrate all these points with examples from studies focusing on the relationships between age, stress physiology and performances in birds. Finally, I will discuss the gaps that persist in our understanding of the role of stress physiology in mediating these "carry-over" and "silver spoon" effects.

**PS2.91 Annetti, Kendall**, (Illinois Natural History Survey, Champaign, United States); Mateus-Pinilla, Nohra (Illinois Natural History Survey, University of Illinois at Champaign-Urbana, Champaign, IL, United States)

AVIAN HEMOPARASITES IN ILLINOIS AND THEIR EFFECTS ON HEALTH

Blood parasites are found in wild birds nearly worldwide but surveys have not been conducted in Illinois since 1957. There has been a limited focus in the literature on upland game and waterfowl species in the state, both of which are important to Illinois economy through hunting license sales. Additionally, avian hematozoa are thought to induce physiological stress in the individual, leading to decreased reproduction and health. To determine this, many studies have only compared body condition score with infected and non-infected individuals, but very few have tried to compare clinical health parameters from blood with infection. Therefore, the objectives of this study are

(1) to assess basic health parameters (white blood cell counts, packed cell volume, glucose, hemoglobin and fecal cortisol) between infected and non-infected upland game and waterfowl and (2) to determine the type, prevalence, density and intensity of hematozoa under natural conditions.

**PS2.179 Anthony, Roberts**, (Utah State University, Logan, United States);

ORIGIN OF WATERFOWL WINTERING ON THE GREAT SALT LAKE: A STABLE ISOTOPE APPROACH

Waterfowl migration has been studied through the use of banding data for decades. Recently stable isotopes from feathers have been recognized as a useful tool in studying avian migration. This tool provides a larger sample size in a shorter time period compared to long-term banding data. The ratio of stable isotopes of hydrogen can be used to identify the latitude at which feathers were grown. Water in food eaten during molt supplies a unique signature to feathers based on latitudinal isoclines. Flight feathers grown after molt are retained throughout the year. The Great Salt Lake (GSL) is an important stop-over and staging area for millions of waterfowl in the Pacific and Central Flyways and objectives of this work are to determine where Northern Shovelers wintering on the GSL migrated from and where the population will be nesting the upcoming year. Migration work, in addition to concurrent work on diet and body condition, will further our understanding of migration and wintering strategies of waterfowl, particularly Northern Shovelers. Feathers were obtained from birds collected by shooting them over decoys or obtained from voluntary hunters. Lab work on individual primary feathers involved drying to remove excess water, incineration, and running contents through a mass spectrometer. Resulting hydrogen ratio values are compared to hydrogen isoclines. We also compared the results of stable isotope data to results seen in long-term banding recoveries. We obtained feather samples from 250 birds from the GSL and wintering areas in the Southern High Plains and Coastal regions of Texas. We included in our analysis of banding data 256 banded female Northern Shovelers recovered from 1938 to 2008. Banding data and stable isotope analysis show two different patterns of Northern Shoveler migration to the GSL. Banding data show birds wintering in Utah have to travel over 1000 km less than average and save up to 3500 km of travel distance from some wintering birds. Stable isotope values implied that Northern Shovelers wintering on the GSL originated their migration further north, with an average latitude in central and northern Canada and southern Alaska. Migration paths and breeding origins will help determine how waterfowl are building up harmful contaminants and how food sources on the GSL affect subsequent survival and breeding attempts.

**PS2.245 Appelt, Christopher**, (Saint Xavier University, Chicago, United States); Ward, Lorrie; Fasanella, Joan; Bender, Colleen; Van Vossen, Brandy; Knight, Lynn (Saint Xavier University, Chicago, IL, United States)

RELATIONSHIPS BETWEEN AVIAN COMMUNITIES AND PRESENCE OF EXOTIC MONK PARAKEETS IN THE CHICAGO AREA

The potential impact of exotic Monk Parakeets on resident species has never been examined anywhere. Their recent expansion in the Chicago, IL area and other places makes such a study imperative. From October 2006 to May 2009, we monitored avian diversity (species richness and Simpson's diversity index) based on biweekly 1-km transect surveys in areas adjacent to Monk Parakeet nests (N=10) and similar areas at least 4 km from known parakeet nests (N=10). We

hypothesized that if Monk Parakeets are affecting other species, we would find differences in diversity between parakeet and non-parakeet areas. Furthermore, preliminary data suggested Northern Cardinals were less abundant in areas with parakeets. Therefore, we examined relative abundances of Northern Cardinals and other seed-eaters in areas with and without Monk Parakeets. Diversity and species richness fluctuated among areas over time, but Monk Parakeets did not appear to be associated with differences in overall diversity. However, numbers of Northern Cardinals tended to be lower in areas with parakeets. Interestingly, Monk Parakeet numbers were positively correlated with two other exotic species (Rock Pigeons and Eurasian Starlings). These data suggest Monk Parakeets do not appear to affect avian community makeup significantly, but they may be competing directly with Northern Cardinals for food.

**PS2.244 Appelt, Christopher**, (Saint Xavier University, Chicago, United States); Moreno, Alexandra (Saint Xavier University, Chicago, IL, United States)

#### CHARACTERISTICS OF NESTING SUBSTRATES USED BY EXOTIC MONK PARAKEETS IN THE CHICAGO AREA

Monk Parakeets have successfully colonized locations around the globe. This is likely due to their generalist nature and ability to build freestanding stick nests on a variety of different substrates. However, it remains unclear how and why they choose the substrates they use, but substrate height has been identified as a potential factor. A recent study of Monk Parakeet expansion in the Chicago, IL area (249 nests identified on 169 substrates) provides an excellent opportunity to examine a variety of nest substrates (43% in trees and 57% on manmade structures) over a broad area. From this list, we randomly selected and examined 30 manmade structures (poles, towers, antennas, etc.), 15 conifer trees, and 15 deciduous trees used as nesting substrates by Monk Parakeets. We recorded several variables: nests and nest openings/substrate, substrate height, height of largest nest (presumably the oldest and first built) on each substrate, and distances to and heights of the nearest unoccupied potential substrates (manmade, conifer and deciduous). We found no difference in the number of nests or nest openings among substrate types. The height of both the substrate and the largest nest differed among types with manmade substrates and nests being over 1.5 times taller/higher on average than their tree counterparts. Distances to and heights of the nearest unused potential manmade and deciduous substrate did not differ among substrate types, but conifers tended to be closer to other conifers. Interestingly, the closest unused manmade structures were taller than the average tree. Therefore, height alone does not seem to be the deciding factor when Monk Parakeets select nest substrates.

**W5.3 Arcese, Peter**, (University of British Columbia, Vancouver, Canada); Richard, Schuster (University of British Columbia, Vancouver, BC, Canada); Tara, Martin (CSIRO, Brisbane, Australia)

#### BIRDS AS INDICATORS OF 'ECOLOGICAL INTEGRITY' AND HUMAN INFLUENCE: USING OCCUPANCY MAPS TO PRIORITIZE CONSERVATION EFFORT

The direct effects of humans on native species and ecosystems via land conversion and harvest are well-documented, but the indirect effects of humans on native species distribution and the 'integrity' of natural ecosystems are, by comparison, still assumed to play relatively minor roles. We provide several examples to show how humans indirectly affect the abundance, distribution and demography of native birds in the 'Salish Sea' and Georgia Basin of the Pacific Northwest. We then show how

occupancy maps developed for common native and non-native species can be used in combination to estimate the indirect effects of humans on species occurrence at broad spatial scales, and to facilitate the prioritization of land management and conservation investments aimed at maintaining examples of native species communities in the absence of non-native or over-abundant, human commensal species. Our results indicate that composite indexes based on native and non-native species distribution can improve existing methods used to identify high value conservation areas, and to design reserve systems most likely to maintain 'ecological integrity' in future.

**PS1.227 Ardia, Daniel**, (Franklin and Marshall College, Lancaster, United States);

#### A RESEARCH COORDINATION NETWORK IN ECOLOGICAL IMMUNOLOGY (RCNE)

Ecological immunology, or eco-immunology, is a rapidly growing field, and in 2010, the National Science Foundation funded a Research Coordination Network in Ecoimmunology (RCNE) to foster conceptual and technical development of the field. Since funding, the RCNE has flourished, including: the spawning of several collaborations; the convening of topical workshops in Florida, Scotland, and (in summer 2012) Michigan; establishing an email list-serve; supporting trainee research exchanges; and producing a website. We present this poster to increase the visibility and membership of the RCNE.

**F13.7 Arizmendi, María del Coro**, (UNAM, Tlalnepantla, México, Mexico); Rodriguez Flores, Claudia I (Universidad Nacional Autónoma de México, Tlalnepantla, Mexico)

#### HUMMINGBIRD CONSERVATION: MUTUALISTIC INTERACTION WITH PLANTS NEEDED!

Hummingbirds are nectar feeding birds that pollinate plants in America. This is a mutualistic relationship where hummingbirds feed on nectar while transporting plant's gametes helping in plant reproduction. This relationship has received a lot of attention and many studies have been published. In order to provide a more accurate estimate of our knowledge about the number and identity of plant species visited by hummingbirds, we compiled a data set of published and unpublished (including thesis dissertations and reports or other unpublished work from authors and colleges) community level or pair wise surveys of plant-hummingbird interactions. A total of 111 papers, 43 thesis and 11 books were reviewed. A total of 1339 plant species belonging to 108 families and 294 hummingbird species were included in the interaction matrix. The matrix was analyzed using hierarchical clusters grouping by plant families and phylogenetical groups in hummingbirds. Clear groups were formed indicating geographical relationships and preferences. Important groups of plants can be highlighted mainly as representing important phenological corridors that support hummingbird migration, as clumped resources in stop-over or residence sites, or as food sources during breeding season. Those plants must be included in conservation plans to ensure Hummingbird conservation.

**PS1.155 Armiger, Jacob**, (Villanova University, Ardmore, United States); Martinez, Juan (Instituto de Ecología, A. C., Xalapa, Mexico); Curry, Robert (Villanova University, Villanova, United States)

#### GROUP COMPOSITION AND SITE-FIDELITY IN THE FACULTATIVELY COOPERATIVE YUCATAN WREN (CAMPYLORHYNCHUS YUCATANICUS)

Current research on cooperative breeding often focuses on factors influencing patterns of breeding within groups

(reproductive skew) as well as ecological variables that may promote divergence in social system among populations and species. *Campylorhynchus* wrens represent a model for studying environmental influences on the evolution of cooperative breeding because the genus includes cooperative and non-cooperative species. This study is the first to quantify group size and composition in the facultatively cooperative Yucatan Wren (*C. yucatanicus*) through intensive observation of color-banded individuals. This species is endemic to coastal thornscrub of the northern Yucatán Peninsula. We conducted fieldwork in May-July 2011 and January 2012 in and near the Ría Lagartos Biosphere Reserve, Yucatán, México. Nests are maintained as dormitories year-round, although clutch initiation did not begin until after the start of the rainy season in mid-June. Fledging likely continued until mid-August based on nestling age at the end of July. Groups of confirmed size contained 2 to 4 individuals. Group membership was defined by dominance behavior and duetting among group members. Of 21 groups monitored, 33% contained  $\geq 3$  individuals. Most auxiliary birds (7 of 8) were male, and all groups larger than 3 birds contained 2 males. Immature birds were present in 2 of the 7 groups; and although these individuals were tolerated on territories, we did not observe these birds engaging in duetting or nest-building behavior with other group members. We consistently re-sighted most individuals (47 of 57) on the same territory throughout the season. However, 10 individuals caught in late May - early June were not resighted later and likely moved outside the study area; most of these (8 of 10) were females. This sex-bias may represent pre-breeding territory selection. Individuals remain on territories year-round; multiple pairs were resighted on their summer territories the following January. Quantifying group size and composition in Yucatan Wrens allows for analysis of relatedness within and between groups and extra-pair parentage. These studies will help us better understand reproductive skew within the context of a facultatively cooperative species, and to consider ecological influences on breeding system in a socially variable genus.

**PS1.21 Armstrong, Tim**, (Adams State College, Alamosa, United States);

**FEMALE VOCALIZATIONS CORRELATE WITH THE SHORT-TERM FITNESS OF MALE AND FEMALE RED-WINGED BLACKBIRDS**

Females of a few bird species sing, but a full understanding of the function of female song is lacking. Red-winged blackbirds (hereafter "redwings") are one of the few temperate zone species in which both males and females use loud, complex vocalizations throughout the breeding season. We tested for correlations between female vocal behavior and female fitness, the fitness of her social mate, and frequency of extra pair paternity (epp). We measured four aspects of female vocalizations: 1) the female's vocalization rate throughout the breeding season, 2) the percentage of female vocalizations that contained tear notes, 3) the percentage of vocalizations given in flight, and 4) the percentage of female vocalizations associated in time with her social mate's songs. Of the four aspects of vocal behavior tested, only the percentage of antiphonal duets in which females vocalized immediately after their social mates' songs correlated positively with the rate of epp and correlated negatively with the fitness of both members of the mated pair. Our findings raise intriguing questions about the tradeoffs between behaviors that may reduce a female's short term fitness but may increase her life time fitness at the expense of her social mate's fitness.

**PS2.196 Arnaiz-Villena, Antonio**, (University Complutense, Madrid, Spain); Ruiz-del-Valle, Valentin; Areces, Cristina; Rey, Diego; Enriquez-de-Salamanca, Mercedes; Serrano-Vela, Ignacio (Canada)

**MAJOR HISTOCOMPATIBILITY COMPLEX ALLELE PERSISTENCE IN EURASIAN AND AMERICAN GENUS *CARDUELIS* DURING MILLION YEARS**

Genus *Carduelis* major histocompatibility complex (MHC) class I molecules were studied; research was centered in two species, parental *Carduelis spinus* (European Siskin) thriving along Eurasia and *Carduelis atrata*, endemic in Peru/Bolivia altiplano around Lake Titikaka at 3,500 metres elevation. Calculations by linearized maximum likelihood trees separate more than 2 million years the appearance of both species on Earth. Exon 2, intron 2 and exon 3 DNA sequences of class I MHC-F molecules were obtained from both species, and also other South and North American and Eurasian species (11 in total) by using standard cloning and automated DNA sequencing. Surprisingly, *C. spinus* and *C. atrata* shared the same MHC-F 01 allele. This allele is probably involved in defense against intracellular microbes and has undergone trans-specific evolution through a long period of time, since intermediate (in time) species also bear it. Advantages of this trans-specific evolution and the relatively low polymorphism (compared to human) found in these wild bird species are discussed. In general, wild animal MHC, including mammals, shows low polymorphism; the significance of these findings are contrasted with high polymorphism present in non-wild species, i.e., human, chicken and mouse.

**W12.3 Arnold, Todd**, (University of Minnesota, Saint Paul, United States);

**COLLISION MORTALITY IN NORTH AMERICAN BIRDS**

Migrating birds frequently collide with windows, wires, and towers; however, the overall impact of these sources of mortality on bird populations have not been rigorously assessed, owing in part to the highly dispersed nature of these mortality sources. Bird banding data provide an untapped source of data on dispersed mortality events such as collision mortality--since 1960, more than 64 million birds have been banded in North America, and more than 4 million of these birds have been reencountered. For birds found dead, encounter history codes include information on cause of mortality, including collision with "stationary objects" or "wires or towers or ceilometers" (i.e., How Obtained codes 13 and 54). I obtained 11,311 collision records from the USGS Bird Banding Laboratory; when combined with data on total numbers of birds banded, such data allow for relative estimates of per capita mortality risk among species. Raptors were especially vulnerable to collisions, whereas waterbirds and aerial insectivores were least vulnerable. Aerial pursuit predators and "feeder birds" predominated among birds killed at buildings, whereas raptors and large waterbirds predominated among birds killed by wires or towers. In marked contrast to previous analyses based on mortality at communication towers, nocturnal and long-distance migrants were not more vulnerable to collision risk with stationary objects and wires.

**PS2.220 Arnold, Todd**, (University of Minnesota, Saint Paul, United States);

**POPULATION ESTIMATES FOR GREAT LAKES MALLARDS**

Currently, Mallards (*Anas platyrhynchos*) from the Great Lakes states are considered part of the Midcontinent population, which is dominated by birds from the Prairie Pothole Region (PPR) of

Canada and the Dakotas. Based on data from the May Breeding Population Survey (BPOP) conducted annually by state agencies, Great Lakes Mallards comprise approximately 11% of the Midcontinent population. However, except for Wisconsin, state BPOP surveys are not strongly correlated with population trends derived from statewide Breeding Bird Survey (BBS) routes: Minnesota ( $r = -0.14$ ,  $P = 0.39$ ), Michigan ( $r = -0.10$ ,  $P = 0.71$ ), Wisconsin ( $r = 0.58$ ,  $P = 0.0003$ ). Waterfowl biologists have long recognized that it is more difficult to conduct population surveys in forested habitats, but the lack of concordance between BPOP and BBS population trends emphasizes the need for better population monitoring of Great Lakes Mallards. Lincoln estimators provide a third alternative for estimating population size of Great Lakes Mallards. Banding and harvest data can be combined to estimate late summer population size using simple capture-mark-recapture models. Lincoln estimators of after-hatch-year Mallard populations during 1995-2009 for Michigan, Minnesota and Wisconsin averaged 2- to 5-fold larger than BPOP estimators, but were at least positively correlated with BPOP estimates for Michigan ( $r = 0.78$ ) and Wisconsin ( $r = 0.60$ ). I conclude that even for well-studied and highly visible species like the Mallard, there is tremendous uncertainty about annual population fluctuations based on existing survey methods.

**F12.9 Auer, Sonya**, (University of Montana, Missoula, United States); Martin, Thomas (University of Montana, Missoula, MT, United States)

#### INDIRECT EFFECTS OF CLIMATE CHANGE ON NEST SITE USE AND OVERLAP AMONG COEXISTING WOOD WARBLERS

Climate-change driven alterations in the intensity of plant-herbivore interactions may have far reaching effects on the larger community because plants provide habitat for a wide diversity of organisms. Heterogeneity in plant community structure allows competing species to partition niche space and thereby facilitates the coexistence of multiple species. However, recent studies demonstrate that climate change can lead to an increase in the intensity of herbivory and a concomitant decline in plant diversity and abundance. Such changes in the plant community may decrease the availability of preferred foraging, nesting and resting sites and thereby lead to increased overlap in resource use among coexisting species with negative consequences for the persistence of those species. We investigated whether climate change intensification of herbivore impacts on a high elevation plant community in north-central Arizona, USA over the last 20 years has affected nest site choices and breeding success in three ground nesting songbirds – Orange-crowned Warbler, Virginia's Warbler and Red-faced Warbler. Reduced snowpack levels caused by increased temperatures have strengthened the browsing impact of elk on the recruitment of woody plants and led to precipitous declines in deciduous tree abundance. Previous studies show that the three bird species exhibited distinct preferences for nest sites among patches dominated by different woody plant species and that partitioning of their nest sites reduced their risk of nest predation. We tested whether declines in stem densities reduced the availability of preferred nesting sites and led to an increase in overlap in nest site use and a concomitant reduction in breeding success. We found that the availability of preferred nesting sites increased for Red-faced Warblers but declined for Orange-crowned Warbler and Virginia's Warblers. Overlap in nest site characteristics between the three bird species increased across years because Orange-crowned Warbler and Virginia's Warbler increasingly selected nest sites that were traditionally selected mainly by Red-faced Warbler. The increase in overlap

among nest sites of the three bird species was associated with an increase in daily nest predation rate for all three species. These results demonstrate that climate-driven alterations in plant-herbivore interactions can have cascading effects within ecological networks of multiple interacting species.

**PS2.44 Augustine, Jacqueline**, (Ohio State University at Lima, Lima, United States); Sawmiller, Jacob; Krohn, Luke; Schafer, Kristin (Ohio State University at Lima, Lima, OH, United States)

#### A THREE-YEAR STUDY OF HOUSE WREN REPRODUCTION AND FEEDING RATES IN THREE HABITATS REPRESENTING VARYING LEVELS OF HUMAN DISTURBANCE

Anthropogenic degradation of habitat may limit reproduction and survival of wild organisms. However, some species thrive in urbanized areas. We hypothesized that House Wrens (*Troglodytes aedon*) would have higher reproductive success in undisturbed habitats when compared to habitats that have been altered by human actions. We also monitored parental visitation rates to the nest box because the quality of parental care may determine offspring survival to adulthood. We monitored 123 nest boxes distributed among a forested habitat, a golf course, and a residential area from 2010-2012. We checked all of the boxes twice weekly between April and August for signs of nesting and daily when egg laying and hatching was expected. On days 4 and 10 after hatching, we observed how frequently the adults visited the box for 30 minutes. Overall, we found inconsistent differences in reproductive success among habitats. In 2010, wrens at the natural area initiated nests earlier in the year, but wrens at the golf course laid larger clutches after controlling for laying date. Despite having similar numbers of nest boxes in each habitat, wrens occupied more boxes at the golf course than the other two areas in 2011, a year with below-average precipitation. The number of visits to the nest box increased between 4 and 10 days after hatching, but did not vary by habitat or year. Our data suggests that house wrens may benefit from moderate levels of habitat disturbance, and that they are able to identify suitable microhabitats within each general habitat category.

**PS2.156 Ausprey, Ian**, (Klamath Bird Observatory, Ashland, United States); Stephens, Jaime (Klamath Bird Observatory, Ashland, OR, United States); Seavy, Nathaniel (PRBO Conservation Science, Petaluma, CA, United States); Alexander, John (Klamath Bird Observatory, Ashland, OR, United States)

#### NINE YEARS AND COUNTING: RESPONSE OF A MIXED BROADLEAF-CONIFER FOREST BIRD COMMUNITY TO WILDFIRE IN THE PACIFIC NORTHWEST, USA

Wildfire presents a significant disturbance within forests of the Pacific Northwest, USA, and is capable of altering avian community composition. While fire is known to have an immediate impact on forest birds, few studies have examined long-term effects as forest succession progresses. Using a Before After Control Impact framework we present the response of a mixed broadleaf-conifer forest bird community to a mixed-severity wildfire in southwestern Oregon, USA over nine years post-fire. We demonstrate that long-term patterns in habitat succession result in persistent population trajectories among forest birds. In particular, mature conifer associates such as Hermit Warbler, Red-breasted Nuthatch, and Chestnut-backed Chickadee, showed both immediate and long-term population declines due to a sustained loss of tree cover, while species associated with forest edges and shrubs, including Lazuli Bunting and Wrentit, increased as shrubs expanded. Considering

the fact that fire intervals in the Pacific Northwest likely spanned decades, long-term monitoring is critical for understanding how bird populations respond to such highly stochastic disturbance regimes.

**SAT10.2 Avery-Gomm, Stephanie**, (University of British Columbia, Vancouver, Canada); O'Hara, Patrick (Environment Canada- Canadian Wildlife Services, Sidney, BC, Canada); Kleine, Lydia (Slater Museum of Natural History, University of Puget Sound, Tacoma, WA, United States); Bowes, Victoria (BC Ministry of Agriculture, Animal Health Center, Abbotsford, BC, Canada); Wilson, Laurie (Environment Canada- Canadian Wildlife Services, Delta, BC, Canada); Barry, Karen (Bird Studies Canada, Delta, BC, Canada)

#### NORTHERN FULMARS AS BIOLOGICAL MONITORS OF TRENDS IN PLASTIC POLLUTION: EVIDENCE OF INCREASING PLASTIC INGESTION BY NORTHERN FULMAR IN THE NORTHEAST PACIFIC.

Marine plastic pollution is an increasingly important global issue, and this study provides one of the first assessments of local levels of plastics ingestion for the North Pacific. We examined stomach contents of northern fulmar (*Fulmarus glacialis*), which have proven a reliable indicator for trends in marine plastic pollution in Europe, to investigate trends in plastic pollution in the North Pacific. We quantified the stomach contents of 67 fulmars collected from beaches from in southwestern Canada, and northwestern USA from October 2009 - April 2010. We found that overall incidence rates (92.5% of fulmars ingested plastic) and amount of plastic ingested ( $36.81 + 9.76$  SE pieces;  $0.385 + 0.0867$  SE g) are among the highest in the world. When compared to earlier baselines for other regions of the North Pacific, our findings suggest that plastic ingestion by northern fulmars has increased over the past forty years, indicating that plastic pollution is an issue requiring attention in the North Pacific. This study provides strong support of the use of fulmar as a biomonitor of plastic pollution in the Northeast Pacific in future efforts to monitor plastic pollution.

**PS1.136 Bailey, Brett**, (University of Massachusetts, Amherst, United States); King, David (University of Massachusetts, Amherst, MA, United States)

#### MIGRATORY BIRDS IN TROPICAL AGRO-ECOSYSTEMS: ASSESSING THE INFLUENCE OF PATCH AND LANDSCAPE FACTORS ON HABITAT QUALITY.

Identification of habitats that support non-breeding migrants and provide sufficient resources for over winter survival and preparation for successful spring migration is a critical research priority. As agricultural development continues throughout the tropics, effective conservation planning requires an understanding of the role that local and landscape structure play in determining the quality of agricultural habitat for migratory birds. While shade-grown coffee has been shown to support a considerable diversity and abundance of Neotropical migrants, factors that influence the quality of coffee habit remain unclear. Through a combination of point count, banding, and telemetry data collected from coffee farms and nearby forest fragments, we modeled habitat quality across an agricultural region of northern Honduras. Two species of high conservation concern, the Wood Thrush and Golden-winged Warbler, are of particular interest within the study region. We analyzed abundance, survival and body condition of non-breeding Neotropical migrant birds as a function of within-patch habitat structure and landscape-level forest cover in order to provide a robust local

assessment of coffee habitat suitability for Neotropical migrants, and to quantify the role of landscape structure in tropical agro-ecosystems. This study is being conducted in collaboration with a local coffee cooperative, and within the context of an international education and research collaborative that includes universities in Massachusetts, Honduras, Nicaragua and Costa Rica. Through these collaborations, this work will directly promote awareness of conservation issues and sustainable agricultural practices among coffee farmers, and will be widely disseminated throughout the coffee growing regions of Latin America.

**S5.5 Balakrishnan, Chris**, (East Carolina University, Greenville, United States); Clayton, David (University of Illinois, Urbana, United States)

#### SONGBIRD TRANSCRIPTOMICS: LINKING THE GENOME AND SOCIAL BEHAVIOR

The first studies of gene expression in birds examined a single gene, the transcription factor ZENK (*egr-1*). These early studies showed that ZENK was expressed in specific regions of the brain in response to playbacks of conspecific song. Since then, studies of a handful of genes have revealed gene regulation in response to a variety of behavioral stimuli including hearing song, the act of singing, and territorial intrusion. Beginning with the advent of microarrays, it has become clear that social context modulates the expression of more than just a few genes in the genome. Rather, a large portion of the genome is engaged under varying behavioral contexts. Whole transcriptomic approaches, now bolstered by next-generation sequencing, have the potential to uncover gene regulatory networks that are differentially regulated in behavior. Moreover, such datasets allow us to predict regulatory interactions and to make inroads into the understanding of the underlying basis of behavioral variation. Transcriptomic approaches allow rapid and relatively inexpensive access to the entire expressed portion of the genome. I will discuss the nuts and bolts of transcriptome sequencing and assembly, and present results highlighting evolutionary changes between some classic (White-crowned Sparrow *Zonotrichia leucophrys*, Song Sparrow *Melospiza melodia*) and new (Violet-eared waxbill *Uraeginthus granatina*) avian models for the study of social behavior. These studies paint a distinctive and complementary picture of molecular evolution to those derived from comparisons of highly divergent whole genome sequences. I will also present data from song playbacks experiments in birds, highlighting novel findings made possible by the RNA-seq approach.

**PS1.194 Balasubramaniam, Priya**, (University of California, Riverside, NA, United States); Rotenberg, James (Department of Environmental Studies, University of North Carolina Wilmington, Wilmington, NC, United States)

#### PATTERNS OF LIFE HISTORY VARIATION IN A BREEDING BIRD COMMUNITY ALONG AN ELEVATIONAL GRADIENT

A central goal of evolutionary ecology is to understand the causes and consequences of the diversity of life history tactics observed among populations and species. The importance of environmental gradients in producing geographic variation in life history traits has been long recognized and studies of avian life history variation along latitudinal gradients are exemplars of that approach. Elevational gradients capture environmental variation similar to that expressed across latitudinal gradients, only over much shorter spatial scales. Compared to lower ones, higher elevations have colder temperatures, shorter breeding seasons, less predictable weather and higher seasonality similar

to the differences between lower and higher latitudes. Thus extrapolating latitudinal patterns to altitudinal ones, we expect birds breeding at higher elevations to show decreased adult survival, higher fecundity and shorter developmental period. To date, few studies have looked at patterns of life history variation of birds along elevational gradients and much of the existing effort has focused on intra-specific variation or variation within closely related species. Here, we aim to examine patterns of life history variation present in a community of birds breeding along an elevational gradient, and environmental factors associated with them.

We used 4th corner analysis to assess the relationship between ecological and life history traits and environmental factors in a breeding bird community in the White Mountains, CA, spanning an elevational range of 2,200-3,800m, from Pinyon-Juniper (low elevation) to Bristlecone Pine (high elevation) woodlands. At the community level, we found a significant positive relationship between length of the nestling period and elevation. The proportion of female-only incubation also increased as elevation increased. Thus higher elevations contained proportionally more species with longer nestling periods and female-biased incubation. As higher elevations pose greater energetic demands, we expected nestling periods to get longer. However, contrary to expectations, bi-parental incubation was not higher and we found increased female-only incubation.

Detecting similar trends across an entire community of birds allows us to understand similar selective pressures favored across these different environments. Further research can help elucidate the generality of these patterns and potentially identify traits that may change as the environment changes.

**T6.5 Baldo, Sarah,\*** (University of Windsor, Windsor, Canada); Mennill, Daniel; Guindre-Parker, Sarah (University of Windsor, Windsor, ON, Canada); Gilchrist, Grant (National Wildlife Research Centre, Environment Canada, Ottawa, ON, Canada); Love, Oliver (University of Windsor, Windsor, ON, Canada)

#### MORE THAN MEETS THE EAR: THE RELATIONSHIP BETWEEN SNOW BUNTING SONG, OXIDATIVE STRESS, AND REPRODUCTIVE PERFORMANCE

Honest signals are maintained by trade-offs between proximate costs associated with producing signals and ultimate fitness benefits obtained by signalling individual quality. Bird song is a well-studied avian behaviour which plays a major role in mate attraction and territory defence. Many studies have demonstrated that song relays information regarding individual quality to prospecting females and can consequently affect male reproductive performance. Male snow buntings (*Plectrophenax nivalis*) sing individually distinctive songs, varying in complexity and performance measures. Our research investigates the relationship between individual variation in song quality and reproductive performance, and examines potential physiological explanations for this relationship. Studying a population on East Bay Island, Nunavut, we recorded songs using focal and autonomous recording equipment, and collected plasma samples from males several times over the course of the breeding season. Our results demonstrate a positive relationship between snow bunting song quality and reproductive performance, suggesting that song quality has reproductive consequences. We investigate the potential honesty of song using the oxidation handicap hypothesis: higher quality males may be able to signal their superior quality via song because they can afford the oxidation costs generated by increased singing activity. We compare oxidative stress levels to song characteristics and reproductive performance, enhancing our understanding of the relationship between male quality and

singing behaviour. By investigating the role of physiology, we explore proximate linkages between song and reproductive performance. Additionally, we aim to provide a novel test of the oxidation handicap hypothesis using an important and widespread avian ornament, song.

**W16.12 Ball, Jeff**, (University of Alberta, Edmonton, Canada); Bayne, Erin (University of Alberta, Edmonton, AB, Canada)  
USING VIDEO MONITORING TO ASSESS THE ACCURACY OF FIELD-BASED ESTIMATES OF SONGBIRD NEST FATE AND NEST PRODUCTIVITY.

Nest fate and nest productivity are key demographic parameters for understanding songbird population dynamics, yet little consideration has been paid to assessing and improving the accuracy of these estimates in the field. We considered the magnitude and sources of error in field estimates of nest fate and productivity for 13 species of boreal forest songbirds, the implications of this error when estimating rates of nest survival and population growth, and the utility of common field cues used to assess fate. Using video from 127 nests, we found that observers correctly identified 85% of nest fates but overestimated nest productivity by up to 35%. This resulted in population growth rates being overestimated by 6%. Field estimates were less accurate when nestling age approached the estimated fledge date and when the nest was depredated. Accuracy of field estimates can be improved by focusing on nest condition and the presence of fecal droppings outside the nest. Spending additional time searching for family groups would be prudent when nests are deemed successful based on nestling age alone. Nest predators force fledged one or more nestlings from 14% of nests. The fate of force-fledged young is unknown. Our measures of error declined as increasingly younger force-fledged individuals were considered successful. Resolving this uncertainty would further improve the accuracy of field-based estimates. We encourage the use of video to quantify and improve the accuracy of field estimates and to evaluate the potential for differential bias in error within variables of interest.

**PS1.166 Ballard, Bart**, (Caesar Kleberg Wildlife Research Institute, Kingsville, United States); Reed, Daniel (Caesar Kleberg Wildlife Research Institute, Kingsville, United States); Geary, Brock; Green, Clay (Texas State University, San Marcos, United States); Howe, William (U.S. Fish and Wildlife Service, Albuquerque, United States)

#### MIGRATION ROUTES AND WINTERING SITES OF REDDISH EGRETS BREEDING IN TEXAS

Movements, migration routes, and wintering areas of Reddish Egrets (*Egretta rufescens*) are relatively unknown. We monitored adult Reddish Egrets marked with satellite transmitters to understand movements during the breeding season, migration, and winter. We attached satellite-GPS transmitters to 21 adults in 2010-11 in the Laguna Madre Texas and obtained 6 locations daily from 20 June 2010 to 30 June 2012. About half of our radio-marked sample migrated to Mexico to winter, while the remaining adults remained in the Laguna Madre and wintered near their nesting colonies. Migratory movements were initiated in mid- to late November and adults returned to the Texas Laguna Madre in late March and early April. Except for one adult that migrated across the Gulf of Mexico to the winter in the Bay of Campeche during both winters, all other migrating individuals moved down the eastern coast of Mexico on their way to wintering areas in Tamaulipas, Oaxaca, and Chiapas. Sixty percent of individuals that migrating south made a stopover at an estuarine site north of Tampico prior to long, non-stop flights to more southerly



wintering areas, revealing the importance of this site to migrating Reddish Egrets. Migration speed was faster during spring as individuals took half the time to return to breeding areas compared to fall migration. Lengths of nonstop flights during migration ranged from 442 to 1,052 km and were similar between fall and spring; however, time spent at stopover areas was 3 times longer in fall than in spring. Adults wintering in Mexico in 2010 and 2011 migrated to the same locations and occupied home ranges of < 30 km<sup>2</sup>. Reddish Egrets wintering on the Pacific Coast of Mexico may be associating with individuals from populations breeding in Oaxaca and Chiapas. Identification of important stopover and wintering areas will help guide management plans and increase our understanding of the connectivity among breeding populations.

**PS1.86 Ballard, Jennifer**, (Southeastern Cooperative Wildlife Disease Study, Athens, United States); Gibbs, Samantha (US Fish and Wildlife Service, Arlington, VA, United States); Dwyer, Chris (US Fish and Wildlife Service, Hadley, MA, United States); Brown, Justin (Southeastern Cooperative Wildlife Disease Study, Athens, GA, United States)

#### LESIONS ASSOCIATED WITH WELLFLEET BAY VIRUS IN COMMON EIDERS (SOMATERIA MOLLISSIMA)

Between 1998 and 2011, 11 mortality events occurred in common eiders (*Somateria mollissima*) along the coast of Cape Cod, Massachusetts. The Southeastern Cooperative Wildlife Disease Study (SCWDS) received 24 birds from three of these events for postmortem examination between 2009 and 2011. Seventeen of these birds had consistent gross and microscopic lesions, indicating a common cause of disease. In 2010, a novel orthomyxovirus, tentatively named Wellfleet Bay Virus (WFBV), was isolated from the tissues of four of these birds. Herein, we describe the clinical signs, gross lesions, and microscopic changes associated with natural WFBV infection in free ranging common eiders. The majority of eiders involved in these epizootics were found dead without showing overt signs of disease. When sick birds were detected, they displayed nonspecific signs including weakness, lethargy, and ataxia. At necropsy, the most consistent gross lesions included emaciation, skeletal muscle congestion, multifocal hepatic necrosis, and splenomegaly. The most common histologic lesions included myositis; multifocal to coalescing, randomly distributed hepatic necrosis; splenic necrosis; and renal tubular necrosis or hemorrhage. The observed gross and microscopic lesions indicate that WFBV infection produces severe, subacute to chronic, multisystemic disease in common eiders. To date, common eiders are the only species known to be susceptible to WFBV, and a great deal more research is needed to discern the pathophysiology, epidemiology, ecology, and long term implications of this virus.

**F5.5 Banko, Paul**, (USGS - Pacific Island Ecosystems Research Center, Hawaii National Park, United States); Camp, Richard (Hawaii Cooperative Studies Unit, Pacific Aquaculture and Coastal Resources Center, University of Hawaii at Hilo, Hawaii National Park, HI, United States); Farmer, Chris (American Bird Conservancy, Hawaii National Park, HI, United States); Brinck, Kevin (Hawaii Cooperative Studies Unit, Pacific Aquaculture and Coastal Resources Center, University of Hawaii at Hilo, Hawaii National Park, HI, United States); Leonard, David (Hawaii Department of Land and Natural Resources, Division of Forestry and Wildlife, Honolulu, HI, United States); Stephens, Robert (Pacific Cooperative Studies Unit, University of Hawaii at Manoa, Hilo, HI, United States)

#### RESPONSE OF A SUBALPINE HAWAIIAN FOREST BIRD COMMUNITY TO PROLONGED DROUGHT AND HABITAT DEGRADATION BY FERAL UNGULATES

Non-native species have severely impacted bird populations on remote oceanic islands. During the past 200 years of anthropogenic change, extinction has claimed half of all historically-known Hawaiian passerines, and today many extant species are endangered. Moreover, climate change has begun to threaten the remaining species and their habitats. Habitat disturbance has historically affected populations of feeding specialists most profoundly, and our results indicate that specialists continue to be at higher risk of extinction than generalists. Nevertheless, climate change effects are also becoming evident even in some abundant introduced generalist species. Surveys of passerines during 1998-2011 in subalpine woodland habitat on Mauna Kea Volcano, Island of Hawai'i, revealed that the abundance of the critically endangered Palila (*Loxioides bailleui*) declined by 79% after 2003. This species had declined to an estimated 1263 individuals in 2011, and its range had contracted to only 14.6 km<sup>2</sup>, thereby increasing the extinction risk of this seed-specialist. An endangered specialist insectivore, the 'Akiapōlā'au (*Hemignathus munroi*), was not detected in the survey area after 1998. The Hawai'i 'Amakihi (*Hemignathus virens virens*), a generalist feeder and the most abundant species on Mauna Kea, was the only native species to maintain a relatively stable population. Annual abundance estimates of the three most common introduced species varied considerably, with two showing no trend, and the Japanese White-eye (*Zosterops japonicus*), a well-entrenched generalist, showing a decline. Also surprising was the continued spread of the new colonist, the Japanese Bush-Warbler (*Cettia diphone*). Drought prevailed in 74% of months during 2000-2011, and dry conditions contributed greatly to the recent decline of the Palila by reducing the annual māmane (*Sophora chrysophylla*) seed crop, which influences Palila breeding and survival. Long-term browsing by introduced ungulates continues to degrade the habitat and reduce māmane reproduction, which has lowered the habitat's carrying capacity. Māmane saplings were 23.6 times more abundant in ungulate-free plots than in plots exposed to ungulates. Eliminating ungulates is critical to restoring the forest and mitigating for the effects of drought. The responses of Palila and other forest birds on Mauna Kea illustrate how changing climatic conditions can interact with the effects of invasive species to intensify threats to endemic birds.

**T15.2 Bardo, Lina**, (McGill University, Ste-Anne-de-Bellevue, Canada); Bird, David (Avian Science and Conservation Centre, Ste-Anne-de-Bellevue, PQ, Canada)

#### COMPARISONS OF ADULT MORPHOLOGY, NEST SUCCESS AND NESTLING GROWTH BETWEEN CAPTIVE-BRED, FIRST-GENERATION CAPTIVE AND WILD AMERICAN KESTRELS (FALCO SPARVERIUS)

Concerns associated with captivity include possible changes in morphology, reproductive success and growth that could render individuals unfit to survive reintroduction into the wild or unsuitable as captive wildlife models in research. Two experimental designs intended to separate the effects of origin and rearing environment were used to study the effects of captivity on the American kestrel: 1) a whole-clutch cross-fostering study between captive and wild pairs, and 2) a comparison between mixed pairs of captive-bred and first-generation captive (F1) kestrels raised in an identical captive setting. Results of the cross-fostering study suggested captive birds produced larger eggs and clutches with reduced fertility and nestling survival compared wild birds, regardless of the environment the clutches were reared in. Comparisons between

captive and F1 pairs showed reduced reproductive success in pairs containing an F1 adult. A gender effect was also noted; broods produced by F1 males exhibited poorer reproductive success than those produced by captive males, regardless of the origin of the female in the pair. Large adult mass and increased egg volume were also associated with reduced nest success. Any differences noted in nestling growth were short-term or temporary in both components of the study. An overall comparison of wild, captive and F1 kestrels revealed that most differences noted in the study were the result of rearing environment, though differences between captive and F1 birds indicated some selection has occurred after 10 - 20 generations of captive breeding with no intentional selection for particular traits.

**PS2.104 Barker, Nicole K.S.**, (Université Laval & Ducks Unlimited Canada, Québec, Canada); Roy, Christian; Cumming, Steven G. (Université Laval, Québec, PQ, Canada); Darveau, Marcel (Ducks Unlimited Canada & Laval University, Quebec City, PQ, Canada)

#### PREDICTING WATERFOWL OCCURRENCE AND DISTRIBUTION: EFFECTS OF CLIMATE AND HABITAT

Species distribution models (SDMs) yield information about species ecology, inform conservation planning, and can be used to predict effects of climate change. We used the USFWS' annual Waterfowl Breeding Population and Habitat Survey (WBPHS) to create species distribution models for 14 waterfowl species and then map their predicted probability of occurrence. The WBPHS collects waterfowl abundance data from hundreds of 28-km x 400-m segments. We aggregated this information to presence-absence per segment across three years (2004-2006) and built boosted regression trees to model probability of occurrence as a function of climate and habitat. Our predictor variables were climate normals summarized to season (spring, summer, fall, winter), as well as percentage of open water and wetlands present in a 1-km buffer around the sampled segments. Across all species, maximum temperature in autumn was the most important variable in determining occurrence; it was the top contributor for 9 species. Percent water was next most important, being the first or second contributor for 8 species. Percent wetland was always in the top 10 (of 14) variables, but never the top contributor. We compared models for species that breed primarily in the prairie-pothole region versus those that breed primarily in the boreal region. For boreal species, the most influential variables were autumn maximum temperature, percent water, autumn precipitation, and percent wetland. For prairie species, the most influential variables were autumn maximum temperature, spring minimum temperature, winter minimum temperature, spring maximum temperature, and percent water.

As expected, the presence of water plays an important role in determining the overall distribution of waterfowl species, although wetlands appear to have less of an influence than expected. Somewhat unexpectedly, climate in autumn appears to play a strong predictive role in distributions of all species, and spring plays an important role for prairie species. The apparent influence of autumn and spring climate could be due to non-causal correlation, or they could be acting as proxies for the length of time available for breeding. Future work will involve bioclimatic indices, forest structure, and other variables to test explicit biological hypotheses.

**SAT18.4 Barr, Kelly**, (USGS, San Diego, United States); Kus, Barbara (USGS, San Diego, United States); Preston, Kristine (Nature Reserve of Orange County, Irvine, CA, United States); Vandergast, Amy (USGS, San Diego, CA, United States)

#### URBAN LANDSCAPE GENETICS OF A PROTECTED SONGBIRD

Extensive urban development and wildfire have substantially reduced available habitat for the Cactus Wren (*Campylorhynchus brunneicapillus sandiegensis*; CACW) in San Diego and Orange Counties. Remaining populations are small and fragmented, raising concerns about genetic connectivity in the protected, resident songbird. We sampled all of the major known aggregations of CACWs in San Diego and Orange Counties, and genotyped 168 individuals across a panel of 20 microsatellites we developed for the species. We characterized patterns of genetic diversity and differentiation across the sample area, and identified the potential effects of fragmentation and other landscape barriers to dispersal and gene flow. Clustering analyses indicate low gene flow among aggregations of CACWs around the southern, more urbanized half of San Diego County relative to those in the northern area of the county and adjacent groups in southern Orange County. This pattern is further evident in the varying signatures of isolation-by-distance (IBD), with strong IBD in the northern half of the sampling area indicating sites are well connected via localized dispersal and stepping stone gene flow. Conversely, a lack of IBD among groups in the southern half of the sampling area indicates movement is more restricted. Genetic diversity is even among all sample sites despite these contrasting signatures of differentiation, indicating that the reduction in gene flow among southern sites is recent. These results underscore the value of understanding connectivity among reserve systems, and will provide guidance for future habitat protection and restoration efforts.

**T13.3 Barrowclough, George**, (American Museum of Natural History, New York, United States); Groth, Jeff; Lai, Jonas (American Museum of Natural History, New York, NY, United States); Schroeder, Michael (Washington Department of Fish and Wildlife, Bridgeport, WA, United States); Gutierrez, Rocky (University of Minnesota, St. Paul, MN, United States)

#### PHYLOGEOGRAPHY AND SPECIES-LIMITS IN THE SPRUCE GROUSE COMPLEX.

We investigated species-limits and patterns of genetic variation in the Spruce Grouse complex (*Tetraonidae: Falcipennis*) using mitochondrial, sex-linked, and autosomal DNA sequences. Populations were sampled from throughout the range of the Canadian, Franklin's, and Prince-of-Wales forms. For the mitochondrial ND2 sequences, those three taxa were approximately 2% divergent from each other and formed monophyletic clades with high bootstrap support; 79% of the total genetic variation was distributed among the geographical regions corresponding to their populations. These results, along with salient phenotypic and behavioral differences, are consistent with three species-level taxa. Within Canadian and Franklin's Spruce Grouse, nucleotide diversity within populations was relatively low and among-population genetic variance was high; *Gst* was 49% and 33%, respectively, among populations of these birds. This suggests the species are composed of fragmented populations with limited dispersal. In addition, the geographic pattern of haplotype distribution within the Canadian Spruce Grouse was highly structured, suggesting the existence of multiple Pleistocene refugia. The patterns of nuclear DNA sequences were generally consistent with the mitochondrial results, but with less differentiation. The geographical position of the transition between Canadian and Franklin's Spruce Grouse at the Z-linked aconitase intron was offset from the mitochondrial transition by several hundred kilometers.

**T5.4 Barton, Daniel**, (Humboldt State University, Arcata, United States); Martin, Tom (USGS Montana Cooperative Wildlife Research Unit, Missoula, MT, United States)

#### TIMING AND PROXIMATE CAUSES OF MORTALITY IN WILD BIRD POPULATIONS: TESTING ASHMOLE'S HYPOTHESIS

Fecundity in birds is widely recognized to increase with latitude across diverse phylogenetic groups and regions, yet the causes of this variation remain enigmatic. Ashmole's hypothesis suggests increasing seasonality leads to increasing overwinter mortality due to resource scarcity during winter, thus increasing per-capita resources for breeding during the resource-rich summer. Clutch sizes are therefore predicted to increase with increasing degree of seasonality, such as occurs with increasing latitude. While this hypothesis has been widely supported through indirect tests such as correlations between clutch size and measures of seasonality, the underlying mechanisms of this hypothesis remain poorly explored. We used a meta-analysis of over 200 published studies to test two underlying assumptions of this hypothesis: that mortality is greatest during the season of greatest resource scarcity and that most mortality is caused by starvation. We show that across 69 studies of seasonal mortality rates, winter was not the season of greatest mortality – indeed, summer often was. Across 39 studies from which we extracted monthly survival rates, relationships between monthly productive and monthly survival varied widely and negative relationships were as common as positive relationships. The most frequent proximate cause of mortality in 148 studies representing a diversity of seasons, study designs, and species was predation, rather than starvation. Our results fail to support the idea that seasonality of resources causes latitudinal variation in clutch size via the mechanism of Ashmole's hypothesis, and suggest alternative explanations of latitudinal variation in clutch size should remain under consideration.

**SAT5.2 Barton, Gina G.**,\* (Kansas State University, Manhattan, United States); Sandercock, Brett K. (Kansas State University, Manhattan, KS, United States)

#### ECOLOGICAL CORRELATES OF LONG-TERM CHANGES IN THE SEASONAL PHENOLOGY OF MIGRATORY SONGBIRDS

Climate change has had widespread impacts on the seasonal phenology and geographic distributions of plants and animals. One mechanism driving declines of long-distance migratory birds is mismatches between changes in climate and timing of food availability during migration. We examined long-term changes in timing of spring and autumn migration in five species of migratory songbirds, and the response of migration timing to regional climate conditions over a 22-year period in northern California. Our project is one of the first studies of migratory timing on the Pacific coast, and we found that changes in timing of migration varied seasonally and among species, with greater variability in spring than in autumn. In spring, timing of migration advanced and the migratory period became compressed or protracted. Delays in timing of migration were the most common pattern in autumn. Responses of timing of migration to regional climate conditions were relatively consistent among five songbird species. Advances in timing of spring migration were most often associated with warm, wet conditions, and delays in timing of autumn migration were most often associated with warm, dry conditions. Variation in the timing of migration was most often associated with El Niño Southern Oscillation and Pacific/North American climate indices, with the strongest effects in migration timing for Pacific-slope Flycatchers (*Empidonax difficilis*) and Orange-

crowned Warblers (*Oreothlypis celata*). Regional climate conditions were key drivers for phenological events for western songbirds, and may be increasingly important because of potential changes in the intensity and periodicity of key climate indices.

**PS1.47 Batdorf, Katharine**,\* (The Ohio State University, Columbus, United States); Rodewald, Paul (The Ohio State University, School of Environment and Natural Resources, Columbus, OH, United States); Matthews, Stephen (The Ohio State University, Columbus, OH, United States); Matthew, Shumar (The Ohio State University, School of Environment and Natural Resources, Columbus, OH, United States)

#### ARE ALL BIRDS MOVING POLEWARD? UNDERSTANDING DISTRIBUTIONAL SHIFTS IN OHIO'S BREEDING BIRDS

Research on the effects of environmental changes on avian distributions is essential in predicting, managing, and conserving bird populations. Several recent studies have reported poleward shifts in bird distributions which are likely associated with a warming climate. However, only a few such studies have used fine-scaled regional data such as that generated by Breeding Bird Atlas projects, only one of which is from North America (New York State). The American Midwest presents different species assemblages and landscapes relative to these previous studies. Our study provides an opportunity to test whether poleward trends in avian distributions observed in other regions transcend these ecological differences. We used detailed grid-based data collected during two Ohio Breeding Bird Atlas projects (1982-1987, 2006-2011) to quantify changes in latitudinal extent, center of occurrence, and occupancy in 94 species within Ohio over ~25 years. Individual species demonstrated dramatic latitudinal changes in their distributions, with the centers of occurrence of 53% of species examined shifting north or south by more than 10km. Despite these results, our analyses did not show a significant poleward shift in distributions across species, although, on average, northern extent and center of occurrence of southerly species did shift north by 4.6km and 8.6km, respectively ( $p > 0.10$ ). Additionally, we found evidence of southward shifts in northerly species, with southern extents and center of occurrence shifting on average 19.6km and 6.5km south, respectively ( $p < 0.05$ ). Although northerly and southerly species did not differ significantly in occupancy changes, we found that for southerly species, the change in occupancy was positively associated with the proximity of a species' distributional range boundary to our study area ( $p < 0.05$ ). This suggests that species along the northern periphery of their range gained more blocks than species for which Ohio is more central in their distribution. Poleward shifts in avian distributions may be more difficult to detect in our study because additional factors such as land cover change may affect distributions more strongly on this finer scale or within Ohio's largely human-utilized landscape. Our future analyses will attempt to partition variance in both climate and land cover change to elucidate environmental determinants of the changes we observed in Ohio's breeding bird distributions.

**PS2.124 Baumann, Matthew**, (University of New Mexico, Albuquerque, United States); Wolf, Blair (University of New Mexico, Albuquerque, United States)

#### TRACING DEUTERIUM THROUGH BIRDS AND MAMMALS ALONG AN ELEVATIONAL GRADIENT IN THE SANGRE DE CRISTO MOUNTAINS

Stable hydrogen isotopes ( $\delta D$ , deuterium) have been used extensively to determine origins and movements of animals

along continental and elevational gradients. Few studies, however, have examined how elevational changes in deuterium values of precipitation are directly transferred into the food web. Because animals incorporate the local food web  $\delta D$  values into their tissues we should see tissue values that reflect elevational changes. Body water  $\delta D$  values reflect an animal's current environment, as isotopes in the body water pool turn over at weekly (or more frequent) intervals. Keratinous tissue such as feathers, fur and nails are inert,  $\delta D$  values in these tissues are reflective of an animal's molt location, and will not change until a new feather or fur is grown.  $\delta D$  values of rainwater show a linear depletion with increasing elevation and in tropical regions this translates to a  $\delta D$  depletion rate in birds of -3.8 to -4.2 ‰ VSMOW for every 500m change in elevation. In this study we examine changes in deuterium isotope ratios in plant water, insect, bird and mammal body water, claws, feathers and fur as a function of elevation on a temperate mountain in central New Mexico. We found, as predicted,  $\delta D$  values of plant water are increasingly depleted with increasing elevation ( $P < 0.001$ ) and the body water pool of animals track these changes. 14 species of birds consisting of 35 individuals were sampled along the elevational gradient and showed a significant depletion of  $\delta D$  with increasing elevation ( $P < 0.0001$ ). Two species of small mammals consisting of 22 individuals also showed a significant depletion of  $\delta D$  with increasing elevation ( $P < 0.001$ ).

**PS1.22 Bayard, Trina**, (University of Connecticut, Seattle, United States); Elphick, Chris (University of Connecticut, Storrs, United States)

**BROADCASTING AUDITORY CUES TO TEST FOR CONSPECIFIC ATTRACTION IN AN OBLIGATE SALT MARSH BIRD: CAN SOCIAL CUES BE USED TO FACILITATE RESTORATION?**

Coastal salt marshes are the subject of widespread restoration efforts, however little is known about the extent to which social cues such as conspecific density may facilitate avian colonization of new marsh habitat. Audio broadcast experiments have increasingly been used to test for social mechanisms of habitat choice in songbird species; for those species that use auditory density cues, broadcasting conspecific vocalizations in restored habitat may help promote colonization. In this study, we tested whether the saltmarsh sparrow (*Ammodramus caudacutus*), a saltmarsh specialist, uses conspecific attraction to make habitat selection decisions. In one experiment we broadcast saltmarsh sparrow vocalizations at 11 unoccupied or low-density sites to test whether auditory conspecific cues would attract saltmarsh sparrows to previously unoccupied habitat. In a separate experiment, we broadcast saltmarsh sparrow vocalizations in experimental plots within two high population density marshes to test whether conspecific attraction affects local settlement decisions. Despite previous research indicating that sparrow density may be a useful cue of nesting activity, we found no evidence that saltmarsh sparrows respond to auditory density cues in either context. Not only were sparrow numbers very similar in pre-treatment and treatment plots at the low-density sites, and in treatment and experimental plots at the high-density sites, but the number of nests and fledglings produced were similar as well. The results of this study suggest that conspecific attraction is not an important component of habitat settlement decisions for this species and that broadcast of auditory conspecific cues is not likely to be effective in promoting colonization of unoccupied or restored habitat.

**F9.4 Bayly, Nicholas**, (SELVA: Research for Conservation in the Neotropics, Bogota, Columbia); Gomez, Camila (SELVA:

Research for conservation in the Neotropics, Bogota, Columbia); Hobson, Keith (Environment Canada, Saskatoon, SK, Canada)

**PREPARING TO CROSS THE CARIBBEAN SEA: THE SPRING STOPOVER OF THE GRAY-CHEEKED THRUSH CATHARUS MINIMUS IN NORTHERN COLOMBIA**

Stopover sites used to store the energy that fuels migration, especially those used prior to crossing ecological barriers, are regarded as critically important for the survival of Nearctic-Neotropical migratory birds, many of which are in decline. To determine if South American stopover sites are used to store the energy required to cross the Caribbean to North America by a Neotropical migratory landbird, we studied Gray-cheeked Thrushes in northern Colombia through constant effort mist-netting during spring migration in 2010 and 2011. We combine stopover duration estimates and models of body mass change based on recaptures, to estimate departure body mass and potential flight range from our study site. We recaptured 62 birds in total, the majority of which gained mass. Models indicated significant differences in rates of mass gain between years (2.6% LBM/day vs. 3.5% LBM/day), age groups (2010 only) and with arrival date (2011 only). 'Total stopover' durations varied between 15.4 (2010) and 12.5 days (2011). Predicted departure mass ranged between 41.3 g and 44.9 g and potential flight range was estimated between 2727 km and 4270 km; consequently Gray-cheeked Thrushes departed from our study site with sufficient energy reserves to cross the Caribbean Sea to North America (2550 km). This strategy has implications for stopover site protection, indicating that strategic conservation measures in northern Colombia can protect habitats where up to 40% of the energy required to complete spring migration is stored by a population of a Neotropical migratory landbird.

**S1.2 Bayne, Erin**, (University of Alberta, Edmonton, Canada); Solymos, Peter (University of Alberta, Edmonton, AB, Canada); Matsuoka, Steve (Boreal Avian Modelling Project, Edmonton, AB, Canada); Stralberg, Diana (University of Alberta, Edmonton, AB, Canada); Fontaine, Trish (Boreal Avian Modelling Project, Edmonton, AB, Canada); Cumming, Steve (Université Laval, Quebec, PQ, Canada); Schmiegelow, Fiona (University of Alberta, Edmonton, AB, Canada); Song, Samantha (Environment Canada, Edmonton, AB, Canada)

**ESTIMATING POPULATION SIZES OF LANDBIRDS FROM NON-STANDARDIZED POINT-COUNT SURVEYS IN NORTH AMERICA'S BOREAL FOREST: MAKING THE MOST OF A POTENTIALLY MESSY SITUATION**

Managing populations of birds across North America's boreal forest region is challenged by increasing rates of industrial resource use and climate change. However, there is a paucity of data from standardized bird surveys to inform avian conservation across this vast and often remote region. We recently compiled data from nearly all of the point-count surveys conducted across boreal Canada and Alaska since 1992 to (1) develop spatially-explicit models of avian breeding density and (2) estimate population sizes of birds breeding across the region to support avian conservation in northern North America. The compiled data were not standardized relative to survey protocol or sample frame. We therefore adjusted the surveys for observational biases due to incomplete detection probabilities, roadside versus off-road sampling, variation in survey protocols, and uneven temporal and geographic sampling. This was to (1) improve our inferences into the ecological associations between avian breeding densities

and habitats, climate, and geographic location across the region; (2) implement the recommendation by Thogmartin et al. (2006, *Auk* 123:892–904) for improving estimates of landbird population sizes by Partners in Flight; and 3) evaluate how different approaches to modelling habitat associations influenced estimates. We compare our estimates to those from the Partners in Flight to emphasize the differences in population size derived from each.

**PS1.6 Beason, Bob,** (Accipiter Radar, Orchard Park, United States); Polak, Mark (Syncrude Canada, Edmonton, AB, Canada)

#### BEHAVIORAL RESPONSES OF WATERFOWL TO RED AND GREEN LASERS

Birds can be exposed to hazardous situations as a result of human activity and commerce, such as manufacturing processes, mining operations, and airports. Various technologies have been employed alone or in combinations to deter birds from using hazardous waste and treatment ponds. Red and green laser deterrents have been reported to disperse some species of birds from water surfaces and other locales but no one has directly compared the efficacy of the two colors. To determine which wavelength was more suitable in our environment, we compared the efficacy of red and green lasers at dispersing waterfowl from small freshwater ponds in northern Alberta, Canada. The green laser ( $\lambda = 532$  nm) was effective at dispersing Sandhill Cranes (*Grus canadensis*) and Canada Geese (*Branta canadensis*), but not ducks. The red laser ( $\lambda = 650$  nm) was less effective than green at dispersing the larger birds and ineffective at dispersing ducks. Although they did not disperse from the ponds, some species of ducks moved to shelter in emergent vegetation along the shore in response to the lasers. Had they been flying into the pond, these birds might have aborted their landings and moved elsewhere. Other ducks, including Lesser Scaup (*Aythya affinis*), appeared to ignore the laser beams and continued feeding. Although the spectral sensitivities of the retinal cones of the species we tested are not available, retinal cones of other waterfowl species contain visual pigments that are sensitive to the wavelengths of the lasers we used. Consequently, we conclude that the birds were able to see the lasers but “chose” not to respond. Although lasers are effective only between dusk and dawn and only with some species when the birds were sitting on the water, they can be useful to augment other deterrent technologies.

**PS1.67 Beaudry, Frederic,** (Alfred University, Alfred, United States); Radloff, Volker; Pidgeon, Anna (University of Wisconsin - Madison, Madison, WI, United States); Plantinga, Andrew (Oregon State University, Corvallis, OR, United States); Lewis, David (University of Puget Sound, Tacoma, WA, United States); Helmers, David (University of Wisconsin - Madison, Madison, WI, United States); Polasky, Steve (University of Minnesota, St. Paul, MN, United States)

#### THE LOSS OF FOREST BIRDS HABITATS RESULTING FROM PROJECTED LAND USE UNDER ALTERNATIVE ECONOMIC POLICY SCENARIOS

Attempts to estimate biodiversity loss due to future land use change are largely based on empirical projections of past changes, rather than on analyses of the socio-economic factors underlying land use change. Spatial econometric models are quantitative analyses of economic relationships that describe how land use is affected by socio-economic factors; they provide new opportunities to link economic drivers and biological models to provide reliable and realistic projections pertinent for conservation. We evaluated the effects of future

land use change on the habitat of at-risk forest breeding bird species. Specifically, we estimated the effects of land use change on the amount of habitat available, compared the relative effects of land use change on species relying on different forest types, and compared the effects of economic policy scenarios on bird habitat. To do this, we coupled a spatial-explicit econometric model of land use change on private lands with models of northern Wisconsin forest bird potential habitat. We compared the effects of a baseline 50-yr ‘business-as-usual’ projection with, first, a scenario providing incentives for forest growth, and second, a high urban growth scenario. The baseline scenario suggests an average of 438,705 ha of forest lost, with 1.9% less loss for the Forest Incentive scenario, and 1.6% greater loss for the Urban Growth scenario. Species relying on boreal forest were projected to experience approximately 2–3% habitat loss under the baseline projection, in contrast to deciduous forest birds forecasted to lose 6–8% of their potential habitat. The species with the highest predicted proportional habitat loss were those that started with the largest amount of potential habitat in the study area. For 80% of the species the high urban growth scenario resulted in the greatest loss of potential habitat, while the forest incentive scenario resulted in less habitat lost. Coupled economic / ecological models can be used to evaluate alternative incentive programs, and to explore the complex interactions between policy, land use change, and broad spatial scale ecological processes that are highly relevant to conservation.

**F15.8 Becker, Peter H.,** (Institute of Avian Research, Wilhelmshaven, Germany);

#### LIFELONG INDIVIDUAL DEVELOPMENT AS AN IMPORTANT LIFE HISTORY COMPONENT IN THE COMMON TERN STERNA HIRUNDO

To date the significance of lifelong ontogeny was underestimated or even neglected, mainly as adequate data were lacking to address this topic. Long-term longitudinal studies, innovative field and analytical techniques nowadays are providing the necessary data. Findings show that individual change over life is a ubiquitous phenomenon in long- and short-lived bird species. Little is known, however, about the extent to which rates of individual change vary between individuals, and about causes and consequences of such variation. I address lifelong developments in the Common Tern and its consequences for individuals and population. Based on a longitudinal, individual-based and integrated population study at the colony site “Banter See”, Germany, I show that age-dependent change at the population level comprises many traits of behaviour, timing of arrival and laying, physiology, body condition and reproduction. Individual improvements were found to be the major mechanism of this change whose effects are further enhanced by selection. The old individuals are shaped by ontogeny and selection and contribute most young to the next generation. The fitness benefits of breeding attempts late in life are only marginally narrowed by senescence. Lifelong ontogeny itself turns out to be a significant life history characteristic affecting fitness and demography.

**W15.1 Beckman, Elizabeth,** (University of New Mexico, Albuquerque, United States);

#### SORTING THE SOUTH AMERICAN SISKINS: THE ROLE OF ECOLOGY IN A RAPID CONTINENTAL RADIATION

Ecological transitions across evolutionary time have important consequences for speciation processes and biodiversity. Analyses of young, rapid radiations permit us to address the relevance of ecological transitions to speciation due to the relatively short period between speciation events and the

present. The genus *Sporagra* is a recent Andean radiation of nine species that includes lowland and highland taxa as well as species confined to dry or humid habitats. Furthermore, the breeding ranges of several congeners overlap extensively. We used phylogenetic methods and ancestral character state reconstruction with a multi-locus dataset to ask: (1) What impact do ecological transitions have on the shape of the *Sporagra* phylogeny? And (2) what ecological and morphological traits characterize the radiation ancestor? We found *Sporagra* to be derived from a single colonization of a dry habitat, lowland ancestor from North America with a generalist bill about 0.74 million years ago (MYA). Andean species also resulted from a single colonization about 0.40 MYA. Interestingly, the most recently diverged taxa (<0.12 MYA) breed sympatrically, however they are ecologically distinct from each other through bill morphology and habitat use, suggesting ecological pressures may have facilitated the rapid evolution of reproductive isolating barriers. Among other closely related taxa, humidity was an important character distinguishing habitats. Additionally, we found the widespread *S. magellanica* fell into three distinct clades across the phylogeny including a lowland clade basal to the Andean radiation. The morphological similarity between highland and lowland *S. magellanica* populations is surprising given the genetic differentiation in mitochondrial DNA and unique ecological regimes of these populations. We suspect further morphological comparisons of the two populations will reveal differences between high and low *S. magellanica* given the strong influence of ecology across the rest of the *Sporagra* phylogeny.

**SAT14.4 Bédard, Simon**, (Université du Québec à Montréal; Centre for Forest Research., Montreal, Canada); Drapeau, Pierre (Université du Québec à Montréal; Centre for Forest Research., Montreal, PQ, Canada)

#### REMNANT HABITATS OF MANAGED LANDSCAPE SATISFY THE ECOLOGICAL REQUIREMENTS OF THE YELLOW-BELLIED SAPSUCKER IN QUÉBEC BOREAL MIXEDWOOD.

Several studies show that the Yellow-bellied Sapsucker (*Sphyrapicus varius*) is a keystone species in boreal forest ecosystems, especially provides numerous cavities for secondary cavity users. Is this key role maintained in the remnant patches in landscapes managed for timber production? We examined habitat quality of those remnant patches for the Yellow-bellied Sapsucker by comparing them with continuous forest tracks of a naturally disturbed landscape. Habitat quality was assessed using five parameters of reproduction: clutch size, hatching date, hatching success, nesting duration and productivity. Data was collected through successive visits inside the cavities using cameras on telescopic poles. We also monitored adults food provisioning to nestlings. We used a video-camera mounted on a telescope to monitor the frequency at which adults supplied food to nestlings and the size of food loads. We also documented the spatial patterns of adult movements when they arrived and departed from the nest. Results show that the Yellow-bellied Sapsucker reproductive parameters in the remnant habitats of the managed landscape were comparable to those of continuous forest in the natural landscape. Thus remnants of managed landscapes were quality habitats for Yellow-bellied sapsuckers. Moreover, no significant differences were found for the frequency of feedings to nestlings or the size of food loads brought to nests by adults in these two landscapes. Overall, our findings indicate that the Yellow-bellied Sapsucker opportunistically uses the residual remnant habitats in managed landscapes and seems to be able to continue to play his

functional role of key cavity provider in managed forest landscapes.

**F13.2 Bednarz, James**, (Arkansas State University, State University, United States); Huss, Martin (Arkansas State University, State University, AR, United States); Thomas, Benson (Illinois Natural History Survey, Champaign, IL, United States); Varland, Dan (Coastal Raptors, Hoquium, WA, United States)

#### EVALUATION OF EXPERIMENTAL FUNGAL INOCULATIONS TO ESTABLISH HEART-ROT AND PROMOTE CAVITY NESTS AND WILDLIFE HABITAT IN MANAGED FORESTS IN WASHINGTON

Because of short timber-harvest rotations, relatively few trees in managed forests are infected with the heart-wood decaying fungi, which soften wood and enables excavation by primary-cavity nesters. A lack of woodpecker activity and resulting deficiency of available nest and roost cavities limits the diversity and abundance of many cavity-using wildlife species. We implemented an innovative experimental management approach wherein a wood-decaying fungus, the red-belted conk (*Fomitopsis pinicola*), and blank controls were introduced into selected trees in 1997 and 1998 to enhance the suitability of managed forests for woodpeckers. In 2006, we revisited 598 trees that were inoculated experimentally and inspected each tree for the presence of fungal growth and signs of woodpecker activity. A significantly higher proportion of treatment trees displayed *F. pinicola* conks (0.165) and mycelia (0.049) than did control trees (0.044 conks, 0.015 mycelia). Also, western hemlocks (*Tsuga heterophylla*) had a higher proportion of conks (0.179) and mycelia (0.035) than Douglas-fir (*Pseudotsuga menziesii*) trees (0.040 and 0.022, respectively). Importantly, we observed more evidence of woodpecker excavations associated with the fungal inoculations (3.9% of treatment trees) than at control trees (1.0%,  $P = 0.056$ ). This pattern suggests that inoculations may enhance habitat for primary-cavity excavating birds over the long term. Although the incidence of woodpecker excavations of treatment trees was still relatively low 8-9 years after inoculation, we suggest that woodpecker use will likely increase as fungi become more established in future years.

**T11.4 Beerens, James**, (Florida Atlantic University, Tallahassee, United States); Noonburg, Erik (Florida Atlantic University, Davie, United States); Gawlik, Dale (Florida Atlantic University, Boca Raton, United States)

#### MODELING WADING BIRD FORAGING TRADE-OFFS TO GUIDE RESTORATION PLANNING

Wading birds are important indicator species for wetland ecosystems, integrating productivity across trophic levels and over a large landscape scale. However, understanding and predicting wading bird responses to wetland restoration are hindered by their changing preference of hydrological processes depending on the production and concentration of prey. In the Everglades, populations of species that are visual foragers and tolerate relatively deep water (i.e., Great Egret; exploiter) have disproportionately increased when compared with populations of tactile foragers that require a higher prey density (i.e., White Ibis & Wood Stork; searcher). Identifying trade-offs among species between components of prey availability will help predict how communities respond to restoration. Locations of foraging Great Egrets, White Ibises, and Wood Storks were obtained from Systematic Reconnaissance Flight daily distribution data from 2000-2009. Hydrological variables over a range of temporal scales were used as a proxy for prey dynamics to

predict daily flock abundance. Days since drydown (DSD) quantified long-term prey production dynamics, recession rate quantified 2-week prey concentration dynamics, and daily water depth quantified short-term prey availability. For all species, daily flock abundance increases as portions of the landscape with higher DSD become available and are used; an important link to a previous study relating increased small fish density to increasing DSD. This effect is more prominent when Great Egrets and especially White Ibises are using shallower depths. Rapid recession rates (i.e., concentration) play a particularly important role for Great Egrets and to a lesser extent White Ibises by maintaining a foraging response when prey production is limiting. In contrast, concentration promotes Wood Stork foraging under high prey production, but not when prey production is low. Concentration is more important for Great Egrets feeding in shallower depths and White Ibises feeding in deeper depths, likely better accommodating their opposing foraging strategies. These patterns indicate important differences among species in their response to the trade-offs of prey production, concentration, and availability. If the Everglades ecosystem is limiting wading bird populations through the mechanism of prey production and/or concentration it will likely be reflected in these species.

**SAT5.3 Behney, Adam,** (Cooperative Wildlife Research Laboratory, Carbondale, United States); O'Shaughnessy, Ryan; Eichholz, Michael (Cooperative Wildlife Research Laboratory, Carbondale, IL, United States); Stafford, Joshua (3U.S. Geological Survey, South Dakota Cooperative Fish & Wildlife Research Unit, Brookings, SD, United States)

#### ECOLOGICAL FACTORS INFLUENCING FORAGING BEHAVIOR OF BIRDS DURING SPRING MIGRATION IN THE WABASH RIVER FLOODPLAIN

Habitat restoration strategies for migrating birds typically focus on providing large quantities of high-quality food with the underlying assumption that if more food is available, birds will increase consumption. Thus, understanding how birds respond behaviorally to additional food availability is important for understanding the impact of management actions. We used behavioral observations and experimentally manipulated food levels to examine duck foraging patterns during spring migration in the Wabash River floodplain of Illinois, USA. We established seven study blocks in Lawrence County, IL, USA; three in emergent wetlands, three in open water wetlands, and one in a forested wetland. Each block contained three, 1 ha plots with experimentally manipulated food levels: a control (0 kg/ha), 300 kg/ha, and 700 kg/ha treatment plots. We conducted 1,780 scan and 257 instantaneous focal-animal behavioral samples on study plots from 18 February – 20 April 2011. The most parsimonious model of time spent feeding included additive effects of species, treatment, date, and visibility. Ducks devoted the greatest percentage of their time to foraging while present in the 300 kg/ha treatment plots (38%), followed by control (33%), and 700 kg/ha plots (23%). The relationship between percentage of time feeding and date was positive and ducks fed more in areas with more visual obstruction. We suggest that in areas of high food abundance, ducks intake rate is higher allowing them to spend more time in other behaviors (e.g. vigilance).

**F15.11 Beissinger, Steven R.,** (University of California, Berkeley, Berkeley, United States); Shawkey, Matthew D. (University of Akron, Akron, OH, United States); Wang, Jennifer M. (University of Central Arkansas, Little Rock, AR, United States); Cook, Mark I. (South Florida Water

Management District, West Palm Beach, FL, United States); Tarwater, Corey E.; Wang, Julie; Firestone, Mary K. (U.C. Berkeley, Berkeley, United States)

#### VARIATION IN THE RISK OF INFECTION IN AVIAN EGGS BETWEEN TEMPERATE AND TROPICAL ENVIRONMENTS

Microbial infection causes mortality of avian eggs despite antibiotic defenses. Many microbes prefer moist habitats and some digest the cuticle, which increases the number of open pores and allows bacteria to penetrate through them. Hotter environments generally favor bacterial growth and more diverse assemblages. Thus, eggs of tropical birds should be at greater risk of embryonic infection than temperate species. We tested this hypothesis using (1) field experiments that quantified microbial growth on and in eggs held at four sites (2 tropical, 2 temperate) differing in temperature and humidity; and (2) lab experiments that manipulated temperature and humidity to disentangle their effects on microbial growth on eggshells. Field experiments found that microbial growth on eggshells was primarily driven by humidity: the two sites with higher humidity and lower temperatures (tropical cloud forest and temperate redwood) had greater microbial than the two sites with higher temperatures (temperate grassland and tropical lowland), which did not exhibit microbial growth. The probability of microbial infection inside the egg increased with exposure period for all sites except for the temperate grassland site, with greatest risk at the tropical cloud forest and least risk at the temperate grassland. Lab experiments found that microbes grew on eggshells held under tropical humidity but not under temperate humidity. Our results suggest eggs in moist tropical environments that sit unincubated may quickly become infected, and hence a latitudinal decline in clutch size and an increase in hatching asynchrony may partly result from selection on egg viability.

**PS1.251 Benedict, Lauryn,** (University of Northern Colorado, Greeley, United States); Bowie, Rauri (University of California, Berkeley, Berkeley, CA, United States)

#### VARIABLE AND STABLE ELEMENTS OF LEARNED BIRD SONG ACROSS A LARGE GEOGRAPHIC DISTANCE

A single bird song may serve multiple functions, causing different song elements to vary as a result of different selective pressures. Song elements that are stable across all individuals over large geographic distances can result from stabilizing selection for indicators of species identity. In contrast, song elements that vary within and between individuals are more likely to serve as indicators of individual identity or quality. We used archived recordings to assess macrogeographic variation in the songs of the red-faced cisticola (*Cisticola erythrops*) and the rattling cisticola (*Cisticola chiniana*) to look for common patterns of song variation. Both species have ranges that cover most of sub-Saharan Africa. We assessed syllable-type use and the frequency and time parameters of songs and syllables for both species. Both species showed some song features that were fixed and others that varied across the species' ranges. Some of the observed variation was related to latitude, suggesting potential effects of environment and cultural drift. Variable syllables tended to be more complex and frequency-modulated than fixed syllables, suggesting that variable signals could have become elaborated as indicators of quality. Each species showed 2-3 fixed syllable types that act as species-indicators. Additionally, the song form for each species was highly conserved over large geographic distances, with common element ordering and spacing between syllables. Results support the idea that temporal patterns of song structure are most important for indicating species identity. Stabilizing selection on

song patterning can coexist with diversification of syllable structure.

**SAT11.2 Benham, Phred,\*** (University of New Mexico, Albuquerque, United States); Cuervo, Andrés; Brumfield, Robb (Louisiana State University, Baton Rouge, LA, United States); Witt, Chris (University of New Mexico, Albuquerque, NM, United States)

#### TOPOGRAPHIC COMPLEXITY IN THE ANDES SHAPES DIVERSIFICATION PATTERNS IN THE HUMMINGBIRD GENUS METALLURA

Processes generating high bird species richness in the Andes can best be understood through studying the spatial and temporal context of endemic avian radiations. Topographic complexity in the Andes provides opportunities for speciation by generating both barriers to gene flow and distinct environments with divergent selection pressures. The hummingbird genus *Metallura* spans different geographic barriers and environments in the Andes, thus making it an ideal group for examining the role of topographic complexity in shaping Andean diversification patterns. A single species, *M. tyrianthina*, occupies the entire range of the genus, occurring sympatrically with all other species. We reconstructed the phylogeny of the genus using a multi-locus dataset that includes all species and *M. tyrianthina* subspecies. Our main goals were to: 1) understand the role of physical barriers and environment in structuring genetic variation in *Metallura*; and 2) examine the origins and spread of *Metallura* taxa throughout the Andes. *Metallura* consists of two clades: one including all subspecies of *M. tyrianthina* and *M. iracunda*, and a second clade consisting of all other *Metallura* species. In both clades river valleys bisecting the Andes play a major role in structuring genetic variation. Transitions between humid and dry slopes have occurred three times within *M. tyrianthina*, however, these transitions are associated with little (<1%) to no genetic divergence. Finally, the *M. tyrianthina* clade exhibits a northern Andean origin spreading southward, whereas other *Metallura* species originated in the south-central Andes followed by northward dispersal. Topographic complexity has played a major role in shaping diversity within *Metallura* with physical barriers shaping genetic structure and sympatric taxa existing in secondary contact after originating at opposite ends of the Andes.

**F14.7 Benson, T.J.,** (Illinois Natural History Survey, University of Illinois, Champaign, United States); Chiavacci, Scott (Illinois Natural History Survey, University of Illinois, Champaign, United States); Ward, Michael (Department of Natural Resources and Environmental Sciences, University of Illinois, Champaign, IL, United States)

#### PATCH SIZE IS NOT A RELIABLE PREDICTOR OF GRASSLAND BIRD NEST SURVIVAL: A SYNTHESIS OF PAST STUDIES

Population declines of grassland birds have been both consistent and widespread over the past 50 years. In fact, grassland birds have fared poorer than any other group of birds during this period. These declines have led to an increased focus on factors limiting grassland bird populations, and over the past 20 years, there have been numerous studies on habitat use and demography of grassland species. Although there has been some effort to synthesize this research, such as the effect of patch size on occurrence and abundance, little effort has been devoted to aggregating results of demographic studies. We set out to synthesize results of demographic studies, particularly those examining nest survival. We focused on studies evaluating the effects of patch size, landscape composition, and proximity to

wooded areas on nest survival, or those that presented values for both patch size and nest survival. We used information from 42 studies that presented information on nest survival, resulting in 181 daily-survival-rate estimates based on >18,000 nests. Even though some studies found evidence for effects of patch size and distance from woody vegetation on nest survival, there was considerable variation among studies and effects were not geographically or temporally consistent. These results suggest that a better understanding of the mechanisms of landscape-level effects, such as numerical or behavioral responses of important nest predators to landscape features, may be more important than simply documenting patterns of nest survival. Given the spatial and temporal variability in nest survival among studies, such an approach is likely to lead to improved conservation and management efforts for this declining group of birds.

**PS1.202 Bergman, Carita,** (Gwaii Haanas National Park Reserved and Haida Heritage Site, Queen Charlotte, Canada); Pattison, Jake; Price, Elin (Canada)

#### BLACK OYSTERCATCHERS AS A SENTINEL SPECIES IN THE RECOVERY OF NORTHERN ABALONE, OR... TOP PREDATOR IN A PIT OF NO RETURN?

Throughout their range, Black Oystercatchers (*Haematopus bachmani*) are known to consume a catholic diet of intertidal marine invertebrates, particularly mussels, limpets, snails and chitons. Despite the wide array of invertebrate prey consumed by them, northern abalone (*Haliotis kamtschatkana*) has not been reported as a prey item, despite vulnerability to predation at low tide conditions and the ease of collecting and recording hard-shelled remains of most invertebrate prey. Moreover, populations of abalone have experienced steep declines in the past several decades, a factor that may contribute to a reduction in occurrence as a prey item for intertidal foragers. We document the diet of oystercatchers on Haida Gwaii, using 211 collections of prey remains found in close proximity to nest scrapes in Gwaii Haanas National Park Reserve and Haida Heritage Site and the adjacent Laskeek Bay, collected between 2004 and 2009. Using data gathered from the lower, mid and upper intertidal zones to estimate prey availability, we examine prey preference of oystercatchers using Ivlev's electivity index. We further report the unique occurrence of and preference for abalone in these prey remains. We compare the size distribution of abalone found in prey remains with a sample of measurements taken from abalone found in situ at nearby foraging sites. We found that Black Oystercatchers showed a preference for abalone the size class of abalone just reaching reproductive maturity. This, in combination with a paucity of older, larger abalone in our in situ sample suggests abalone may face a predator pit, with little escapement to older age classes. Ironically, we speculate that the presence of abalone in oystercatcher prey remains may be indicative of locally abundant numbers of abalone. This result is unexpected because the status of northern abalone was uplisted to Endangered in 2009 after the population showed no recovery since 1990. It is possible that the baseline measure of abalone abundance used to support an assessment of "Endangered" was actually above the normal range of historical variation, due to local extirpation of the sea otter.

**T12.3 Berkunsky, Igor,** (Universidad Nac. del Centro de la Prov. de Bs As, Tandil, Argentina); Aramburu, Rosana M. (Universidad Nac. de La Plata, La Plata, Argentina); Ruggera, Román A. (Instituto de Ecología Regional, Yerba Buena, Tucumán, Argentina); Faegre, Sarah (University of Washington,



Rota, United States); Rebores, Juan C. (Universidad de Buenos Aires, Buenos Aires, Argentina)

#### BREEDING ECOLOGY OF THE BLUE FRONTED PARROT (AMAZONA AESTIVA) IN THE ARGENTINEAN CHACO

Parrots are among the most preferred species for the pet-trade market. The sustainability and implications of wild parrot trade have been extensively analyzed and discussed. In Argentina, since 1998, there is a local community based national harvesting program that regulates the harvest and commercialization of a variable number (between 300 and 5,000) of Blue-fronted Parrots (*Amazona aestiva*) chicks every year. The aim of this study was to determine the main factors that affect the reproductive success of Blue-fronted Parrots in the Chaco region of Argentina. This information is particularly relevant for estimating the impact that harvesting could have on parrot wild populations. We monitored Blue fronted Parrot nests during five consecutive breeding seasons (2002-2003 to 2006-2007). Clutch size was 3.7 eggs and it decreased along the breeding season. Number of eggs at the end of incubation was 3.6 and number of chicks hatched was 2.7. We observed brood reduction in 20% of the nests and it was more frequent in broods of three and four chicks. On average 2.2 chicks fledged per nest and young's survival during the first month was 94%. Nest survival varied between 27% and 67% depending of the year and method of estimation used. Most nests failed during the incubation and the first 10 days of the chick's period. Daily survival rates varied between 98.5% and 99.5%. The best models to explain survival included as covariables age of the nest, laying date, high and orientation of entrance hole. Nest site fidelity was 68% and cavity reoccupation was 62%. Harvested nests had a low survival than non-harvested nests (73% vs. 93%). The information presented in this work represents a contribution to the general knowledge of the reproductive strategies of parrots. In addition, this information could be relevant to develop management and conservation strategies for Blue-fronted Parrots.

**FI.4 Berres, Mark E.,** (University of Wisconsin - Madison, Madison, United States);

#### WEBIRD: CONNECTING PEOPLE TO BIRDS THROUGH MOBILE TECHNOLOGY

Energized by the wide availability of mobile electronic devices, automatic identification of audio patterns has become a popular research topic in the past few years. Yet automated acoustical recognition of bird species has received relatively little attention despite being a closely related audio recognition problem. WeBIRD, the Wisconsin Electronic Bird Identification Resource Database, is a new tool that uses species-specific audio patterns - digital fingerprints - to automatically identify birds by bioacoustical features contained in their vocalizations. Embodied in a series of algorithms, WeBIRD first evaluates and categorizes temporal changes in audio features across the frequency range of a vocalization. Employing a dynamic approach to minimize variation in both frequency and time, the similarity of the query audio to a database of vocalizations is quantified and evaluated statistically for match significance. Access to WeBIRD is made through a wireless-enabled smartphone. A user records a bird song which is transmitted to a remote computer for identification. If a significant match is found, the AOU ID is transmitted back to the smartphone and the species is identified with imagery and text. The queried song is georeferenced and all information is stored remotely for accession into the audio database. The WeBIRD interface has been designed with simplicity in mind, requiring only a small amount of effort for any user to make full use of its capabilities. The target audience of WeBIRD is broad, ranging from

professionals, natural resource organizations, educators, and amateur bird watchers. Mobile automatic recognition technologies will have a significant impact on the development of future research design in field ornithology. Ideally suited for crowd-sourcing, WeBIRD is also capable of playing an important role in the growing field of citizen science which requires accurate species identification. This better serves scientists and increases awareness among participants of the pressures facing birds and bird habitats.

**SAT12.3 Berzins, Lisha,** (University of Northern B.C., Prince George, Canada); Dawson, Russell (University of Northern B.C., Prince George, BC, Canada)

#### DO MALE TREE SWALLOWS (TACHYICINETA BICOLOR) ADJUST THEIR INVESTMENT IN PARENTAL CARE IN RELATION TO EXPERIMENTALLY ALTERED FEMALE ORNAMENTATION?

The expression of female ornamental traits, such as bright plumage coloration, may be important for mate choice, especially in species with male investment in parental care. Moreover, bright plumage color may signal female attractiveness (or quality), and if assessed by males, variation in this trait may influence male reproductive decisions, such as how much effort to allocate to parental care. Adult female tree swallows (*Tachycineta bicolor*) display bright iridescent blue-green plumage, and characteristics of female plumage color are related to reproductive investment and success, and age. To test the hypothesis that male tree swallows allocate reproductive investment in relation to their mate's plumage color, we experimentally manipulated (enhanced, reduced, control) the plumage brightness of females during the nestling period. We also simultaneously manipulated brood size (enlarged, reduced, control) to test whether female plumage brightness affected male investment in parental care at different levels of brood demand. Parental care was measured by recording the number of feeding trips performed by each sex during the nestling period. We found that the provisioning rates of males were related to provisioning rates of their mates as well as brood size. However, males did not appear to adjust their provisioning rate in relation to female plumage brightness. Our results suggest that males allocate their investment in parental care in relation to female investment in reproduction rather than perceived quality of females.

**PS1.170 Bierregaard, Rob,** (UNC-Charlotte, Wynnwood, United States); Martell, Mark (Audubon Minnesota, St. Paul, United States)

#### NAVIGATION AND ORIENTATION IN MIGRATING OSPREYS: INSIGHTS FROM SATELLITE TELEMETRY.

How birds navigate between breeding and wintering areas, often thousands of kilometers apart, remains one of Ornithology's most puzzling mysteries. Decades of experiments with a host of bird species have demonstrated that the many cues birds use for simple orientation and astonishing navigation include landmarks, the position of the sun and stars in the sky, polarized light at dusk and dawn, the earth's electromagnetic field. Since 1998 we have tagged 42 juvenile Ospreys (*Pandion haliaetus*) in Minnesota (7) and the eastern US (35). Comparisons of the tracks of naïve Ospreys with those of adults provide insights into how juvenile Ospreys learn the route to their wintering grounds that they will use as adults. Eastern adult Ospreys move south in the fall over a fairly narrow front from the coast inland, funneling to Florida and then on to Cuba, Hispaniola, and thence across the Caribbean to South America. In marked contrast, roughly 1/3 of all eastern young we tagged migrated over the

Atlantic Ocean in non-stop flights of up to 50-60 hours, covering as much as 1,700 km of open water. We argue that it is on the first trip north that the Ospreys that crossed the Atlantic in their first fall migration learn the migration routes they will follow as adults. Two juveniles that wandered roughly 1,000 km west of the “normal” route for eastern birds corrected for the displacement, indicating that they had either an innate or an acquired sense of east vs. west.

**SAT15.4 Billerman, Shawn,** (University of Wyoming, Laramie, United States); **Carling, Matthew** (University of Wyoming, Laramie, WY, United States)  
SPATIO-TEMPORAL CHANGE IN THE RED-BREASTED/RED-NAPED SAPSUCKER HYBRID ZONE IN OREGON AND CALIFORNIA

Biodiversity is created through population divergence and speciation, and hybrid zones offer unique opportunities to investigate these important evolutionary processes by facilitating studies of the evolution of reproductive isolation. Two species of North American sapsucker (Aves: Picidae) form an excellent model system with which to quantify the interactions between species recognition and patterns of genetic introgression. The two species, Red-naped (*Sphyrapicus nuchalis*) and Red-breasted (*S. ruber*) Sapsuckers are morphologically distinct, yet similar genetically (~0.7% divergent at mtDNA), and hybridize over a narrow contact zone that stretches from British Columbia to northern California. This hybrid zone is located in a previously recognized North American suture zone, and allows for robust comparisons to other taxa. Preliminary evidence based on field observations shows that hybrids were found an estimated 115 kilometers east from where “limited” introgression was occurring in 1948. If the leading edge of the hybrid zone has been advancing at a steady rate since 1948, this would amount to 1.8 km of movement a year. Ongoing work is more thoroughly exploring these movement patterns by using data from specimens collected in the 1950’s and 1980’s, as well as current genetic samples. If there has been significant movement of the hybrid zone, such that Red-breasted Sapsuckers are expanding eastward, there will be neutral Red-naped markers “left behind” within morphologically “pure” Red-breasted Sapsuckers in the wake of the hybrid zone. Studying a shifting hybrid zone can be extremely informative, as there are relatively few examples of a moving hybrid zone. The Red-naped and Red-breasted Sapsucker hybrid zone offers a unique opportunity to study patterns of how hybrid zones can change over time.

**Fl.1 Bird, David,** (Avian Science and Conservation Centre, Ste-Anne-de-Bellevue, Canada); **Chabot, Dominique** (McGill University, Ste-Anne-de-Bellevue, PQ, Canada)

APPLICATIONS OF UNMANNED VEHICLE SYSTEMS TO BIRD STUDIES

Small unmanned vehicle systems (UVS), formerly exclusive to militaries, are rapidly advancing in sophistication and availability to civilians. Ranging from hand-launched autonomous airplanes to terrestrial robots to underwater machines, they are increasingly being employed in such areas as agriculture, emergency services, meteorology, oceanography and geophysics. A number of potential applications for small UVS can be envisioned in the field of avian research and management, for example conducting population surveys, tracking radio-tagged birds, sensing and observing birds in sequestered or dangerous places, mapping and monitoring bird habitats, and deterring nuisance bird species. However, genuine efforts to put such ideas into practice have thus far been limited. This presentation will attempt to explore possible applications of

UAS of all sizes for avian research and management, including costs, sizes, practicality in the field, regulations, etc.

**W12.11 Bishop, Christine,** (ENVIRONMENT CANADA, DELTA, Canada); **MCKIBBIN, RENE** (ENVIRONMENT CANADA, DELTA, BC, Canada); **Russello, Michael** (UNIVERSITY OF BRITISH COLUMBIA, KELOWNA, BC, Canada)

POPULATION BIOLOGY, GENETICS AND IDENTIFICATION OF CRITICAL HABITAT OF THE ENDANGERED POPULATION OF THE WESTERN YELLOW-BREASTED CHAT (ICTERIA VIRENS AURICOLLIS) IN BC

In the south Okanagan valley, British Columbia, Canada, an endangered population of the western Yellow-breasted Chat (*Icteria virens auricollis*) was studied during 2001 to 2011. In BC, this skulky species nests exclusively in riparian habitats, mainly wild rose thickets. The population is believed to have been reduced in size to approximately 70 pairs due to the loss of 87+% of its riparian breeding habitat since 1938. Our goal was to understand the demography and genetics of this population to develop population objectives and identify critical habitat for the conservation of this population. Apparent survival for male chats banded as adults was 65% and survival and recapture were constant across time in the AIC best model. Defended breeding territories were 0.55ha in size but radio telemetry revealed foraging area was on average 1 ha and therefore critical habitat identified for this species was based on a much larger area per breeding pair. While this population is small, population viability indicates it could persist at this size with critical habitat protection and restoration. There is no evidence of a genetic bottleneck although we found with 30.7 % offspring not sired by the putative parents.

**W15.5 Bitton, Pierre-Paul,\*** (University of Windsor, Windsor, Canada); **Stéphanie M, Doucet** (University of Windsor, Windsor, ON, Canada)

SYMPATRY AND PLUMAGE EVOLUTION IN THE GENUS TROGON

Differences in sexually selected traits allow individuals to discriminate between conspecifics and closely related congeners. It is believed that divergence in plumage patterns between species is an important pre-mating isolation mechanism and minimizes the risk of hybridization. While studies on single pairs of sympatric species generally support these ideas, large-scale comparative studies are needed to determine the broader occurrence of this phenomenon. Furthermore, it is necessary to compare members of the same evolutionary lineage to establish how traits involved in species recognition have evolved. In this study, we evaluated the influence of sympatry on plumage patterns in members of the genus Trogon, a Neotropical group of 20 species, using subspecies-level differences in plumage characteristics.

We measured plumage reflectance of several plumage patches directly from museum skins and used tetrahedral colour space to describe and analyze differences in traits. Character difference matrices were compiled by calculating Euclidian distances between plumage patches for all pairwise possibilities. To control for phylogenetic relationships among the species and subspecies, we calculated uncorrected p-distances, a measure of species relatedness. We conducted partial Mantel tests comparing the plumage character matrices to the sympatric overlap matrix while controlling for genetic relatedness (uncorrected p-distance matrix).

Our analyses show that plumage differences in South American species, but not Central American species, were positively correlated with degree of sympatric overlap. Further analyses showed that no single plumage characteristic was responsible for the significant relationship. This suggests the overall plumage patterns, not specific patches, diverged in sympatry. We argue that in South America, where a greater number of species overlap, there was a greater influence of sympatry on character divergence. This study is the first to use subspecies level comparison for an entire genera to evaluate the influence of sympatry on character divergence. Our results support the idea that geographic overlap can influence character evolution in an evolutionary lineage and further suggests that character displacement may have played a role in Trogon plumage evolution.

**PS2.58 Blanc, Lori**, (Virginia Tech, Blacksburg, United States); Jeffrey, Walters (Virginia Tech, Blacksburg, United States)

#### AN EXPERIMENTAL TEST OF THE RED-COCKADED WOODPECKER'S "KEYSTONE" EFFECT ON OTHER CAVITY NESTING SPECIES.

Over 27 vertebrate species are known to use cavities created by the endangered Red-cockaded Woodpecker (RCW). Consequently, the RCW is considered a keystone species and is assumed to influence the presence and abundance of other cavity-nesters within the longleaf pine ecosystem. Our goal in this study was to experimentally test this assumption. During the 2003 breeding season, we conducted nest-searches within 22 48-ha plots within longleaf pine sandhills habitat in Florida. We then experimentally increased RCW cavity availability in 11 plots by drilling  $12.0 \pm 1.3$  (mean  $\pm$  SD) cavities within each plot (pre-treatment mean: 1.8 RCW cavities per plot) using the standard RCW cavity management technique, and designated eleven plots as controls (mean: 2.5 RCW cavities per plot). We predicted that increasing RCW cavity availability would cause an increase in the number of cavity-nests for species using both normal-sized (unaltered) and enlarged RCW cavities. We conducted nest-searches again in 2005 (short-term post-treatment) and 2010 (long-term post-treatment). We grouped nest data into (a) RCWs, (b) species that use unaltered RCW cavities (NCN), (c) species that use enlarged RCW cavities (LCN) and (d) species that do not use RCW cavities (OCN). We used a Mann-Whitney U test to detect significant differences in the amount of change between treatment and control plots, pre- and post treatment, both short- and long-term. We found 107 cavity nests in 2003, 111 nests in 2005, and 86 nests in 2010, including nests in both snags and RCW cavity trees. By 2005, RCW nests increased significantly in experimental treatment plots ( $P = 0.02$ ), however there was no difference between the number of LCN, NCN or OCN nests in control and treatment plots. In 2010, there was a significant increase in RCW ( $P = 0.01$ ) and NCN ( $P = 0.04$ ) nests found in RCW cavities within treatment plots. In addition, there was a reduction in NCN use of snags in both treatment and control plots. Since 2003, snag availability at our study site has been decreasing, remnant of a pulse in snag creation associated with habitat restoration efforts in 2002 (e.g., reintroduction of fire in long fire-suppressed areas), followed by the loss of snags over time due to natural processes. We evaluate whether the increased use of RCW cavities reflects (a) a preference for RCW cavity trees over snags or (b) a switch to the use of RCW cavity trees due to decreased snag availability.

**W15.10 Block, Nicholas L.**, \* (Committee on Evolutionary Biology, University of Chicago, Chicago, United States); Goodman, Steven M.; Hackett, Shannon J.; Bates, John M.

(Department of Zoology, Field Museum of Natural History, Chicago, IL, United States); Raheirilalao, Marie Jeanne (Département de Biologie Animale, Université d'Antananarivo, Antananarivo (101), Madagascar, United States)

#### PARASITES REVEAL DESPECIATION OF DEEPLY DIVERGENT LINEAGES IN A PASSERINE

Despeciation, the merger of formerly isolated lineages, is hypothesized to occur in vertebrate taxa under certain conditions. However, despite many demonstrated instances of introgression between taxa in secondary contact, examples of complete despeciation are rare, and none have been documented in birds. In this study, we examined the genetic diversity of a Malagasy humid-forest passerine, *Xanthomixis zosterops*, and tested the hypothesis that it is undergoing despeciation. We tested this hypothesis by comparing mtDNA sequence and microsatellite data, as well as mtDNA sequence data from host-specific feather lice in the genus *Myrsidea*. *Xanthomixis zosterops* comprises four deeply divergent, broadly sympatric, cryptic mtDNA clades. Three major phylogroups of *Myrsidea* were found on *X. zosterops* specimens, supporting previous allopatry of the *X. zosterops* clades. Genetic differentiation tests and Bayesian clustering analyses on the microsatellite data show a high level of panmixia among the *X. zosterops* mtDNA clades, despite about 4 million years of divergence. In combination, the data from *Myrsidea* mtDNA and *X. zosterops* mtDNA and microsatellites document a case of cryptic despeciation involving previously allopatric lineages. Both natural changes in recent geological time and anthropogenic changes in the past few thousand years have affected Madagascar's humid forests and likely contributed to the despeciation of *X. zosterops*. This represents the first report of sympatric hybridization among more than two terrestrial vertebrate lineages and one of the rare documented cases of complete genetic mixing of previously isolated lineages. Further, the mtDNA phylogeographic pattern of *X. zosterops*, namely the syntopy of more than two deeply divergent cryptic clades, appears to be a novel scenario among vertebrates. We highlight the value of gathering multiple types of data in phylogeographic studies to contribute to the study of vertebrate speciation. We also emphasize the importance of sampling across a taxon's distribution to provide greater insight into the biodiversity of a region and to reveal unknown patterns of regional endemism.

**PS1.117 Bobowski, Melissa**, (Arkansas State University, Jonesboro, United States);

#### FORAGING BEHAVIOR AND DECISION STRATEGIES BY OVERWINTERING RED-TAILED HAWKS (*BUTEO JAMAICENSIS*) AND AMERICAN KESTRELS (*FALCO SPARVERIUS*) IN NORTHEASTERN ARKANSAS

We studied the foraging behaviors of wintering Red-tailed Hawks (RTHAs) and American Kestrels (AMKEs) in northeastern Arkansas in relation to prey density, plant cover density, and perch site characteristics in three cover types. Based on optimal foraging theory, we predicted that RTHAs and AMKEs should exhibit greater frequencies of successful captures and shorter giving up times in cover types with higher densities of prey and lower densities of plant cover. Between December 2011 and February 2012, we observed 35 RTHAs and 15 AMKEs foraging in three representative cover types (i.e., short rice stubble, soybean stubble, and fallow). RTHAs were successful at capturing prey 45.0% of attempts in short rice stubble ( $n = 20$ ), 0.0% in soybean stubble ( $n = 1$ ), and 13.3% in fallow ( $n = 15$ ). AMKEs were successful at capturing prey 7.7% of the time in short rice stubble ( $n = 13$ ), 20.0% in soybean stubble ( $n = 5$ ), and 6.7% in fallow ( $n = 30$ ). The mean giving up

time for RTHAs in short rice stubble was 37.56 min, 14.00 min in soybean, and 50.28 min in fallow. The mean giving up time for AMKEs in short rice stubble was 30.50 min, 106.00 min in soybean stubble, and 28.43 min in fallow. Using a vegetation cover board the mean percent cover was 5.05% in the rice stubble fields, 6.34% in soybean stubble, and 45.16% in fallow. Based on mark-recapture techniques and Jolly-Seber analyses, the estimated population density in short rice stubble was 30 prey animals/ha, 29 prey animals/ha in soybean stubble, and 317 animals/ha in fallow. Our results indicated that the highest prey densities occurred in fallow fields, but these sites also had the greatest amount of cover, probably reducing rodent availability. The high cover in these fields may account for the reduced success rate (13.3%) and long giving-up times by RTHAs in these fields (50.3 min). Overall, our results qualitatively supported our prediction that RTHAs were more successful in short rice stubble fields (45.0%), where there was the greatest prey density and the least amount of plant cover. However, AMKEs were shown to be more successful and exhibited the longest giving up times in soybean stubble, contrary to optimal foraging theory predictions.

**F10.8 Boggie, Matthew**, (University Of Arizona, Tucson, United States);

#### SPATIAL ECOLOGY AND MATE INTERACTIONS OF COOPER'S HAWKS IN THE NON-BREEDING SEASON

Use of space by birds during the non-breeding season potentially is influenced by the distribution and abundance of required resources, interactions with competitors and predators, and activities associated with maintenance or establishment of territories and pair bonds. Most predatory birds, including Cooper's Hawks (*Accipiter cooperii*), are thought to be solitary during the non-breeding season, but limited information exists on how space use of mated males and females relates in the non-breeding season and almost no information exists on how much males and females interact during this period. I studied the movements of mated pairs of Cooper's Hawks during the non-breeding season in Tucson, Arizona and found size of average home range for males (58.0 ha, SE = 9.56, n = 8) was smaller than for females (169.5 ha, SE = 57.26, n = 8). Percent overlap among pairs varied by sex. On average, males overlapped their females home range by 78.4% (SE = 8.55%, n = 8), whereas females overlapped their males home range by 40.4% (SE = 8.50%, n = 8). Mate interactions including vocalizations and acts of courtship between males and females occurred throughout the non-breeding period and distance between mates ( $\bar{x}$  = 473.4 m, SE = 23.08, n = 568) did not change with time during this period. Considerable overlap of home ranges among pairs, the relatively close average distance between pairs, and instances of courtship suggest that Cooper's Hawks in Tucson maintain some level of pair bond throughout the non-breeding season. Pair bond maintenance may influence non-breeding season space use in some predatory birds.

**PS2.24 Bogrand, Ashley**, (Sam Houston State University, Huntsville, United States);

#### NEST DEFENSE BY CAROLINA WRENS (*THRYOTHORUS LUDOVICIANUS*) IN NATURAL AND URBAN ENVIRONMENTS.

We tested the hypothesis that predator recognition within Carolina wrens is partly a learned behavior, and that wrens will respond differently according to their experience with particular predators. The study was conducted at the Sam Houston State University Center for Biological Field Studies and in residential yards in the city of Huntsville, Walker County, TX. We compared responses of parent birds to mounts of a feral cat (*Felis catus*), a Texas rat snake (*Elaphe obsoleta lindheimeri*), and a Rock Dove (*Columba livia*) placed near the nest during the nestling stage. Wrens in both environments defend their nests with a variety of alarm calls and close approaches. Wrens in the urban (n=15) environment responded to both cats and Texas rat snakes as potential predators. Urban wrens used rasp calls for both predators but cheer calls were used mostly in response to the cat. Wrens in the natural environment (n=14) used rasp and Tadink calls for both predators. Wrens in both environments responded with similar intensity to the snake and cat suggesting experience with these particular predators may not be important in recognition. Carolina Wrens are an excellent model species for investigating the impacts of urbanization on birds because they are common in urban environments. Information from this study could provide insights for conservation of species that are endangered or of concern as urbanization continues to diminish natural habitat.

**PS1.190 Bolduc, Francois**, (Canadian Wildlife Service, Quebec, Canada); Savard, Jean-Pierre (Environment Canada, quebec, PQ, Canada)

#### CONSISTENCY IN THE DISTRIBUTION OF MOLTING SCOTERS AND COMMON EIDERS IN THE ESTUARY AND GULF OF ST. LAWRENCE IN 1998 AND 2010

We compared results of aerial surveys conducted in late July and early August in the Estuary and the northern Gulf of St. Lawrence in 1998 and 2010 to investigate whether common molting sites could be identified between decades and species. In July or August, between 24,000 and 45,000 Surf Scoters (*Melanitta perspicillata*) gathered along 90 km of coastline on the north shore of the Estuary (Between Forestville and Baie-Comeau) in 1998 and 2010 based on our visual estimates. In July and August, areas associated with the greatest concentrations of molting Common Eiders (*Somateria mollissima*) (3,000-15,000) were found close to Les Escoumins and on the southwest coast of Anticosti Island (22,000-40,000). Visual estimates will be corrected using stratified ratio estimators and, as the ratio photo/visual estimates most often is between 1.2 and 2.0, results suggest that between 100,000-200,000 molting sea ducks can be found at a given time in our study area. Spatial analyses suggest that scoters and eiders use the same areas for molting every year, but they rarely molt in mixed flocks; Common Eiders are mostly found over rocky substrates and scoters over sandy substrates. Such consistency in location of molting sites within species offers potential for monitoring changes in the population among years. Our results also point out potential conservation issues for sea ducks in this area, such as oil pollution due to high shipping traffic, disturbance from ferries and recreationists, and mollusk harvesting and farming.

**T6.3 Bolus, Rachel**, (Graduate Program in Organismic and Evolutionary Biology, University of Massachusetts Amherst, Amherst, United States);

#### COMMON YELLOWTHROAT (*GEOTHLYPIS TRICHAS*) SONG PREDICTS HABITAT CHARACTERISTICS, ARTHROPOD ABUNDANCE, AND MALE QUALITY

Broadly speaking, the songs of landbird species have been shaped by habitat structure; for example, birds in open habitats such as grasslands sing with broader bandwidths. But are spectral qualities of song predictive of habitat at a smaller scale, among individuals within species? And are they potentially useful for eavesdroppers assessing male quality or resources? We hypothesized that features of song predict microhabitat structure, food abundance, and singer quality, information that

could assist prospecting common yellowthroats to locate and assess suitable habitat patches. To test this hypothesis, we recorded the songs of 78 common yellowthroat males (2009-2011). We measured songs for a suite of acoustic features, including frequencies (Hz), times (s), and consistency (%). We assessed habitat using James and Shugart (1970) plots. We target-netted males, photographed masks for digital analysis, determined age classes, and measured wings, bills, tarsi, and masses. We sampled arthropods at shrubs at the recording locations and at random locations near the singing areas for comparison. In 2009 (2010 & 2011 data were similar), our habitat/song model was not significant ( $F = 0.79$ ,  $p = 0.68$ ), however, we found that males sang differently in different habitat types within a field site. In the most open habitat, the field edge, birds sang the broadest bandwidths over their phrase duration (Hz/s), a coarse performance measure. The bandwidth by phrase duration decreased with increasing vertical cover, with increasingly narrower bandwidths by phrase duration in the marsh, honeysuckle thicket, and ash grove ( $F = 4.23$ ,  $p = 0.036$ ). Our bird quality/song model was significant ( $F = 3.00$ ,  $p = 0.015$ ). Specifically, wing length ( $F = 3.22$ ,  $p = 0.04$ ), tarsus length ( $F = 4.87$ ,  $p = 0.02$ ), and mask area ( $F = 3.74$ ,  $p = 0.03$ ) were significant predictors of song features. Birds with larger black mask areas (an indicator of quality) had lower minimal frequencies, higher maximal frequencies, larger frequency ranges, and more elements per note than birds with smaller mask areas. Also, there were more arthropods in areas where males were singing than in nearby shrubs ( $t = 2.13$ ,  $n = 84$ ,  $p = 0.036$ , bird mean = 3.05 arthropods/sample, random mean = 1.98 arthropods/sample). This evidence supports the hypothesis that common yellowthroat song is a potential source of information for eavesdropping conspecifics, possibly used to assess variation among territories within a breeding population.

**W5.5 Bonnot, Thomas**, (University of Missouri, Columbia, United States); Thompson, Frank (United States Forest Service, Northern Research Station, Columbia, MO, United States); Millsbaugh, Joshua (University of Missouri, Columbia, MO, United States); Jones-Farrand, D. Todd (United States Fish and Wildlife Service, Central Hardwoods Joint Venture, Columbia, MO, United States)

#### LANDSCAPE-BASED POPULATION VIABILITY MODELS DEMONSTRATE IMPORTANCE OF STRATEGIC CONSERVATION PLANNING FOR BIRDS

Efforts to conserve regional biodiversity in the face of global climate change, habitat loss and fragmentation will depend on approaches that consider population processes at multiple scales. By combining habitat and demographic modeling, landscape-based population viability models effectively relate small-scale habitat and landscape patterns to regional population viability. Here, we demonstrate their power to inform conservation planning by using these models to evaluate responses of prairie warbler (*Dendroica discolor*) and wood thrush (*Hylocichla mustelina*) populations in the Central Hardwoods Bird Conservation Region to simulated conservation scenarios. We structured simulations to assess the effectiveness of three conservation approaches (habitat restoration, afforestation, and increased survival) as well as different placements and levels of effort for implementing those approaches. Patterns in the projected responses of the two species confirmed the potential for large-scale conservation to sustain regional populations. For example, projected abundances of prairie warblers and wood thrush tripled under afforestation and increased survival scenarios, respectively. Furthermore, responses to conservation actions were driven by interacting local and large-scale population processes (e.g., source-sink interactions and

dispersal). Thus, results revealed the importance of strategically restoring habitat in the region; relying on randomly placed habitat restoration and afforestation was ineffective and potentially counterproductive to promoting prairie warbler and wood thrush viability. These models offer a valuable advance in conservation planning because they allow an understanding of the effects of local actions on regional growth, which is necessary for translating regional goals into local actions.

**W14.2 Bonter, David**, (Cornell Laboratory of Ornithology, Ithaca, United States); Zuckerman, Benjamin (University of Wisconsin-Madison, Madison, WI, United States); Hochachka, Wesley (Cornell Lab of Ornithology, Ithaca, NY, United States)  
CACHE ECONOMY: INTER-ANNUAL VARIABILITY IN RELIANCE ON SUPPLEMENTAL FOOD REVEALED BY "SMART" FEEDERS

Caching food for later retrieval is a behavior vital for the survival of many temperate-zone resident birds. Food may be stored and retrieved over several months with caching activity varying with changes in the food supply, weather, or predation pressure. Yet caching behavior is poorly understood due to the difficulty of tracking the foraging activity of individual birds over extended periods of time. To gain an unprecedentedly detailed view of feeding and caching activity in wild birds, we employed a network of feeders enabled with RFID tracking technology and attached passive integrated transponders to 273 individual birds of 7 resident species. This system captured each visit made by individual birds to our "smart" feeders, recording more than 2.4 million feeder visits over 30 months. We demonstrate a significant peak in visitation in late summer and autumn, corresponding to the peak in caching activity, when daily visitation rates increased from approximately 15 visits/day to more than 80 visits/day in the Black-capped Chickadee, with similar patterns detected in Tufted Titmouse, and White-breasted Nuthatch. Visitation rates declined in winter, following the caching season, when birds should require more food for daily maintenance. We further demonstrate high inter-annual variability in dependence on supplemental food for feeding and caching, with monthly visitation rates as much as four times greater in 2010 than in 2011. These differences followed a flush of natural food resources during a mild autumn and winter in 2011, indicating that reliance on supplemental food is directly related to environmental conditions. Our results elucidate a highly variable pattern of reliance on supplemental food resources potentially being driven by shifting environmental conditions.

**W10.1 Borgmann, Kathi**, (University of Arizona, Tucson, United States); Conway, Courtney (USGS Idaho Cooperative Fish & Wildlife Research Unit, Moscow, United States); Morrison, Michael (Texas A&M University, College Station, United States)

#### A NEW METHOD TO MEASURE NEST CONCEALMENT

Establishing repeatable and unbiased field measurements is the foundation of reputable science. Yet, some of the methods avian ecologists use to measure vegetation at nest sites often lack repeatability and are subject to observer error. Numerous studies estimate the percent of vegetation surrounding the nest site by estimating visually how much vegetation conceals the nest. We examined the amount of among- and within-observer error for the most common method used to assess nest concealment. Estimates of the percentage of the nest concealed by vegetation at the same nest site on the same day varied among observers by 43%. Repeated measurements of a nest by the same observer on the same day varied by up to 19%

depending on the observer. Given the lack of repeatability and variation among observers for visual estimates of nest concealment we propose a new method to measure nest concealment. We took digital photographs of nest sites and analyzed the percent of the nest area obscured by vegetation. We used MATLAB image processing to calculate the percentage of pixels in each image and to determine the average percentage of foliage obscuring the nest. Estimates of nest concealment from digital photographs can reduce sampling error and improve data quality. We recommend that methods to assess nest concealment be re-evaluated to reduce the amount of observer error.

**S4.6 Borker, Abraham,** (University of California - Santa Cruz, Santa Cruz, United States); **McKown, Matthew** (UC Santa Cruz, Santa Cruz, United States); **Ackerman, Josh** (U.S. Geological Survey, Western Ecological Research Center, Davis, CA, United States); **Eagles-Smith, Collin** (U.S. Geological Survey, Forest and Rangeland Ecosystem Science Center, Corvallis, OR, United States); **Donald, Croll** (UC Santa Cruz, Santa Cruz, CA, United States); **Bernie, Tershy** (UC Santa Cruz, Santa Cruz, United States)

#### ACOUSTIC ACTIVITY AS AN INDEX OF RELATIVE ABUNDANCE AT SEABIRD COLONIES: A LOW-COST AND SCALABLE TOOL FOR MEASURING CONSERVATION OUTCOMES.

For threatened and elusive seabirds, acoustic monitoring presents a cost-effective, scalable alternative to traditional monitoring methods that are limited by remote/inaccessible locations and skilled field personnel. Despite conservation actions underway to prevent extinctions, knowing where and how to intervene is hampered by a dearth of scalable, cost-effective monitoring tools. A key assumption in monitoring population trends is that measures of acoustic activity are correlated with the relative abundance of seabirds at colony sites. Here we tested the efficacy of acoustic sensors to measure relative seabird abundance at colonies. Sensors recorded ambient noise at Forster's Tern (*Sterna forsteri*) breeding colonies in San Francisco Bay for two breeding seasons. We used an automated method (spectrogram cross-correlation) to detect and count tern vocalizations from recordings. We calculated mean calling rates at different time scales and compared these to active nest counts at colonies. Our results show that acoustic activity was a strong index of colony size within years (2009  $r^2=.84$ ,  $n=5$ ,  $p<.05$ ; 2010  $r^2=.59$ ,  $n=7$ ,  $p<.05$ ) and a powerful index of change in colony size between years ( $r^2=.92$ ,  $n=5$ ,  $p<.05$ ). We also estimated the predictive power of an acoustic activity index to detect population changes. Acoustic recordings also captured activity patterns at daily and seasonal scales, and highlighted the potential to measure colony phenology and productivity. Quantifying the relationship between acoustic activity and relative abundance is a fundamental step in designing effective acoustic monitoring programs for seabirds and other vocalizing wildlife. These tools present low-cost, scalable and comparable tools for measuring population trends and responses to conservation actions.

**T15.11 Borneman, Tracy,** (USGS NC Cooperative Research Unit/North Carolina State University, Raleigh, United States); **Simons, Theodore** (USGS NC Cooperative Research Unit/North Carolina State University, Raleigh, NC, United States)

#### EFFECTS OF HUMAN ACTIVITY ON AMERICAN OYSTERCATCHERS BREEDING AT CAPE LOOKOUT NATIONAL SEASHORE, NORTH CAROLINA

As human populations and associated development increase, human-wildlife conflicts are occurring with greater frequency. Anthropogenic noise is an often overlooked and poorly understood source of potential wildlife disturbance. We measured the effects of human activity and noise on American Oystercatchers (*Haematopus palliatus*) nesting on the Outer Banks of North Carolina. The species is designated as a "bird of conservation concern" by the U.S. Fish and Wildlife Service and a "species of special concern" by the State of North Carolina. Our study measured the effects of various forms of anthropogenic activity, including military jet overflights, off-road vehicles, and park visitors, on the behavior, physiology, and reproductive success of American Oystercatchers nesting at Cape Lookout National Seashore. To assess effects, we employed a variety of technologies including; audio recorders to monitor sound levels, video cameras to monitor oystercatcher incubating behavior and beach activity, and microphones embedded in artificial eggs to monitor heart rates of incubating birds. We recorded an average of 33 human activity events occurring near nests each day, with passenger vehicles the most commonly recorded activity type. Although aircraft had louder median sound levels than off-road vehicles, aircraft did not elicit a behavioral response as off-road vehicles did. Oystercatchers were on their nests significantly less during all types of off-road vehicle events than before those events occurred. Oystercatchers spent a large portion of the day incubating, on average 85%, with successfully hatched nests exhibiting greater overall nest attendance than nests which failed. Oystercatcher heart rates were not significantly escalated during most types of human activity except for low-altitude military fixed-wing aircraft; the mean heart rate during low-altitude flights ( $175\pm 4$  beats/min) was significantly higher than the mean heart rate before those flights occurred ( $163\pm 5$  beats/min). Oystercatchers had higher breeding productivity during study years, 0.484 and 0.750 chicks fledged per pair, than historical averages for the entire state of North Carolina (0.376 chicks fledged per pair). American Oystercatchers appear capable of adapting to various forms of anthropogenic activity as long as that activity does not preclude their access to food resources and safe nest sites.

**PS2.15 Borowske, Alyssa,** (University of Connecticut, Storrs, United States); **Dai, Morgan;** **Joseph, Waas** (University of Waikato, Hamilton, New Zealand)

#### DO HETEROSPECIFIC SIZE AND DemeanOR INFLUENCE VISITATION BEHAVIOR OF BIRDS AT URBAN FORAGING PATCHES?

The ability of a bird to use cues for the recognition of potential threats is important, especially for interactions with non-native species. Two cues that may be useful for assessing both familiar and unknown threats are body size and demeanor (i.e. potential for aggressive encounters). To assess the relative importance of these two traits as cues for threat recognition, we compared the feeding behavior of back-yard birds in the presence of four heterospecific decoy species at suburban feeding stations in New Zealand. Two of the decoy species, Australian magpie, *Cracticus tibicen*, and common myna, *Acridotheres tristis*, are large and small species, respectively, known to chase and harass heterospecifics. Both are considered invasive pest species in New Zealand. The other decoy species, rock dove, *Columba livia*, and ringneck dove, *Streptopelia risoria*, are comparably-sized to magpie and myna, respectively, and are not known for inter-species aggression. In each experimental trial, a live, caged decoy was placed at the feeding station after a control period. Backyard birds of all species arrived at feeding stations sooner and displayed higher-risk activities in the presence of small decoys. Silvereye, *Zosterops lateralis*, and house sparrow, *Passer*

domesticus, the two most common visitors to the feeding stations, were most likely to perform high-risk behaviors (i.e. landing on the stimulus cage and feeding from the station) in the presence of common mynas. These activities were performed least frequently in the presence of Australian magpies. As backyard birds likely had the most experience interacting with common mynas, the results suggest that a two-step decision rule, with size and familiarity as important cues, may be used by birds to recognize potential threats.

**PS1.192 Borstad, Gary**, (ASL Environmental Sciences Inc, Victoria, Canada);

#### A "REMOTE SENSING AWARENESS TUTORIAL" FOR ORNITHOLOGISTS

Remote sensing provides us with the opportunity to obtain information about places or things without actually touching them or even being there, and to map and monitor when and where we can not otherwise do so. Technological advances in the last two decades provide many satellite and airborne remote sensing tools and global datasets that are long enough to be useful for ornithologists and other ecologists as time series. Acoustic remote sensing provides opportunities to look below the surface of lakes and oceans and to do so in real time. This presentation will provide an overview of some fundamentals and discuss examples of remote sensing in action at a variety of time and space scales both on land and over the ocean. Terrestrial examples will include habitat mapping of natural changes in terrestrial vegetation (a) across the entire province of British Columbia 1985-2009, (b) in the Anderson River Bird Sanctuary on the Arctic Coast 1972 to 2003 and (c) reclamation at the Highland Valley Copper mine 2001-2010. Marine examples will focus on the relationship between seabirds at the Triangle Island colony and satellite derived oceanography, including winds as well as sea surface temperature and phytoplankton during the period 1998-2009. Examples of underwater profiling of ice thickness, fish, zooplankton and currents will also be shown.

**T11.2 Bortolotti, Lauren**, \*U (University of Alberta, Edmonton, Canada); Clark, Robert (Environment Canada/University of Saskatchewan, Saskatoon, SK, Canada); Wassenaar, Leonard (Environment Canada, Saskatoon, SK, Canada)

#### HYDROGEN ISOTOPE VARIABILITY IN FOOD WEBS OF PRAIRIE LANDSCAPES: IMPLICATIONS FOR STUDIES OF MIGRATORY CONNECTIVITY

Hydrogen isotopes ( $\delta^2\text{H}$ ) are often used to infer the origins of migratory birds based on the strong correlation between deuterium content of tissues and long-term averages of precipitation. However, extreme hydrological dynamics of surface waters in Prairie wetlands could mask these correlations. We investigated H isotopic variability in an aquatic food web associated with tree swallows (*Tachycineta bicolor*), birds that rely heavily on wetland-derived aerial insects for food. We also evaluated isotopic turnover and incorporation of environmental water into tissues of selected aquatic organisms, processes that could affect H isotopic composition. Wetland water showed intra- and inter-annual H isotopic variation mainly related to evapotranspiration and the amount and timing of precipitation. Periphyton and aerial insects, while isotopically variable, did not change in a predictable pattern with date. In contrast, snails showed rapid turnover of tissue deuterium, a large contribution of environmental water to their tissues, and generally tracked changes in their environment. Swallow feather deuterium ( $\delta^2\text{H}$ ) was variable, but did not clearly follow changes in any of

the food web compartments measured. Instead, isotopic variability may have been driven by shifts in the type or relative amounts of prey consumed and types of wetlands used. Nevertheless, despite relatively high variance in  $\delta^2\text{H}$ , a majority of birds fell within the predicted range of  $\delta^2\text{H}$  for the study area during a period of flood conditions, revealing that significant trophic averaging occurred. However, diet shifts or specialization and variable hydrological conditions (e.g., drought) have considerable potential to increase isotopic variance that must be considered when assigning origins of migratory birds on the basis of  $\delta^2\text{H}$  in precipitation.

**PS1.97 Bosley, Jason**, (Florida Atlantic University, Davie, United States); John, Baldwin; Erik, Noonburg (Florida Atlantic University, Davie, FL, United States)

#### IT'S GOOD TO HAVE NEIGHBORS: DEVELOPING AN OCCUPANCY MODEL FOR A DECLINING NESTING POPULATION OF BALD EAGLES IN FLORIDA BAY, EVERGLADES NATIONAL PARK

We modified the incidence function model (IFM) framework to model a nesting population of Bald Eagles, *Haliaeetus leucocephalus*, in decline. Territories within Florida Bay exist in a naturally fragmented landscape of small mangroves keys at the southernmost range of the species. Using data collected from a 50-year monitoring program, the proposed model derives estimates of colonization and abandonment rates from territory specific histories. Presence of a directional gradient in occurrence and an increase in territory patchiness coincide with changes in prey assemblages and hydrology. Probabilities of incidence were used to assess the risk of local abandonment and identify habitat parameters of importance to nest success. Productive territories in close proximity relative to one another had a greater probability of being occupied than territories that were isolated or less productive. We observed greater yearly variation in the number of nesting territories as the distances between remaining occupied territories increased. Simulated model estimates of critical territory productivity and annual turnover are in good agreement with their respective empirical values. The incidence function approach provides a meaningful framework for modeling occupancy dynamics while retaining valuable site-specific information unique to this long-term dataset.

**PS1.225 Bosque, Carlos**, (Universidad Simón Bolívar, Caracas, Columbia); Martin, Thomas E. (University of Montana, Missoula, MT, United States)

#### SURVIVAL AND ENERGY TURNOVER RATES ARE NEGATIVELY RELATED ACROSS SPECIES OF PASSERINES

Life history theory postulates that physiological mechanisms can constrain the pattern of variation of adaptive responses such as survival and reproductive success. One of such possible control mechanisms involves the idea that increased life span is associated with low energy turnover. We tested this hypothesis by examining the relationship between the rates of energy expenditure and survival across species of temperate species of passerines. We examined, mostly from published data, the relationship between annual adult survival rate and several estimates of energy turnover: basal metabolic rate (which provides an approximate of minimum maintenance energy requirements), winter metabolic rate, and field metabolic rate of adults while incubating or raising nestlings, which provide an integrated estimate of maximum sustainable energy expenditure. We found, in agreement with expectation, that survival rates are significantly, and negatively, correlated with all metabolic

predictors, while controlling for body mass. Our results support the notions that physiological mechanisms can constrain the expression of evolutionary components of life histories, and that the scrutiny of physiological mechanisms is essential to understand variations in the life history of birds and other organisms.

**F3.2 Botero-Delgadillo, Esteban,** (SELVA: Research for conservation in the neotropics, Bogotá DC, Columbia); Páez, Carlos Andrés; Bayly, Nicholas J. (SELVA: Research for conservation in the neotropics, Bogotá DC, Columbia)

#### THE IMPORTANCE OF DEFINING DISTRIBUTION PATTERNS TO DETERMINE THE CONSERVATION STATUS OF ANDEAN POPULATIONS OF PYRRHURA PARAKEETS IN NORTH-WESTERN SOUTH AMERICA

In theory, conservation priorities should be defined not only for species, but also for subspecies or populations facing imminent extinction. However, this is seldom applied and consequently some populations or cryptic species facing a critical situation may be disappearing in the absence of targeted conservation actions. Although detecting cryptic biodiversity is a key step to identifying species requiring urgent action, conservation of some threatened populations cannot wait. This is the case of several range-restricted populations of *Pyrrhura* parakeets, especially trans-Andean populations that occur in the north-western Andes of Colombia, such as *Pyrrhura picta caeruleiceps*, *P. p. subandina*, *P. melanura chapmani* and *P. m. pacifica*. Although biogeographic and morphological approaches suggest that some of these races merit species status, they have yet to be defined, diverting attention away from their conservation status and main threats. We used Climatic Envelope Models (CEMs) to determine the distribution patterns of trans-Andean populations of *Pyrrhura* in Colombia and to infer their conservation status using IUCN criteria. Based on predictions of climatic niche and ecological distribution, we demonstrated that all populations are allopatric and are unlikely to maintain contact with sister populations, and therefore can be considered independent conservation units. Using GIS analyses and a Gap analysis, we estimated extent of occurrence and area of occupancy for each population, and determined remaining habitat and conservation gaps in Colombia. Based only on the IUCN criteria B1 and B2, we conclude that all four taxa should be considered threatened with extinction at a regional level based on current knowledge.

**SAT17.4 Botson, Bryan A.,** (Florida Atlantic University, Boca Raton, United States); Gawlik, Dale E. (Florida Atlantic University, Boca Raton, FL, United States)

#### QUANTIFYING THE EFFECT OF WATER LEVEL FLUCTUATIONS ON NEST EFFORT OF WHITE IBIS, WOOD STORKS AND GREAT EGRETS

The pattern of water level fluctuations controls the production and concentration of aquatic fauna that support breeding wading bird populations in the Everglades. Water levels in this ecosystem fluctuate seasonally based on the severity of the subtropical wet and dry seasons. We developed a priori hypotheses and used model selection to quantify relationships between hydrological conditions and nest effort for the White Ibis (*Eudocimus albus*), Wood Stork (*Mycteria americana*) and Great Egret (*Ardea alba*). The landscape availability hypothesis proposes that nest effort is a function of the amount of the landscape that becomes available as foraging habitat during the course of the dry season. The progressive dry-down hypothesis predicts that there will be more wading bird nests when the dry-season recession of water levels is uninterrupted by rainfall. The prey production hypothesis states that high water levels

during the wet season provide more space for fish production leading to higher wading bird nesting effort. The best supported model for the White Ibis ( $w_i=0.59$ ,  $r^2=0.71$ ), Wood Stork ( $w_i=0.35$ ,  $r^2=0.70$ ) and Great Egret ( $w_i=0.46$ ,  $r^2=0.70$ ) included terms for landscape availability, days of rising water, and their interaction. The number of wading bird nests for all three species was positively correlated with landscape availability and negatively correlated with days of rising water, although the magnitude of the effect of each parameter on nest effort differed among species. The landscape availability and progressive dry-down hypotheses were favored over the fish production hypothesis demonstrating that hydrological conditions that promote an uninterrupted water level recession and produce a large number of foraging patches are at least as important as are conditions that promote an increase in prey population size.

**PS2.11 Boves, Than,** (Department of Forestry, Wildlife, and Fisheries, University of Tennessee, Knoxville, United States); Buehler, David (The University of Tennessee, Knoxville, TN, United States); Bohall Wood, Petra (U.S. Geological Survey, Morgantown, WV, United States); Rodewald, Amanda (The Ohio State University, Columbus, OH, United States); Larkin, Jeffrey (Indiana University of Pennsylvania, Indiana, PA, United States); Keyser, Patrick (Department of Forestry, Wildlife, and Fisheries, University of Tennessee, Knoxville, United States); Wigley, Tim (NCASI, Inc., Clemson, Canada)

#### INFORMATION CONTENT AND HABITAT CONTINGENCY OF MULTIPLE PLUMAGE ORNAMENTS IN A CANOPY-DWELLING SONGBIRD, THE CERULEAN WARBLER

Sexual selection theory postulates that males display ornaments, such as colorful plumage in birds, to provide reliable information about individual quality or condition during female mate choice and intrasexual competition. Multiple ornaments may convey different messages because they are produced at different times or by different metabolic mechanisms. In addition, environmental heterogeneity may influence the magnitude and direction of the relationship between ornament expression and condition. In this study, we examined the information content of four potential plumage ornaments of various metabolic origins in a population of free-living Cerulean Warblers (*Setophaga cerulea*), a canopy-dwelling songbird. We also evaluated the impact of environmental heterogeneity on the honesty of plumage ornaments by assessing relationships between plumage and individual quality across a range of disturbed forest conditions. We found that individuals displayed several plumage ornaments which were related to measures of condition and parental ability. All plumage ornaments were related to age class, and within age classes we found evidence to support the multiple messages hypothesis. Tail white was the only plumage ornament positively related to condition at time of molt, while structural rump plumage was the only ornament positively related to provisioning rate. Eumelanic breast band width was positively related to body mass, but only in high-density, moderately-open forest habitats, providing support for the notion that melanin-based plumage signals the ability to occupy highly competitive environments. Furthermore, we documented non-random spatial distribution of eumelanic breast band and tail white; both ornaments were found in their most exaggerated forms in preferred, moderately-open forest habitat

**W13.8 Bowman, Reed,** (Archbold Biological Station, Venus, United States); Lykins, Grant (Mosaic Fertilizer LLC, Lithia, FL, United States); Gordon, David (Quest Ecology, Wimauma,



FL, United States); Deaner, Lauren (Georgia Southern University, Statesboro, GA, United States)

#### TRANSLOCATION OF FLORIDA SCRUB-JAYS INCREASES LOCAL POPULATIONS AND REDUCES METAPOPOPULATION EXTINCTION RISK.

Translocations often are used to establish new populations or augment existing ones, but rarely to rescue metapopulations. We developed a decade-long translocation project with the primary goal of establishing and growing a new population near the geographic center of an existing metapopulation. The successful translocation transformed the spatial structure of the metapopulation from a non-equilibrium structure, in which most occupied patches were small and relatively isolated from one another, to a mainland-island structure, dominated by a large occupied patch within dispersal distance of several smaller protected patches. In total, we translocated 51 Florida Scrub-Jays into one site, but birds also settled on an adjacent site. Habitat restoration began on the recipient site pre-translocation and on the adjacent site about 4 years into the project. Within a decade the local population had grown to 32 groups, 24 of which included translocated birds or their descendants. Habitat restoration, establishment of a local population, and the availability of potential mates along with suitable but unoccupied habitat also increased the rate of natural immigration. Pre-translocation spatially-explicit PVAs predicted a very high rate of extinction risk for the metapopulation, even under assumptions of increased land acquisition and population growth; however, these models also assumed the same spatial structure. Post-translocations models with similar assumptions of population growth, but with an altered spatial structure as a result of translocation have much reduced extinction risk. Careful consideration of metapopulation spatial structure in selecting potential recipient sites for translocation can greatly magnify the benefits of this conservation tool.

**SAT18.1 Bowser, Kirsten**, (University of New Brunswick, Fredericton, Canada); **Diamond, Antony** (University of New Brunswick, Fredericton, NB, Canada); **Addison, Jason** (University of New Brunswick, Fredericton, Canada)

#### SEQUENCING A SEABIRD FOOD CHAIN - NEXT GENERATION SEQUENCING OF THE FECES OF ATLANTIC PUFFIN AND THE STOMACH CONTENTS OF THEIR MAJOR PREY, ATLANTIC HERRING

The collapse of the cod stocks in the early 1990s precipitated a restructuring of the food web in the Bay of Fundy which we are only beginning to understand. Seabirds can provide insights into the marine food web, particularly when their diet includes commercially or ecologically important fish species. Machias Seal Island (MSI), a rocky outcrop in the mouth of the Bay of Fundy, supports breeding colonies of seabirds that forage predominantly on juvenile Atlantic herring (*Clupea harengus*). Herring are a lipid-rich prey item considered necessary to the continued survival of MSI's seabird populations. Recent declines in the proportion of herring in chick diet coincided with the multi-year abandonment of the largest tern (*Sterna* spp.) colony in the region. Our ability to understand how changes at the base of the food web influence herring availability is limited since information about juvenile herring diet is sparse and outdated. We are also unaware of proportions of herring in adult seabird diet since our diet data is derived from observations of adults provisioning chicks. I use universal primers and next-generation sequencing on 1) stomach contents of herring to provide detailed diet information and 2) Atlantic puffin (*Fratercula arctica*) feces to compare adult and chick diet. Together, the diet of puffins and juvenile herring will contribute

to the understanding of the food web at both a local (MSI) and regional (Bay of Fundy) scale. Then we can begin to investigate how and why changes in herring or seabird populations occur.

**F4.6 Boyce, Andrew**, (University of Montana, Missoula, United States); **Martin, Thomas** (USGS, MT Cooperative Wildlife Research Unit, Missoula, MT, United States)

#### THE FIGHT FOR SPACE: DOES INTERSPECIFIC COMPETITION OR PHYSIOLOGICAL TOLERANCE LIMIT ELEVATIONAL DISTRIBUTIONS OF TROPICAL BIRDS?

Understanding the mechanisms that limit species distributions is a fundamental goal of ecology. Such an understanding is also essential to predict future ranges of species in light of large scale human-caused changes in both abiotic and biotic components of the environment. Interspecific competition and physiological tolerances are both thought to influence species distributions. However, their relative importance has not been studied simultaneously within a single system. Additionally, most studies have focused on changes in ecological mechanisms across a latitudinal gradient while elevational gradients remain relatively unstudied. Here, we are conducting an observational and experimental study to investigate the importance of interspecific competition and physiological tolerances in limiting species distributions in clades of birds with parapatric elevational distributions. This pattern of abutting, non-overlapping, elevational ranges of close relatives is a key component of biodiversity and endemism in the tropics and has been documented across taxa. However, the mechanisms underlying this pattern are poorly understood. We are experimentally testing the hypothesis that interspecific competition limits elevational ranges of parapatrically distributed species by conducting interspecific playback experiments on two clades of passerine birds, Muscicapid flycatchers (*Ficedula* & *Cyornis*) and Stachyris babblers. To address the hypothesis that elevational ranges may be limited by physiology, we are mapping elevational ranges of passerine birds on two mountains with similar avifauna, and combining this information with temperature data measured across elevations to produce simplified physiological niche models for each species. Based on the physiological tolerance hypothesis, the physiological niche for each species should remain constant across sites. This project is currently underway in Kinabalu National Park in Sabah, Malaysia (6° N).

**SAT3.3 Boyd, Sean**, (Environment Canada, Delta, Canada); **Esler, Dan** (Simon Fraser University, Delta, BC, Canada)

#### USING SATELLITE TELEMETRY TO DESCRIBE THE POPULATION STRUCTURE OF SEA DUCKS

To direct conservation for migratory birds and to appropriately scale inferences from research, we need to discriminate demographically independent population segments. This requires knowledge of affiliations among breeding, molting, and wintering areas and the degree of site fidelity at each annual cycle stage. We used satellite telemetry to address these issues for sea ducks that winter in southern BC. We implanted Surf (SUSC), White-winged (WWSC) and Black (BLSC) Scoters and Barrow's goldeneye (BAGO) with small transmitters, and the resulting data revealed very different patterns of movements and distributions among species. SUSC and WWSC migrated north along the Pacific Coast in spring and eventually bred over a large area of boreal forest east of the Rocky Mountains, broadly overlapping with birds from other wintering areas on the Pacific coast. BLSC, on the other hand, continued north along the coast and bred only in western Alaska. BAGO migrated directly inland and bred throughout south-central BC, largely segregated from other breeding areas. Post-breeding movements

also varied by species, with scoters returning to coastal habitats but male BAGO migrating up to 2,000 km further inland and north, as far as Great Bear Lake NT, to molt. All species showed a high level of site fidelity at all annual cycle stages. The combination of migratory connectivity and site fidelity information revealed different degrees of population segregation among the species, with correspondingly different conservation and research implications. This information would not have been possible to achieve without the use of satellite telemetry.

**W3.5 Boyer, Alison**, (University of Tennessee, Knoxville, United States); James, Helen (NMNH, Smithsonian Institution, Washington, DC, United States)

#### EFFECTS OF EXTINCTIONS AND INTRODUCTIONS ON THE FUNCTIONAL ECOLOGY OF HAWAIIAN BIRD COMMUNITIES

We examine the effects of extinction and endangerment on the structure and function of bird communities, using the Hawaiian Islands as a study system. We describe the distinctiveness of each species within an island community in terms of its ecological role and morphology. Quantifying functional diversity with two independent methods, we test predictions about which avian species are most likely to become extinct and what the effects of extinction may be on ecosystem functions, such as pollination and seed dispersal. Known prehistoric and European-era extinctions removed between 60 and 78% of landbird species from each of the four largest islands, translating to loss of 34 to 66% of local functional diversity (FD; a dendrogram-based metric) and 39 to 76% of functional richness (FRic; a volume-based metric). Extinctions were biased towards granivorous and functionally generalized species. We also examined the effects of the numerous bird species introduced to the Hawaiian islands and determined whether introductions serve as functional “replacements” in the bird community. Our findings highlight the dramatic loss of functional diversity incurred by species extinctions, especially in low-richness communities (such as isolated islands) which exhibit particularly low functional resilience. This work provides an initial step towards understanding the ecological changes that may result from impending global change.

**F15.7 Boyle, Alice**, (University of British Columbia, Vancouver, Canada); Sandercock, Brett (Kansas State University, Manhattan, KS, United States); Joy, Jeffery (Simon Fraser University, Burnaby, BC, Canada); Martin, Kathy (University of British Columbia, Vancouver, BC, Canada)

#### LIFE-HISTORIES OF BIRDS ALONG ELEVATIONAL GRADIENTS: A META-ANALYSIS

Understanding changes in life history strategies of avian populations distributed across elevational gradients can yield important insights into the important factors that shape life history evolution generally. Key abiotic gradients (temperature, radiation, and O<sub>2</sub> partial pressure) covary with elevation globally. These gradients could affect reproduction and survival directly, or could operate via one of several indirect factors. Using meta-analyses of >80 intra-specific empirical studies, we (1) describe patterns of variation in life history strategies (using multiple traits) along elevational gradients in terrestrial birds, and (2) formalize and test mechanistic hypotheses that could explain these patterns by evaluating analytical models considering several covariates (latitude, body size, migratory behaviour). We analysed the full data set using vote-counting methods, and a restrict dataset consisting of studies reporting sample sizes and variances permitting formal meta-analyses framework. Additionally, we compared these results with

those of analytical models that accounted for phylogenetic relationship among species. High elevation populations tend to lay smaller clutches later in the season, incubating them longer, and have fewer reproductive attempts per year. Some variables showed stronger effects at higher latitudes than at low latitudes, but in general, responses were weakly associated with body size, occurrence in alpine habitats and migratory behaviour. As a whole, our results suggest that abiotic processes general to mountains globally are the most important in shaping variation in life history along elevational gradients, but at high latitudes, additional constraints on timing of reproduction further shape life histories. A shift to slower life histories at high elevations suggests that highland populations, already threatened with range-restriction due to climate change, must overcome the additional handicap of lower reproductive rates relative to their lower-elevation counterparts.

**PS2.215 Brackett, Carol**, (East Carolina University, Greenville, United States); McRae, Susan (East Carolina University and North Carolina Center for Biodiversity, Greenville, NC, United States)

#### REPRODUCTIVE ECOLOGY OF THE KING RAIL, RALLUS ELEGANS, WITH IMPLICATIONS FOR EAST COAST POPULATION DYNAMICS

The king rail (Family Rallidae) inhabits freshwater and brackish wetlands of the southeastern U.S. It is considered a priority species of conservation concern across most of its range by the U.S. Fish and Wildlife Service. Yet, little is known about its reproductive ecology or dispersal. We are investigating fundamental aspects of king rail breeding behavior and ecology at MacKay Island NWR, in coastal North Carolina, a probable regional source population in the easternmost part of its range. Throughout the breeding season, nests are monitored, reproductive parameters are collected, and causes of hatching failure documented. We capture, band, and sample breeders and chicks. We have developed a panel of species-specific microsatellite markers for analyses of population structure and parentage. Neighboring pairs have been found to nest as close as 25m from one another leaving open the possibility for reproductive interference. Conspecific brood parasitism (CBP) occurs in many species of rails, but has not been documented in the king rail. Incidences of CBP will be detected by monitoring daily egg laying sequences for anomalies and by parentage analysis. Experimental introduction of mimetic model eggs is used to determine if king rails have evolved behavioral responses to CBP. Banded adults with broods are monitored to determine mortality rates and movement patterns of chicks in the post-hatching period. Vital rates of reproduction and insight into the genetic structure at familial and population scales will be used to extend our knowledge of king rail ecology and behavior, guide more effective local and regional conservation efforts, and contribute to the development of additional field techniques for studying secretive marsh birds.

**W13.7 Bradley, David**, (University of Waikato, Hamilton, New Zealand); Molles, Laura (Lincoln University, Lincoln, Canterbury, New Zealand); Waas, Joseph (University of Waikato, Hamilton, New Zealand)

#### DIALECT-BASED ASSORTATIVE MATING FOLLOWING TRANSLOCATION OF THE ENDANGERED NORTH ISLAND KOKAKO (CALLAEAS WILSONI)

The North Island Kōkako (*Callaeas wilsoni*) is an endangered duetting songbird that has declined to c.780 pairs, and is confined to isolated reserves and offshore islands in New Zealand; each population exhibits a distinctive vocal tradition.

Conservation efforts are centered on intensive management of introduced mammalian predators – the current leading cause of kōkako population decline – followed by re-establishment of populations through translocation. When several culturally distinct groups have been translocated to the same release site, like-with-like assortative pairing based on dialect may potentially hinder successful population establishment due to low partner availability, leading to slow population growth. We assess this tendency by harnessing an existing 18-year data set from government reports documenting multi-source translocations to six sites from 11 source populations. In each breeding season at each site we compared the numbers of same- and mixed-dialect pairs to the numbers of possible pairs of each type, and found that kōkako pairs do form assortatively following translocation. However, mixed-dialect pairs did form in low numbers at two sites, either when an existing "core" population was present at the time of translocation, or following the release of a captive-reared sub-adult bird with potentially plastic song. These results suggest that sufficiently large differences in a sexually selected behavioural trait, such as song, can inhibit gene flow between populations, which could hinder population establishment following translocation of a small number of individuals from multiple sources. We discuss the implications of our results and make suggestions for future translocations.

**SAT10.4 Brasso, Rebecka,** (University of North Carolina Wilmington, Wilmington, United States); Polito, Michael (University of North Carolina Wilmington, Wilmington, NC, United States); Chiaradia, Andre (Philip Island Nature Parks, Cowes, VI, Australia); Parsons, Nola (Southern African Foundation for the Conservation of Coastal Birds, Bloubaai, South Africa); Raya Rey, Andrea (Centro Austral de Investigaciones Científicas (CADIC), Ushuaia, Argentina); Emslie, Steven (University of North Carolina Wilmington, Wilmington, NC, United States)

#### PENGUIN FEATHERS AS A PREDICTIVE TOOL FOR ASSESSING MERCURY EXPOSURE IN MARINE FOOD WEBS THROUGHOUT THE SOUTHERN HEMISPHERE

The wide geographic distribution of penguins throughout the Southern Hemisphere provides an opportunity to expand our understanding of large-scale patterns of mercury in marine food webs using a single taxonomic group. Because penguins nest in large, readily accessible colonies, it is possible to obtain large sample sizes of a variety of tissues (eggshells, feathers, blood); as such, penguins may serve as model species in marine ecosystems in the Southern Hemisphere. The goal of this study was to document mercury exposure in penguins in four distinct marine ecosystems: the Southern, south Pacific, southeastern Atlantic, and southwestern Atlantic Oceans. We tested the hypothesis that mercury exposure in Antarctic penguins, foraging in an ostensibly remote food web, would have a lower exposure risk than species found at lower latitudes in closer proximity to anthropogenic sources of mercury pollution. Trophic position and proximity of the nesting colony and feeding grounds to anthropogenic and natural sources of mercury also were investigated to create a predictive model of mercury exposure among geographic regions. Body feathers were collected from seven species of penguins between 2009 and 2011. Preliminary results show a significant effect of species ( $F_{4,189}=73.1$ ,  $p<0.001$ ); mercury concentrations in feathers of Magellanic penguins were 2-4 times higher than Black-footed African penguins and all three Pygoscelis penguins, respectively. Mercury in Black-footed African penguin feathers were lower than Magellanic penguins, but

significantly higher the Pygoscelis penguins ( $p<0.04$ , all cases). Within the Pygoscelis penguins, Chinstrap penguins had higher mercury than the Adélie or Gentoo penguins ( $p<0.01$ ). Continued analyses will determine mercury levels in Rockhopper and Little penguins with the ultimate goal of using the penguin model to enhance predictions regarding the risk of mercury exposure to these and other marine vertebrates in food webs throughout the Southern Hemisphere.

**SAT18.5 Braun, Michael,** (Smithsonian Institution, Suitland, United States); Braun, Edward (University of Florida, Gainesville, FL, United States); Mirarab, Siavash; Warnow, Tandy (University of Texas, Austin, TX, United States)

#### EARLY BIRD UPDATE: THE AVIAN TREE OF LIFE BASED ON 28 GENES AND 203 TAXA

Recent estimates of the phylogeny of birds based on molecular sequence data (e.g., Ericson et al. 2006, Hackett et al. 2008) differ dramatically from most previous estimates and potentially provide important new insights into avian relationships, morphological and ecological adaptation and biogeography. The 19 gene, 169 taxon Early Bird dataset of Hackett et al. (2008) has now been augmented to 28 genes and 203 taxa, and subjected to automated alignment and maximum likelihood analysis. For nodes that had moderate to high bootstrap support in the 19 gene tree, we see substantial increases in bootstrap support and few changes in topology. Nodes with low support in the 19 gene tree were more labile, but a number of them do show substantial increases in support as well. Interesting groups now receiving strong support include 1) parrots, passerines, falcons and seriemas; 2) trogons, coraciiforms, piciforms and bucerotiforms; and 3) a waterbird clade including loons, penguins, procellariiforms, ciconiiforms and pelecaniiforms. All basal nodes in the "landbird" clade are occupied by raptorial lineages, increasing support for a scenario in which the common ancestor of groups 1 and 2 above was a raptor.

**SAT9.4 Brawn, Jeffrey,** (University of Illinois, Urbana, United States); Thomas, Benson (Illinois Natural History Survey, Champaign, United States)

#### POPULATION GROWTH RATES IN TROPICAL UNDERSTORY BIRDS AND THEIR PROSPECTS UNDER CLIMATE CHANGE

Population growth rates (i.e., lambda) tell us much about the biology and viability of bird populations. Estimates of lambda can be derived from capture-mark-recapture sampling (CMR), but such estimates are rare owing to the need for many captures and, especially, recaptures. Thus, with notable exceptions such as long-term studies of single species, we know little about the nature of variation in growth rates of bird populations. Nowhere is this more evident than in the tropics. Here, we present results from a 35-year CMR study of understory species conducted in the lowland forests of Central Panama. Our analysis of 20 species reveals surprisingly great variation in lambda over time. For some species, this obtains from variation in apparent survival rate while in others it appears to stem from variation in reproductive success. Importantly, for most species we found that changes in lambda are associated with annual variation in rainfall. In most cases, rain and lambda were positively associated. Even under the most optimistic scenarios for climate change, much of Central America is expected to become dryer. While this is but one study, our results motivate a need for better understanding of basic population biology in resident tropical birds and of sampling/monitoring that will support this effort. Moreover, we believe that for tropical species especially, monitoring efforts based only on censusing

or counts of territorial birds may not capture essential information.

**PS2.174 Brian, Paterson,** (Hemmera, Vancouver, Canada); Palmer, Charlie (Hemmera, Vancouver, BC, Canada)  
PATTERNS OF RAPTOR MIGRATION AND FATALITIES ASSOCIATED WITH THE CONSTRUCTION OF THE BEAR MOUNTAIN WIND ENERGY FACILITY NEAR DAWSON CREEK, BC.

Wind turbine caused raptor fatalities garnered considerable attention in the early stages of wind energy development with facilities located in the Altamont Pass, California, and Tarifa and Navarra, Spain resulting in relatively high fatality rates to certain species. As such, avian monitoring programs have had considerable focus towards determining risk and impacts to raptors associated with operation of wind energy facilities.

While carcass search programs are often designed to quantify the operational effects to raptors through estimation of fatalities, collecting baseline data (flight patterns and behaviours) to compare with operational data evaluates both risk to and response of raptors to wind energy development. Raptor migration surveys were conducted during the spring and fall migration periods in 2005 (baseline), 2007 and 2008 (construction), and 2009 and 2010 (operation) along the Bear Mountain Wind Park near Dawson Creek in northeast BC to assess risks to raptors, and observe response of migrating raptors both during and post-construction. These data, collected at the first operational wind energy development in BC, corroborated some previously known information (such as seasonal and diurnal timing of species movements) and also showed that raptors tended to avoid the Bear Mountain ridgeline following construction. Coupled with carcass searches during migration and breeding (two raptor carcasses were recovered during the breeding season over 2.5 years of monitoring), these data provide evidence that fatality impacts to actively migrating raptors from wind turbines operating at this location are non-existent or very low. Rather, effects to migratory raptors at this site involve adjustment in site usage to avoid the airspace associated with operating turbines.

**PS2.10 Bribiesca, Rafael,** (Universidad Nacional Autónoma de México, Tlalnepantla de Baz., Mexico);  
EFFECT OF FLORAL ABUNDANCE AND INTRA/HETEROSPECIFIC INTERACTIONS IN TERRITORIAL BEHAVIOR ON THE WHITE-EARED HUMMINGBIRD (*HYLOCHARIS LEUCOTIS*).

R. Bribiesca 1 & M. C. Arizmendi 1 1. Laboratorio de Ecología, UBIPRO. Facultad de Estudios Superiores Iztacala UNAM. Av. de los Barrios 1, Los Reyes Iztacala Tlalnepantla, Edo. México. Zip code 54090. E-mail: huitziatl@hotmail.com, coro@unam.mx  
Abstract The most important food source for hummingbirds is the nectar produced by flowers. Because of this, hummingbirds have adapted closely to flower phenology following flowering season of plants used. These foraging patterns have been documented extensively, but have not been described in detail for *Hylocharis leucotis*. In this work we studied the effect of floral abundance and intra and heterospecific interactions in hummingbird territorial behavior of *H. leucotis*, during the winter in a temperate forest pine-oak forest of northwestern Mexico. We recorded species of hummingbirds, their abundance, agonistic interactions and the abundance of flowers and nectar. Additionally, plant abundance and availability of nectar resources were measured. We tested if the increment in the abundance of resources and changes in community composition of hummingbirds have an effect on the

territorial behavior of *H. leucotis* reducing their aggressiveness, as winter progresses. The territorial behavior of *H. leucotis* is affected mainly by the composition of the hummingbird community in the area. This medium sized hummingbird behave as subdominant when there are larger species competing for resources and territorial when these competitors move. The abundance and availability of resources was constant. Key words: México, nectarivorous, territorial behavior, competition

**S2.9 Bridge, Eli S.,** (University of Oklahoma, Norman, United States); Contina, Andrea; Kelly, Jeffrey F. (University of Oklahoma, Norman, OK, United States)  
MANIPULATING MIGRATION: EXPERIMENTAL EXAMINATION OF CARRY OVER EFFECTS ON MOLT AND MOVEMENT IN PAINTED BUNTINGS.

Painted Buntings that breed in the western-central United States are regarded as molt migrants that fly to traditional molting grounds in northwestern Mexico to replace their feathers before moving south to their wintering grounds in southern Mexico and Central America. Stable isotope ratios of carbon and hydrogen in the feathers of Painted Buntings in Oklahoma suggested that two or more migration strategies are practiced by individuals in the same breeding population. To test whether different migration strategies might be related to the timing of migration, we held Painted Buntings in captivity and manipulated day lengths to give rise to a group of early migrants and a group of late migrants. We then released these birds with geolocators to determine the effects of our treatments on the timing and route of fall migration. Unfortunately, our initial tracking data is limited to two birds both in the late-migrant group. However these two data sets revealed two very different migration paths. One bird performed a loop migration ranging through northwestern Mexico, whereas the other appeared to travel directly south to the Isthmus of Tehuantepec and back to the breeding site. These data make it clear that different migration routes occur in our study population, and an ongoing replication of this experiment will allow us to better evaluate whether different migration routes relate to the timing of departure.

**S4.12 Briggs, Forrest,** (Oregon State University, Corvallis, United States); Lakshminarayanan, Balaji; Neal, Lawrence; Fern, Xiaoli; Raich, Raviv (Oregon State University, Corvallis, United States); Frey, Sarah (Oregon State University, Corvallis, OR, United States); Hadley, Adam; Betts, Matthew (Oregon State University, Corvallis, United States)  
ACOUSTIC CLASSIFICATION OF MULTIPLE SIMULTANEOUS BIRD SPECIES IN THE H.J.A. EXPERIMENTAL FOREST

Prior work on automatic recognition of bird species from audio has typically been limited to recordings containing only a single species of bird. However, field-collected recordings often contain multiple simultaneously vocalizing birds of different species. To address this challenge, we propose to use the multi-instance multi-label framework from the field of machine learning to predict the set of bird species present in an audio recording (this is the first application of this framework to audio). Our proposed methods achieve 96.1% true positives/negatives in an audio dataset collected using unattended omni-directional microphones in the H. J. Andrews Experimental Research Forest. These new methods for audio classification enable acoustic bird population surveys at a temporal resolution and extent that is not possible with traditional human-observer based surveys, particularly in remote sites. Population surveys collected by acoustic monitoring can

be used to for species distribution modeling, conservation planning, and to better understand bird phenology.

**W13.11 Brisson, Andree**, (Department of Biological Sciences, Hays, Canada); Channell, Rob (Department of Biological Sciences, Hays, Canada)

A GLOBAL STUDY OF COLOR, ORNAMENTATION, SONG AND MIMICRY IN BIRDS: CHARISMATIC SPECIES ARE MORE VULNERABLE TO EXPLOITATION AND ENDANGERMENT

Conservationists have hypothesized that extinction is non-random; some species are intrinsically more prone to extinction than others. Multiple traits have been cited as contributing to extinctions (e.g., large-bodied, long-lived, slowly-reproducing, migratory, habitat and/or dietary specialists). Due to global anthropogenic demand for wild species (sport, trade, fashion, medicine, food), we propose charisma as an intrinsic trait of endangerment. This assumes that charismatic species are more often targets of direct exploitation as global demand increases with world population and development. These superlative species represent our most iconic, attractive, and animated organisms. We measured charisma through color, ornamentation, and vocalizations in ~1600 Old and New World species of Passeriformes and Psittaciformes. Color, ornamentation, and mimicry are shown to correlate significantly with both exploitation and endangerment risk. Additionally, both number of colors and proportion of color are shown to increase endangerment. This study suggests overexploitation is removing charismatic species from the Earth's biota, and may be valuable in identifying species across taxa that are potential targets of exploitation.

**F14.1 Britt, Charles**, (New Mexico State University, Las Cruces, United States); Garcia, Rony (Wildlife Conservation Society, Bronx, NM, United States); Desmond, Martha (New Mexico State University, Las Cruces, NM, United States)

ISOLATED AND UNDER THREAT: SCARLET MACAWS IN BELIZE AND GUATEMALA

Scarlet Macaws (ARA MACAO CYANOPTERA) in northern Mesoamerica are isolated and under threat from a myriad of human pressures. Individuals from Mexico, Guatemala, and Belize were historically a single population but recent genetic evidence points to a lack of gene flow between individuals in Belize and Guatemala/Mexico. Much of this is likely driven by land conversion and population declines. The core breeding areas in Belize and Guatemala are large riparian valleys of the Chiquibul Forest and lowland moist forests in the central-west Maya Biosphere Reserve, respectively. From 43 monitored nests in 2010, 20 in Belize and 23 in Guatemala, nest poaching was determined to be the greatest threat to nest survival in Belize; concentrated around the Chalillo dam reservoir. Connecting tree canopies has an important influence on nest survival across both countries; likely affecting access for non-volant nest predators. Corroborated by the highest nest poaching rates in Belize reported to date, in 2011, nest survival rates from 2010 suggest that the Belize population is likely to be experiencing decline. The intense management efforts in Guatemala are reflected in high nest survival rates, suggesting that current management practices may result in an increasing population. In 2011, we tracked three nesting/post-breeding females in Belize for eight months using satellite telemetry collars. Primary utilized habitats were mid-elevation lowland broad-leaved moist forest, adjacent submontane pine forest, and shrubland, respectively, near water. These macaws exhibited restricted, but gradually expanding, movements following the estimated fledge dates, and continued

to utilize nesting areas as the core of their daily movements. These findings emphasize the need to protect nest areas in Belize from nest poachers. An intensive management program may undertake some canopy modifications to reduce the likelihood of predation. In addition, protected areas managers need to create buffers around nesting and adjacent areas when planning activities as both are important to post-breeding family groups.

**SAT1.3 Brown, Clare,\*** (Louisiana State University, Baton Rouge, United States);

EVOLUTIONARY PATTERNS AND LIKELY CAUSAL FACTORS IN HUMMINGBIRD MIGRATION

Despite apparently high dispersal ability and biogeographic patterns that suggest a history of frequent colonization, the majority of hummingbird (Trochilidae) diversity is confined to the tropics, with few species reaching the temperate zone. Hummingbirds depend on seasonally ephemeral floral resources, rendering migration a necessity for species that breed at higher latitudes. To explore patterns of migratory behavior and geographic distribution in the Trochilidae, I coded 124 hummingbird species as either tropical or temperate in distribution and as either non-migratory or at least partially migratory, and applied maximum-likelihood ancestral character state reconstruction of migration to a published phylogeny. I also compared migration and distribution in hummingbirds to their sister group, the swifts (Hemiprocnidae and Apodidae). Migration has appeared multiple times in Trochilidae, and as expected, migration and temperate distribution are significantly correlated. Swifts, which are specialized aerial insectivores, are also dependent on a seasonally ephemeral resource, and migration in swifts is similarly correlated. However, a much greater proportion of swifts occurs at temperate latitudes than of hummingbirds. This low frequency of temperately distributed hummingbird species suggests that hummingbirds may be constrained in their ability to evolve long-distance migration. Hummingbird flight physiology is extremely specialized and energetically costly. It seems likely that the demands of migration present a significantly greater problem to hummingbirds than they do to other potentially migratory birds, and that as a result hummingbirds are less likely than other birds to evolve long-distance migratory behavior.

**PS2.153 Brown, Jessi**, (University of Nevada, Reno, Reno, United States); Colopy, Michael (University of Nevada, Reno, Reno, NV, United States)

FRAGMENTATION OF OPEN-STRUCTURED HABITATS REDUCES OCCUPANCY OF NEST BOXES BY AN OPEN-COUNTRY RAPTOR

Despite the recent rapid decline of many grassland bird species, the relative importance of open habitat configuration to population persistence is unclear. We used Southeastern American Kestrels (*Falco sparverius paulus*) in north-central Florida as a model system to explore the relative influence of landscape structure components on site occupancy patterns at two spatial scales, and for two different time periods. We focused on the dynamic processes of site-level population expansion or contraction, rather than static assessments like abundance indices or raw presence estimates. We modeled the occupancy of 131 kestrel nest boxes with Bayesian state-space models that considered both the partially observed process of true occupancy probability and the probability of detection of occupancy. Results from reversible jump Markov chain Monte Carlo (RJMCMC) algorithms suggested that  $\gamma$ , the probability of colonization of nest boxes between time periods, was strongly negatively influenced by increasing patch dispersion of open

habitat at our finest scale. We found weaker effects of landscape components on the continued occupancy of nest boxes, or  $\Phi$ . Landscape-level edge contrasts at our coarser scale negatively influenced  $\Phi$  during the early time period (1992-93). However, patch shape complexity of open habitat at the coarse scale positively influenced  $\Phi$  at the later time period (2008-2010). Our results indicate that continued fragmentation of open habitat would be deleterious for this threatened subspecies. Additionally, certain land cover management practices recommended for the Florida sandhills, such as frequent low-intensity controlled burns, will likely help conservation attempts.

**S11.3 Brown, Justin**, (Southeastern Cooperative Wildlife Disease Study, Athens, United States);

#### UNDERSTANDING AVIAN INFLUENZA VIRUS INFECTION IN GULLS

Although gulls are widely recognized reservoirs for low pathogenic avian influenza viruses (LPAIVs), basic questions including what subtypes are involved or how these viruses are transmitted in this reservoir system are not understood. Many subtypes have been isolated from gulls; however, two hemagglutinin subtypes (H13 and H16) are rarely detected in other avian groups and are thought to be maintained almost exclusively in gull populations without causing overt signs of disease. To address the dearth of information on influenza in gulls, we conducted a series of experiments to characterize infection with different LPAIVs in gulls and other susceptible avian species.

Our results suggest that laughing gulls (*Leucophaeus atricilla*) are competent hosts for multiple subtypes (H5N2, H7N3, H3N8) of LPAIV isolated from ducks. Susceptibility and/or extent of viral shedding varied between subtypes, but all viruses tested were isolated more frequently from oral than cloacal swabs. Mallards (*Anas platyrhynchos*) inoculated with the same viruses exhibited a similar level of susceptibility, but viral shedding was detected more frequently in cloacal swabs. In contrast to the duck-origin viruses, H13 LPAIVs appear to exhibit a strong degree of host adaptation. Ring-billed gulls (*Larus delawarensis*) inoculated with a H13N9 LPAIV became infected and excreted virus via the respiratory and intestinal tracts without clinical signs of disease. Alternatively, mallards, chickens (*Gallus domesticus*), and turkeys (*Meleagris gallopavo*) were either highly resistant or completely refractory to infection with multiple strains of H13 LPAIVs.

The results of these challenge studies are consistent with existing surveillance data on LPAIV in gulls and suggest that H13 LPAIVs are strongly host-adapted to gulls, but are capable of spilling-over and infecting other groups of birds. Preliminary data from another study conducted in our laboratory suggests that the host-ranges and patterns of viral excretion described above may relate strongly to the expression and distribution of sialic acid receptors in tissues of different avian species.

**W16.6 Brown, Sarah**, (Warnell School of Forestry and Natural Resources University of Georgia, Athens, United States); Palmer, William (Tall Timbers Research Station, Tallahassee, United States); Cooper, Robert J (Warnell School of Forestry and Natural Resources University of Georgia, Athens, GA, United States)

#### SINGING RATES OF RADIOTAGGED BACHMAN'S SPARROWS

Estimates of songbird populations are often obtained from counting the number of singing males. Songbird surveys, however may fail to meet assumptions required for estimating populations including that birds at the observer's location will be detected and that birds behave independently of one another. Problems with detection inherent in survey methods can be mitigated by incorporating a singing rate. To estimate the singing rate of Bachman's Sparrows (*Peucaea aestivalis*) we performed 5 minute point counts ( $n = 398$ ) on radio-tagged sparrows during April-June of 2011 on Apalachicola National Forest, FL USA. We also determined the effect of weather and the presence of conspecific singing males on an individual's likelihood of singing using logistic regression and an information-theoretic approach. On average, sparrows sang  $> 1$  time during 44.5% of point counts ( $SE = 2.49$ ). The selected best model included individual sparrow ( $P = 0.0002$ ), conspecific singing males ( $P = 0.000$ ) and wind speed ( $P = 0.05$ ). There were 3 models in the model selection set, 3. Singing rate declined with increasing wind speed. Our study indicates that only 45% of males would be detected during 5 min point counts underestimating abundance and that models predicting singing rate are necessary to improve estimates. We encourage other researchers studying radiotagged songbirds to estimate singing rate as part of research projects to improve estimates of detection used for estimating density.

**PS1.8 Brownson, Anna**, (Old Dominion University, Norfolk, United States); Walters, Eric (Old Dominion University, Norfolk, VA, United States); Koenig, Walter (Cornell University, Ithaca, NY, United States)

#### MATE GUARDING VS. MATE CHOICE: REPRODUCTIVE SKEW IN POLYANDROUS ACORN WOODPECKER (MELANERPES FORMICIVORUS) GROUPS

Acorn woodpeckers (*Melanerpes formicivorus*) are a social species with a highly variable mating system ranging from monogamy to cooperative polygyny; and groups that are polyandrous demonstrate high reproductive skew. However, this skew is not reflected in a clear dominance hierarchy among males, and overall paternity frequently switches to a different male in subsequent nests during the same breeding season. To determine the mechanism by which paternity is partitioned in acorn woodpecker groups, I quantified the mate guarding behavior of males in groups consisting of one breeding female and 2-5 breeding males during the fertile period of the female, and observed and quantified the behavior of the breeding birds near nest cavities within the territory of each group during three breeding seasons in central California. Mate guarding was initiated by all males in polyandrous groups 5-30 days prior to egg-laying, and terminated 1-2 days after clutch initiation. The males in the study attended the female an average of 95% of the time; and there was no significant variation in mate guarding intensity between co-breeding males once mate guarding was initiated, which indicates competition for the female is very high among all breeding males. Females entered tree cavities more frequently during the mate guarding period, and males entered tree cavities with the female regularly. I hypothesized that the female copulated with males only inside cavities, as successful copulations in the open were never witnessed and attempted copulations in the open were interrupted by other males. The frequency with which males entered tree cavities with a female differed significantly between males in some groups, suggesting tree cavities restrict reproductive access to the female, facilitating a degree of mate choice for the female in an otherwise highly competitive social environment. These results indicate that skew within polyandrous acorn woodpecker groups is a product of the interaction between male-male conflict in the

form of vigilant mate guarding which restricts access to the female in the open, and female-male conflict in the form of mate choice facilitated by cavity use.

**PS2.128 Brush, Timothy**, (University of Texas-Pan American, Edinburg, United States); Conway, Mark (Texas State Technical College, Harlingen, TX, United States)

**BREEDING STATUS OF BROWNSVILLE COMMON YELLOWTHROAT (GEOTHLYPIS TRICHAS INSUPERATA) IN HIDALGO COUNTY, TEXAS**

Common Yellowthroats are near the southern edge of their breeding range in the Lower Rio Grande Valley of Texas. The Brownsville Common Yellowthroat has been confirmed breeding only in Cameron County. During April-July 2008-2011, we banded 32 birds at Santa Ana National Wildlife Refuge and confirmed breeding. Wetland habitat decreased during high water in 2010 and 2011, so monitoring of this vulnerable subspecies will continue.

**F10.6 Brussee, Brianne**, (United States Geological Survey, Dixon, United States); Coates, Peter; Hothem, Roger (United States Geological Survey, Dixon, United States); Eadie, John (University of California, Davis, Davis, United States)

**NEST SURVIVAL OF BLACK-CROWNED NIGHT-HERONS AS RELATED TO INCUBATION BEHAVIOR AND NEST PREDATORS BASED ON VIDEO-MONITORING AT ALCATRAZ ISLAND, SAN FRANCISCO, CALIFORNIA**

Few researchers have used fine-scale monitoring to define predator-prey relationships. We used videography on Alcatraz Island over a 2-year period to identify nest predators of Black-crowned Night-Herons (*Nycticorax nycticorax*), to quantify their daily time budgets, and to identify behavioral patterns in relation to predation events. We also used a two-step modeling approach to investigate relationships between night-heron incubation constancy (% time of contact between brood patch and eggs), attendance (% time with an adult on the nest), nest activity (ratio of active to inactive behaviors), and nest success. We first developed a priori models (hypotheses) that included explanatory factors of incubation constancy, nest attendance, and nest activity as response variables. The explanatory variables included nest age, clutch size, habitat, light period, and ordinal date. We then modeled incubation constancy, nest attendance, and nest activity as explanatory factors for nest survival. Preliminary analyses show that the most parsimonious models for both incubation constancy and activity included the covariate light period. Overall, incubation constancy averaged  $93.2\% \pm SE 1.0$  and was lowest during the morning hours ( $90.3\% \pm SE 1.3$ ). Furthermore, incubation constancy was an identifiable source of variation in nest survival. That is, for every 1% increase in incubation constancy there was a  $32\% \pm SE 1.32$  (CI = 8 – 61%) increase in the odds of nest survival. Based on direct video observations, predations were caused primarily by Common Ravens (*Corvus corax*), a visually cued predator. Night-Heron behavior patterns on the nest likely cue ravens, resulting in higher predation rates among those nests with riskier incubation strategies. This research has widespread implications, as raven populations are increasing throughout California and the Western United States. This ongoing research into predator and prey strategies will provide invaluable insight necessary for formulating the most effective adaptive management plans.

**PS1.183 Bubac, Christine**, (Black Hills State University, Spearfish, United States);

**HOW HABITAT CONNECTIVITY SHAPES GENETIC STRUCTURE DURING RANGE EXPANSION: INSIGHTS FROM VIRGINIA'S WARBLER IN THE BLACK HILLS**

Species range expansions facilitated through global climate change has been documented across the spectrum of life. Consequently, the ecological and evolutionary costs of range expansion in response to climate change are beginning to be teased apart and have the potential to be strikingly different among taxa experiencing different types of range expansion across highly variable landscapes. Contiguous range expansion with recurring gene flow could curtail the loss of genetic diversity in newly colonized areas. Alternatively, range expansion across inhabitable regions to habitat islands could produce founder events and without recurring gene flow substantially decrease genetic variation in newly colonized areas. We aim to investigate how landscape and habitat connectivity impact genetic diversity in Virginia's Warbler, *Oreothlypis virginiae*, which has recently colonized (within the last 10-15 years) the Black Hills of South Dakota. To investigate population connectivity, we have sampled Virginia's Warblers from throughout their breeding range. Twelve microsatellite loci were used to characterize genetic structure within and among populations and investigate genetic variability associated with landscape features and the recent founder event in the Black Hills.

**SAT12.5 Buchholz, Richard**, (University of Mississippi, University, MS, United States);

**IMMUNOGENIC EXPOSURE IMPACTS MATING-RELATED PERSONALITY TRAITS IN FEMALE WILD TURKEYS.**

Many studies have considered how parasites and other immunogenic challenges affect the ability of males to attract mates. Few studies, however, have considered how the cost of immunogenic exposure in females changes the way that they behave during mate assessment. Recent theoretical work has suggested that early parasite exposure may lead to life-long personality traits in females. These personalities have been hypothesized to explain variation in female mating preferences, and thus the evolution of sexually-selected ornaments in males. I will present the results of the first experimental investigation of this question. Wild turkey hens were reared in captivity in four treatment groups reflecting graduated levels of parasitic exposure early in life: control, antigen-exposure only, parasite infection only, and antigen + parasite exposure. I hypothesized that increasing immunogenic exposure would result in greater variation in female responses to mating scenarios, indicative of the formation of unique personalities depending on the ability of individuals to respond to parasitic threats. Preliminary results reveal that combined antigen + parasite exposure in juvenile turkey hens produces anxious, fearful adults that do not engage in mate choice under normal trial conditions. I will present a more detailed analysis of personality differences within and between treatment groups and discuss the possible implications of parasite-induced personalities for the evolution of male and female mating strategies.

**T16.10 Buck, Kenton\*** (College of William & Mary, Williamsburg, United States); Ramos, Claire; Swaddle, John; Cristol, Dan (College of William & Mary, Williamsburg, United States)

## EVALUATING THE POTENTIAL FOR ADAPTIVE RESPONSE TO MERCURY IN CAPTIVE-DOSED ZEBRA FINCHES

Mercury is a ubiquitous pollutant with numerous effects on reproduction, physiology, and behavior in birds. Current predictions of mercury accumulation and biomagnification overlook possible variation in mercury uptake/removal within species and the potential for evolution in sensitive populations. We assessed the potential for adaptive response to mercury exposure in captive-dosed zebra finches (*Taeniopygia guttata*) by investigating patterns of variation and heritability of mercury accumulation. Zebra finches were maintained on standardized diets containing 0.0, 0.3, 0.6, or 1.2 ppm methylmercury cysteine, and narrow-sense heritability ( $h^2$ ) of mercury accumulation in blood was estimated using a repeated-measures 'animal model'. Significant variation in mercury accumulation was observed within all mercury dose treatments; this variation was highly repeatable for individuals. At 1.2 ppm dietary mercury levels, zebra finches exhibited a substantial additive genetic contribution to phenotypic variance ( $h^2 = 0.25$ ). At 0.3 and 0.6 ppm dietary mercury levels, additive genetic effects did not have a significant effect on blood mercury accumulation. If wild bird populations exhibit a heritable response to mercury accumulation, natural selection could act to produce tolerant/resistant populations. Such populations could increase total mercury biomagnification in the food web as more individuals survive to pass mercury on to the next trophic level. More research is necessary to investigate potential adaptation to mercury in wild bird populations and to understand gene expression mechanisms underlying mercury tolerance in birds.

**PS2.35 Buckley, Shannon.** (SUNY College of Environmental Science and Forestry, Syracuse, United States); McNulty, Stacy (SUNY College of Environmental Science and Forestry, Newcomb, NY, United States); Hodgman, Thomas (Maine Department of Inland Fisheries and Wildlife, Bangor, ME, United States)

## USING MOTION-TRIGGERED TRAIL CAMERAS TO DOCUMENT NEST PREDATION IN THE DECLINING RUSTY BLACKBIRD (*EUPHAGUS CAROLINUS*): A NOVEL NEST-MONITORING TECHNIQUE FOR FOREST PASSERINES

The Rusty Blackbird (*Euphagus carolinus*) has experienced one of the most significant declines ever documented among extant North American birds. While the cause of the decline is not yet understood, one possible factor is increased nest predation in regenerating clear-cuts. Previous studies found nests in wetlands adjacent to logged areas suffered significantly higher predation than nests in undisturbed forested wetlands. The identity of the predators responsible, however, remained a mystery. We addressed this question using motion-triggered trail cameras to monitor natural Rusty Blackbird nests. To minimize disturbance, we used covert infrared camera models (Reconyx Hyperfire HC600, Bushnell Trophy Cam or Uway NightTrakker NT50B IR). From May-August 2011, we monitored 13 Rusty Blackbird nests in the timberlands of central Maine. Ten of these were monitored with a camera during some or all of the nesting cycle. Of ten camera-monitored nests, six successfully fledged chicks, three were depredated and one was of unknown fate (though probably depredated). We captured images of two predation events: one by an *Accipiter* spp. and one by a white-tailed deer (*Odocoileus virginianus*). We found that cameras operated best when mounted 1-2 meters from the nest. Of the three models we used, the Uway cameras were the least reliable. On two occasions, they never triggered at all, and

as a consequence we missed a predation event. On two different nests, they triggered almost continuously initially (the first day or two after installation), and then stopped completely. None of the camera-monitored nests were abandoned, which is critical considering Rusty Blackbirds are known to be neophobic. Through camera footage of a little-understood and imperiled species, we are providing insight into nesting ecology and predation that may aid in conservation efforts. We have also successfully employed a camera technique in the dense vegetation of the boreal forest that was previously only used for monitoring nests of grassland and game birds. This may be of use to other researchers interested in remote monitoring of forest-dwelling passerine species.

**PS2.169 Buler, Jeffrey,** (University of Delaware, Newark, United States); Dawson, Deanna (USGS, Laurel, MD, United States)

## RADAR ANALYSIS OF BIRD DISTRIBUTIONS DURING FALL MIGRATORY STOPOVER IN THE NORTHEASTERN U.S.

The national network of weather surveillance radars (WSR-88D) detects birds in flight, and has proven to be a useful remote-sensing tool for ornithological study. We used data collected during Fall 2008 and 2009 by 16 WSR-88D and 3 terminal Doppler weather radars in the northeastern U.S. to study the spatial distribution of landbirds shortly after they leave daytime stopover sites to embark on nocturnal migratory flights. The aerial density of birds, as measured by radar reflectivity, was georeferenced to the approximate locations on the ground from which birds emerged. We modeled bird distributions based on landscape characteristics (land cover, ground elevation, geographic location), using ordinary least squares (OLS) regression and geographically-weighted regression (GWR) within an information-theoretic framework. The top OLS model explained 44% of variability in mean radar reflectivity and indicated that across the study region, migrant density increased to the south and west, and with proximity to major coastlines. GWR analysis revealed that relationships between bird density and landscape composition varied across the study region. Overall, GWR models explained 81% of variability in mean radar reflectivity and indicated that, at a local scale, migrant density was positively associated with the amount of deciduous forest, especially within landscapes dominated by developed or agricultural lands. We applied GWR models to predict migrant densities in portions of the study region not sampled by the radars. We classified bird stopover use by the magnitude and variation of radar-observed or predicted mean bird densities across nights; areas were considered 'important' stopover sites if mean bird density was consistently or occasionally high. Classified stopover use across the region was mapped for conservation uses and to provide a sampling frame for field surveys to 'ground truth' the radar and analytical results. Preserving patches of natural habitat, particularly deciduous forests, in developed or agricultural landscapes and along major coastlines should be a priority for conservation plans addressing the stopover requirements of migratory landbirds in the northeastern U.S.

**S9.1 Buler, Jeffrey,** (University of Delaware, Newark, United States); Diehl, Robert (USGS, Bozeman, MT, United States); Moore, Frank (University of Southern Mississippi, Hattiesburg, MS, United States); Paxton, Eben (USGS, Hawaii National Park, HI, United States)



## FACTORS THAT INFLUENCE THE DISTRIBUTIONS OF MIGRATORY BIRDS DURING STOPOVER IN A COASTAL SETTING

The distribution patterns of birds during migratory stopover result from a hierarchical process of habitat selection in which birds respond to factors operating at different scales. Factors extrinsic to habitats (e.g., weather and energetic condition of a bird) generally pose higher-order constraints on habitat selection, while lower-order stopover site selection is generally based on intrinsic habitat factors (e.g., food availability). The constraints of extrinsic habitat factors may be especially acute for landbird migrants negotiating a large ecological barrier such as the Gulf of Mexico. We present research integrating data from weather surveillance radars that map widespread bird distributions with data gathered on the habits of individual birds to better understand stopover use and distribution of migrants along the northern Gulf coast. We found evidence of extrinsic constraints on bird distributions; migrant densities generally increased with proximity to the coast, with differences among species related to their flight morphology. Birds near the coast were less closely associated with the amount of forest cover in the landscape than birds farther inland, indicating constraints on habitat selection at a landscape scale. During spring, most migrants likely use sites near the coastline for resting during their initial landfall and seek resource-rich habitats for refueling further inland during subsequent stopovers. Birds that arrive in coastal habitat with low subcutaneous fat reserves in fall reverse migrated to habitats further inland. These movements act to redistribute birds across the larger landscape in ways that may partially explain a weaker pattern of coastal concentration in fall.

**PS1.110 Burg, Theresa.** (University of Lethbridge, Lethbridge, Canada); Martin, Alice; Pelton, Haley (University of Lethbridge, Lethbridge, AB, Canada); Hudon, Jocelyn (Royal Alberta Museum, Edmonton, AB, Canada)

## ASYMMETRICAL HYBRIDIZATION IN SAPSUCKERS

Birds provide useful model systems for studying mechanisms of population differentiation, gene flow and hybridization. The sapsuckers species complex shows high levels of variation in both morphology and plumage with three distinct morphotypes: red-breasted, red-naped and yellow-bellied sapsuckers. Using mitochondrial DNA markers, we sequenced the control region for more than 100 individuals from 11 sites across North America including four sites at or near contact zones. Our results show hybridization is occurring between each of the three morphotypes; however, the amount and direction of hybridization differs among morphotypes and sampling sites. Furthermore, evidence of gene flow among morphotypes was not restricted to populations at/near contact zones.

**T12.12 Burger, Joanna,** (Rutgers University, Piscataway, United States); Niles, Lawrence (Conserve Wildlife, Greenwich, NJ, United States); Porter, Ronald (none, Ambler, PA, United States); Dey, Amanda (Endangered and Nongame Species Program, Millville, NJ, United States)

## USING GEOLOCATOR DATA TO REVEAL INCUBATION PERIODS AND BREEDING BIOLOGY IN RED KNOTS (CALIDRIS CANUTUS RUFA)

Shorebirds that nest at low densities in the Arctic are difficult to study. Understanding breeding rates and incubation outcomes can aid in understanding population dynamics, particularly for species whose populations are declining. We describe a technique for using data from geolocators placed on Red Knots (*Calidris canutus rufa*) to determine information about breeding,

and report on the percent of knots that reached Arctic breeding grounds, attempted breeding, and incubated to full term, as well as total time spent in the Arctic. We captured 19 knots that were fitted with geolocators in New Jersey, Massachusetts, Florida, Texas, and southern Argentina, and reached Arctic breeding areas. The median arrival date in the Arctic was 10 June, the median departure date was 22 July, and the mean time in the Arctic was  $44 \pm 2.3$  days (range = 28 – 65 days). Because of 24 hr sunlight in the Arctic summer, prolonged periods of a dark signal indicate that the geocator was not exposed to light, and indicated incubation. Using these diurnal, dark periods as indicators of incubation, we found that 85 % initiated incubation (17/20), 65 % (11/17) incubated for 18 – 24 days, and one incubated for 30 days. Wet/dry records indicated that knots rarely entered salt water while in the Arctic. The data suggest that knots leaving migration stopover areas reached Arctic breeding grounds, and that a high percent initiated incubation and incubated to full term, suggesting that population declines were not due to failures on the breeding grounds.

**T15.8 Burke, Dawn,** (Ontario Ministry of Natural Resources, London, Canada); Doug, Tozer (Bird Studies Canada, Port Rowan, ON, Canada); Nol, Erica (Trent University, Peterborough, ON, Canada); Elliott, Ken (Ontario Ministry of Natural Resources, London, ON, Canada)

## DOES LOGGING CREATE ECOLOGICAL TRAPS FOR YELLOW-BELLIED SAPSUCKERS?

The Yellow-bellied Sapsucker is a common migratory woodpecker throughout hardwood and mixed forests of eastern Canada. As selection logging preferentially removes declining trees and snags typically used for foraging and nesting, we wanted to assess the effects of logging on this keystone species. Between 2006 and 2011 we examined habitat quality among logged and unlogged stands in Algonquin Provincial Park, ON. Sapsuckers are most abundant, settle first, and produce the most young in uncut stands. Though they prefer to nest in recently logged stands these habitats are 'ecological sinks' due to high nest predation by black bears. Since 2009, 189 sapsucker adults have been colour banded to measure differences in age-structure, return rates, and site fidelity. Uncut stands support the highest proportion of ASY birds, particularly males. Sites experimentally logged using group selection had high proportions of young birds, particularly females. Overall return rates were 41%, being lowest in group selection sites compared to reference stands. Males are more likely to return than females, particularly SY females. Most previous territories, and even old nest trees are re-occupied, but not necessarily by the same pair, as would be assumed. Though birds successful the previous year tended to return to their territory more often, many successful breeders still switch nest trees or even territories the following season. This data has provided new insight into the ecology of breeding Yellow-bellied Sapsuckers and further support for the value of uncut mature tolerant hardwood forests for their conservation.

**W14.9 Burle, Marie-Helene,** (Simon Fraser University, Burnaby, Canada); Rico Guevara, Alejandro (University of Connecticut, Storrs, CT, United States); Rubega, Margaret (University of Connecticut, Storrs, United States); Lank, David (Simon Fraser University, Burnaby, BC, Canada)

## INDEPENDENT EVOLUTION OF NECTARIVORY: TUAMOTU SANDPIPERS ARE NECTAR-FEEDERS

The Tuamotu sandpiper (*Prosobonia cancellata*) is an endangered Scolopacid sandpiper endemic to the Tuamotu Archipelago in French Polynesia. An understanding of its

feeding habits and ecology is critical to efforts to conserve the small and declining population. We document here evidence that Tuamotu sandpipers feed on floral nectar, with adaptations of behavior, morphology and feeding mechanics that reflect a commitment to nectarivory that is more than merely facultative. Previous investigators (Pierce & Blanvillain 2004: WSGB 105:93-100) noted anecdotally that Tuamotu sandpipers visit flowers, but could not confirm that they were obtaining nectar by doing so. Our field observations revealed that adult and juvenile Tuamotu sandpipers visit nectar-producing flowers of the shrub *Scaevola taccada* and the tree *Cordia subcordata* frequently, probing deep into flower corollas in a manner consistent with nectar gathering. Examination of museum specimens showed that their tongue tip is bifurcated, a morphological modification unknown from other charadriiforms, but common in other known nectarivores (e.g., hummingbirds and sunbirds). We used high-speed video (up to 240 f/s) to film free-living Tuamotu sandpipers feeding at flat-sided nectar feeders; our videos demonstrate that the birds use cyclic tongue protrusion (licking) to extract nectar; no other sandpiper is known to, or is likely to be able to, protrude its tongue as far past the bill tip as do Tuamotu Sandpipers. When given access to sufficiently large volumes of nectar, the birds submerged the bill tips and used suction feeding to drink nectar rapidly. To our knowledge, all other sandpipers are tip-up drinkers. Collectively, these lines of evidence demonstrate conclusively that Tuamotu Sandpipers represent a previously unappreciated independent evolution of nectarivory in shorebirds, and that floral food resources must be considered a key factor in any plan for their conservation

**F14.6 Burle, Marie-Helene**, (Simon Fraser University, Burnaby, Canada); Lank, David B. (Simon Fraser University, Burnaby, Canada)

#### OCEAN SWELL DRIVES UNEXPECTED POPULATION CRASH IN THE ENDANGERED TUAMOTU SANDPIPER SUGGESTING EARLIER CONSEQUENCES OF FUTURE SEA-LEVEL RISE

The tribe Prosoboniini consisted of at least six species of sedentary shorebirds endemic to the Pacific Ocean. Introduced mammalian predators led to the extinction of all species except the formerly widespread Tuamotu Sandpiper *Prosobonia cancellata*, which survives in four isolated breeding populations. It is listed as endangered by the IUCN, with a total of ca. 1200 individuals. In 2008/2009, we conducted five months of field work in one population and learnt that the species is found at surprisingly high density wherever habitat remains and mammals are absent, is socially monogamous and highly territorial with a fifth of the population unable to acquire territories. Diet consisted of arthropods, seeds and nectar. We returned in 2011 to obtain the first demographic data on the species and found little change in population size and social structure. But a strong ocean swell event in the middle of a drought resulted in the entry of seawater into the water tables of the islets forming the atoll. The vegetation partially died out, terrestrial invertebrate populations might have been affected and we witnessed a dramatic population crash, with 56% of individuals starving to death within a month. The condition of surviving individuals varied widely, with a few maintaining or even increasing their body mass. Such an event could impose severe selection in the species, comparable to those documented in Galapagos finches. The population's rate of recovery following this event remains to be determined. However, in the context of climate-change induced sea-level rise, entries of saltwater seem likely to happen with a higher frequency and will be a source of conservation concern long before atolls become

submerged, rendering Tuamotu Sandpipers more vulnerable to water level increase than previously thought.

**PS2.178 Burrell, Ken**, (University of Waterloo, Heidelberg, Canada); Murphy, Stephen (University of Waterloo, Waterloo, ON, Canada)

#### THE 2010-2012 SPRING REVERSE MIGRATION OF SONGBIRDS AT POINT PELEE NATIONAL PARK AND FISH POINT, PELEE ISLAND.

Spring reverse migration of songbirds within the Great Lakes region is an important, yet much understudied, aspect of songbird migration and ecology. It is still not completely understood whether the spring reversal of songbirds indicates a true migration or simply a re-orientation. This study focused on the phenomenon of reverse migration, where passerines have been observed to fly south during spring migration within southern Ontario. The objectives of this study were to observe, and correlate reverse migration occurring at Fish Point, Pelee Island and Point Pelee National Park, observe and correlate species composition and numbers of reverse migrants, observe and correlate weather influencing reverse migration and nocturnal migration, and observe and correlate the species composition and abundance of diurnal and nocturnal migrants. Visual surveys occurred at the extreme southern tip of Fish Point, Pelee Island and Point Pelee National Park, to record the total number of birds observed to be reverse migrating. All reverse migrants were identified as to species or family as best possible. A portable microphone (the 21C) was implemented to document nocturnal migration during the spring of 2012. This study was conducted during the springs of 2010-2012 from April 26 – May 20 consecutively. Information pertaining to this form of flight has only been scientifically documented twice in the Great Lakes region, most recently in 1951. This study will contribute towards the general information of songbird migration in the spring in the Great Lakes region as well as help to understand how weather affects bird migration.

**PS2.159 Burrell, Lucy**, (Colorado State University, Fort Collins, CO, United States); Pavlacky, David (Rocky Mountain Bird Observatory, Fort Collins, CO, United States); Skagen, Susan (U.S. Geological Survey-Fort Collins Science Center, Fort Collins, CO, United States)

#### CLIMATE IMPLICATIONS FOR NORTH AMERICAN PLAYA SYSTEMS AND ASSOCIATED AVIFAUNA

Playa wetlands provide resources for a diverse avifauna during breeding and migration seasons in the semiarid western Great Plains of North America. Playas are highly susceptible to sediment infilling from upland erosion and shortening of hydroperiods during climatic dry periods. We modeled the inundation state of the playas as a function of hydrological and landcover variables using a generalized linear mixed model with the binomial distribution and logit link function. We forecasted erosion rates, sediment depths, and resultant playa depths relative to surrounding landcover with the Revised Universal Soil Loss Equation (RUSLE) using historic values and downscaled precipitation predictions from three general circulation models and three emissions scenarios. We calibrated erosion results using field sediment measurements. Playa inundation was positively related to amount of rainfall in the previous 14 days, the size of the rainfall event, playa area and the slope and cover type of the surrounding landscape. There was a non-linear decline in playa inundation in response to the percentage of Conservation Reserve Program (CRP) lands within 100 m. Sediment accumulation rates will continue near historic levels through 2070 and are sufficient to cause most

playas (if not already filled) to fill with sediment within the next 100 years in the absence of mitigation. Surrounding landuse, whether grassland or cropland, is more influential on sediment accumulation than climate-driven precipitation change. Predicted reduced precipitation across expanses of the playa region will likely alter regional hydrology and diminish inundation rates and habitat availability for playa-associated species. Avian conservation in western Great Plains playas is challenged by several issues: playa sedimentation, buffer functionality, and inundation potential and availability of wetland habitats in response to climate change.

**PS1.132 Burt, Brent**, (Stephen F. Austin State University, Nacogdoches, United States); Macey, John (US Army Garrison - Fort Stewart, Fish and Wildlife Branch, Fort Stewart, GA, United States); Conner, Richard (USDA Forest Service - Southern Research Station, Nacogdoches, TX, United States); Saenz, Daniel (USDA Forest Service - Southern Research Station, Nacogdoches, United States)

#### A HABITAT MANAGEMENT MODEL BASED ON FORAGING RED-COCKADED WOODPECKER HABITAT USE AND AVOIDANCE

The endangered Red-cockaded Woodpecker (*Picoides borealis*) is endemic to the pine ecosystems of the southeastern United States. Mature pine savannas with minimal midstory and a lush herbaceous ground cover represent high quality habitat. This study examines the foraging habitat preferences of Red-cockaded Woodpeckers in a loblolly-shortleaf pine habitat in eastern Texas. We present a logistic regression model with a combination of habitat variables that best differentiate between habitats used for foraging and habitats avoided by foraging birds. We found that an increase in the basal area of hardwood midstory has the greatest negative impact on the probability of a site being used for foraging. The remaining 5 variables in descending order of significance are: shrub height, diameter at breast height (DBH) of pine midstory, canopy closure, and density of pine and hardwood midstory. Our model is an efficient tool for estimating the probability a habitat patch will serve as Red-cockaded Woodpecker foraging habitat. Our model also shows general utility in forests composed of different pine species in East Texas.

**PS1.123 Butler, Christopher**, (University of Central Oklahoma, Edmond, United States);

**WINTER ECOLOGY OF YELLOW RAILS IN OKLAHOMA**  
Yellow Rails winter along the US Gulf Coast, from North Carolina to Texas and have recently been discovered to winter in southeastern Oklahoma. Although this species is listed as a species of special concern in most of the provinces and states where it breeds, little has been published about the winter ecology of this secretive species. The goals of our Oklahoma study were fourfold – 1.) To use a stable isotopes analysis to determine where these birds bred; 2.) To examine age and sex ratios; 3.) To examine whether Yellow Rail fat reserves changed from October through March; and 4.) To create population estimates of the Oklahoma population. We banded Yellow Rails at Red Slough Wildlife Management Area (Red Slough WMA) in McCurtain County, Oklahoma from November 2008 to March 2009, October 2009 to April 2010, and October 2010 to March 2011. Feather samples were collected from each bird banded for use in DNA sexing. One hundred and five Yellow Rails were banded at Red Slough WMA (25 in 2008-2009, 56 in 2009-2010, 24 in 2010-2011). The majority of the birds encountered came from the western half of their breeding range. HY birds made up approximately 40% of the population and

there was a slight male-bias for birds wintering at Red Slough WMA. Fat reserves varied significantly by month, with the greatest fat deposits visible during the winter. An estimated  $68 \pm 18$  (x ± se) individuals wintered in the fields we sampled at Red Slough WMA (total of 17 ha) during 2009-2010, and  $132 \pm 53$  individuals during 2010-2011. The population of Yellow Rails wintering in Oklahoma was larger than expected given that this location was not historically known to harbor wintering Yellow Rails. Observers at other inland locations in the southeastern US should be alert for the species during the winter.

**PS2.161 Butler, Luke K**, (The College of New Jersey, Ewing, United States);

#### INFLUENCES OF LATITUDE AND CLIMATE ON THE MOLT DYNAMICS OF A WIDELY-DISTRIBUTED PASSERINE, THE VERMILION FLYCATCHER

The geographical region of the Mexican monsoon is recognized as a molting “hotspot” for migrant passerines that breed in northwestern North America. It is unclear if monsoon-molting evolved primarily in response to a localized surge in food resources that follows the monsoon rains, or in response to the temporal benefits of molting at more-southern latitudes, or in response to both influences. I attempted to isolate the influences of resources and time on the evolution of monsoon molt by comparing molt dynamics of populations of the Vermilion flycatcher molting 1) within a narrow latitudinal range in and outside of the food-rich monsoon region, and 2) over a wide latitudinal range within the monsoon region. I tested the predictions 1) that flycatchers molting at the northern end (35°N) of the monsoon region would molt more rapidly than flycatchers molting in arid areas east and west of the monsoon region at the same latitude, and 2) that flycatchers molting at the northern end of the monsoon region would molt more rapidly than flycatchers molting at the southern end of the monsoon region (20°N). Contrary to prediction, flycatchers molting in the monsoon region did not molt more rapidly than flycatchers in arid areas east and west of the monsoon region. However, as predicted, flycatchers from the northern end of monsoon region molted more rapidly than flycatchers from the southern end of the monsoon region, with molt in the southernmost population starting approximately two weeks earlier and lasting approximately 30 days (70%) longer than molt in the northernmost populations. Altogether, these results suggest that time is a more important factor than resource availability in the evolution of molt strategies in the Vermilion flycatcher. If this applies to other monsoon-molters, then the observed high inter-annual variability in the timing and location of the monsoon rains may not pose a physiological challenge for the several species of molt-migrants that depend on the Mexican monsoon each summer.

**F7.6 Butler, Michael**, (Lafayette College, Easton, United States);

#### DIFFERENTIAL EFFECTS OF EARLY- AND LATE-LIFE ACCESS TO CAROTENOIDS ON ADULT IMMUNE FUNCTION AND ORNAMENTATION IN MALLARD DUCKS (ANAS PLATYRHYNCHOS)

Environmental conditions early in life can affect an organism's phenotype at adulthood, and the resultant adult phenotype can either be tuned to perform optimally in conditions that mimic those experienced during development (Environmental Matching hypothesis), or be generally superior when conditions during development were of higher quality (Silver Spoon hypothesis). Here, we tested these hypotheses by examining how diet during development interacted with diet during adulthood to affect adult sexually selected ornamentation and immune

function in male mallard ducks (*Anas platyrhynchos*). Mallards have yellow, carotenoid-pigmented beaks that are used in mate choice, and the degree of beak coloration has been linked to adult immune function. Using a 2X2 factorial experimental design, we reared mallards on diets containing either low or high levels of carotenoids (nutrients that cannot be synthesized *de novo*) throughout the period of growth, and then provided one of these two diets to these same individuals as adults while simultaneously quantifying beak coloration and response to a variety of immune challenges. We found that both developmental and adult carotenoid supplementation temporarily increased circulating carotenoid levels during dietary treatment, and that diet during development also affected carotenoid physiology of adults. Specifically, birds that received low-carotenoid diets during development more effectively maintained circulating carotenoid levels during a carotenoid-depleting adult immune challenge. Individuals that received low levels of carotenoids during development also had larger phytohemagglutinin (PHA)-induced cutaneous immune responses at adulthood, although dietary treatment during neither development nor adulthood affected adult antibody response to a novel antigen, nitric oxide production, natural antibody levels, hemolytic capacity of the plasma, or beak coloration. However, beak coloration prior to immune challenges did positively predict PHA response, and more robust PHA responses were correlated with losses in carotenoid-pigmented coloration. In sum, we did not find consistent support for either the Environmental Matching or Silver Spoon hypotheses, which led to our proposing a new hypothesis that should be tested in future studies examining developmental plasticity.

**PS1.135 Buxton, Valerie**, (University of Illinois - Illinois Natural History Survey, Champaign, United States); Benson, Thomas (University of Illinois/Illinois Natural History Survey, Champaign, IL, United States)

#### MAKING THE MOST OF WHAT REMAINS: EXAMINING THE QUALITY OF URBAN GRASSLANDS FOR CONSERVATION-PRIORITY BIRDS IN ILLINOIS

As urban and suburban development continues to spread, natural environments are invariably converted into areas that are unsuitable for many native wildlife species. In these landscapes, most of the areas that once provided habitat for many bird species have been lost, fragmented, and surrounded by unsuitable habitat. This is especially relevant for grassland birds which are the most consistently declining group of species in North America, with at least 48% of conservation concern. In developed landscapes, which are largely unsuitable for grassland birds, suitable grassland fragments are needed if these species are to persist. In the greater metropolitan Chicago region there are >12,000 ha of grassland that may provide valuable habitat for grassland birds. However, little is known about the value of grasslands located in an urban matrix. We examined grassland bird habitat use and reproductive success in a range of patch sizes across an urban to rural gradient to determine the quality of available habitat. Although occupancy and densities varied depending on numerous factors including habitat structure and landscape context, grasslands in the Chicago region provided habitat for several species of conservation concern including Henslow's Sparrow (*Ammodramus henslowii*), Dickcissel (*Spiza americana*), Grasshopper Sparrow (*Ammodramus savannarum*), and Bobolink (*Dolichonyx oryzivorus*). Overall, our results suggest that grasslands embedded in urban landscapes can contribute to grassland bird conservation and this research contributes to an ongoing effort to determine the factors

important for designing grassland bird conservation areas in this landscape.

**SAT7.3 Byrd, Allison**, (University of Maine, Orono, United States); Olsen, Brian (University of Maine, Orono, ME, United States); Evers, Dave (Biodiversity Research Institute, Gorham, ME, United States)

#### UNDERSTANDING COMMON LOON (*GAVIA IMMER*) BIOGEOGRAPHY AND VIABILITY IN AN ERA OF CLIMATE CHANGE

Climate change has the potential to shift and restrict ranges for a suite of species. The birds of the boreal ecosystem, like the Common Loon (*Gavia immer*; hereafter "loon"), may be particularly at risk given the changes predicted for this biome. The goal of our research is to understand the vulnerability of loons to climatic change. We used a recursive partitioning technique to analyze loon presence/absence in 452 lakes across the southern edge of their North American distribution using 112 abiotic and landscape-level factors. The resulting binary tree ("decision tree") classifies lakes into groups based on the probability of loon presence. The most significant splits in the cross-validated tree used measures of mixed-forest cover in the watershed, lake water salinity, and lake area. We employed similar methods to compare models for loon presence/absence and loon seasonal fecundity at a smaller scale (New England) to elucidate potential demographic mechanisms of loon persistence. Results from twenty-two potential predictors suggest that similar processes to the continental model are driving loon presence/absence in New England (lake chloride levels, lake acid neutralization capacity, and lake area). Loon productivity was best partitioned using the size of both the lake and watershed. As few of the predictors in the best decision trees are likely to change dramatically with climate, these outcomes suggest that future range alteration in loons due to climate change is likely to be more sensitive to annual adult survival (which will influence breeding ground settlement patterns) than extrinsic factors encountered on the breeding grounds.

**T8.2 Cabrera, Leonardo**, (Parks Canada Agency, Leamington, Canada); Celis-Murillo, Antonio (University of Illinois, Urbana-Champaign, IL, United States)

#### PUTTING ACOUSTIC MONITORING SCIENCE INTO PRACTICE: DEVELOPMENT, CHALLENGES AND OPPORTUNITIES FOR POINT PEELE NATIONAL PARK MONITORING PROGRAM

Parks Canada ecological integrity monitoring program was established across Canada's national parks with the purpose to document biodiversity components, ecological processes and stressors so ecological integrity can be protected or enhanced. Monitoring in Parks Canada is a key component in the planning and information cycles. The agency's directions (2007; 2011) established that ecosystem monitoring needed to be cost-effective, science-based, have long-term vision and respond to local realities and inform management decisions. These requirements do challenge park scientists as they face ecological complexity that require robust sampling design and analysis, baseline or reference information, consistency on data and field monitoring protocols thus monitoring can inform park management. In Canada's national parks, birds have been selected as one of the most important monitoring measures to assess ecosystem condition. Through bird monitoring, park managers obtain relevant information on bird population trends, habitat associations, and restoration and protection needs. Point Pelee National Park, a renamed park for its spectacular bird

migration, was lacking of a formal bird assessment and monitoring strategy until 1995 when a contracted service brought professional ornithologists to establish 22 point count stations in the park's forest ecosystem. In 2009, park scientists considered unsustainable continuing spending important financial resources at the light of Parks Canada's new directions. Acoustic monitoring (Wildlife Acoustic song meters) was introduced for first time to census Point Pelee's breeding birds and results were analyzed in the Mennill Sound Analysis Laboratory at the University of Windsor. As expected, stereo recordings provided accurate results on bird species richness and gave the basis for a basic analysis of abundances (classes). In order to maintain data consistency with previous census (obtain bird abundances), park managers decided to also assess a multi-channel recording system (SRS - Celis-Murillo et al. 2009) in 2010 and 2011. Preliminary results indicate that the system was capable to provide similar estimates of species richness and bird abundances as field observers in the field however; additional testing and more rigorous analyses are planned for 2012. Integration of acoustic monitoring technology and acoustic interpretation systems, challenges faced by scientists and managers at the light of current ecosystem monitoring directions and needs of ecosystem managers will be discussed.

**PS1.88 Cabrera-Cruz, Sergio A.**, (Instituto de Ecología A.C., Xalapa, Mexico); Mabee, Todd (ABR Inc., Environmental Research & Services, Forest Grove, United States); Villegas-Patracá, Rafael (Instituto de Ecología A.C., Xalapa, Mexico)  
**USING THEORETICAL FLIGHT SPEEDS TO DISCRIMINATE BIRDS FROM INSECTS IN RADAR STUDIES**

Marine radar is a widespread tool used to study bird migration, however, it is polemical because of its inability to identify detected objects to species in most cases. For this reason airspeed is used as one of the main criteria to separate bird-like from insect-like targets, but such a criterion does not exist for areas outside the temperate regions where this criterion was developed. We used a theoretical approach calculating minimum power speeds ( $V_{mp}$ ) and maximum range speeds ( $V_{mr}$ ) of birds and insects to create a new flight speed-based criterion for the Isthmus of Tehuantepec in southern Mexico. This approach, with data from 36 insect species and 60 passerine species either known to occur or similar to species occurring in southern Mexico, found that although insect and avian  $V_{mp}$  overlaps at 5.5m s<sup>-1</sup>, birds generally fly faster than insects. After combining our results with available data from literature, we consider that the best airspeed to be used as criterion to separate bird-like from insect-like targets actually lies within the range of 6.2 – 8.6m s<sup>-1</sup>. These airspeeds are applicable in southern Mexico and in regions where avian and insect fauna have physical dimensions similar to the species in this study.

**SAT16.2 Cabrera-Cruz, Sergio A.**, (Instituto de Ecología A.C., Xalapa, Mexico); Mabee, Todd (ABR Inc., Environmental Research & Services, Forest Grove, United States); Villegas-Patracá, Rafael (Instituto de Ecología A.C., Xalapa, Mexico)  
**NOCTURNAL BIRD MIGRATION IN MEXICO: FIRST RECORDS**

Millions of Neotropical migrant birds fly over Mexico in their migratory journeys to their wintering grounds, provoking high concentrations of migrating birds in virtually all the Mexican territory, but few studies have been made on the Isthmus of Tehuantepec, the narrowest part of Mexico between the Atlantic and Pacific slopes, despite its importance as stopover site and corridor for birds continuing to Central and South America.

However, some studies have been made recently due to the potential of that area for wind energy development. We studied the nocturnal bird migration with a X-band marine radar during 21 nights from October 15th to November 8th 2010 during the preconstruction phase of a proposed wind energy development on the Pacific side of the Isthmus, estimating a mean Migratory Passage Rate (MPR) of 79.9 targets/hr/km, ranging from 25.3 to 158 targets/hr/km with a typical pattern of migratory activity through the night, peaking around midnight and decreasing thereafter. Mean flight direction was seasonally appropriate (i.e. to the Southeast) and with a high concentration around the mean. Mean flight altitude for the complete season was 523.5 meters above ground level, ranging from 402 to 755m agl. We consider that our results provide further evidence on the importance of the Isthmus as a corridor for migrant birds, and provides valuable information about an important but little studied phenomenon in Mexico; however, we encourage for the realization of further and continued studies both in this area and all Mexico.

**F14.5 Cadman, Michael**, (Environment Canada, Burlington, Canada); Lebrun-Southcott, Zoe (Environment Canada, Downsview, ON, Canada)

**NESTING SUCCESS OF BANK SWALLOWS IN AGGREGATE PITS**

A high but currently unknown percentage of Bank Swallows in developed parts of southern Ontario nests in aggregate (sand and gravel) pits. In 2011, we compared aspects of nesting success in 21 active pits to 9 natural colonies along the banks of a river. All pits surveyed contained suitable habitat (vertical banks), and nesting Bank Swallows were located in 95% of those pits. Burrow destruction from pit operations (incidental take) occurred in 12 of the 20 occupied pits (60%). Extraction activities accounted for a loss of 29% of all burrows in pits, ranging from 0% to 100% of the burrows in a colony. An estimate of burrow occupancy at the time of excavation will be provided. Erosion and collapse of banks destroyed 20% of burrows in both pits and river colonies. Predation accounted for the loss of 3% of burrows in pits, and 1% on the river. In total, 52% of burrows were destroyed in pits compared to 20% in river colonies. Results are being used to develop recommendations to help pit operators reduce their impact on nesting productivity.

**PS1.80 Calderón-Parra, Rafael**, (Universidad Autónoma Metropolitana Unidad Iztapalapa, Distrito Federal, Mexico); Corcuera Martínez del Río, Pablo; López Ortega, Gerardo (Universidad Autónoma Metropolitana Unidad Iztapalapa, Distrito Federal, Mexico)

**ENVIRONMENTAL EDUCATION PROPOSAL BASED ON THE BIRD SPECIES DISTRIBUTION IN LA CIENEGA GRANDE DE XOCHIMILCO, FEDERAL DISTRICT, MEXICO.**

Mexico City is one of the most populated cities in the world and the expansion of the urban area has critically reduced the aquatic environment to a few wetlands remnants. "La Cienega Grande de Xochimilco" is a flood regulating water body and it is part of the known as "Ejidos de Xochimilco y San Gregorio Atlapulco" protection area. Even though is an important area for wildlife associated to aquatic environments, there have been no conservation programs to protect the site. Environmental education is a potential instrument to generate changes in the public attitude towards the environment and to increase law enforcement effectiveness. Birds are particularly useful as an educational tool because they can be observed almost anywhere, have attractive morphological characteristics, and offer the

opportunity to observe some of their natural history aspects in their natural environments. Promoting birdwatching activities by means of educational birding trails could increase the public interest for bird conservation and promote the engagement of environment actions necessary for the conservation of green areas within the cities. In order to assess the species richness, abundance and distribution, we conducted 37 bird counts along 13 fixed-width line-transects from February 2009 to February 2010. The transects were classified using cluster analysis based on bird species composition and abundance. The birding trails were designed accordingly and considering the greatest number of birds typical of each environmental cluster. Finally, target species were identified based on its ecological characteristics and cultural value. A total of 125 species of birds belonging to 97 genera, 41 families and 15 orders were registered. Eight species were threatened according to Mexican legislation. Based in the ecological knowledge 8 trails were recommended and target species were identified for each one. The study site is one of the most important areas for birds in Mexico City in terms of species richness. The ecological knowledge allowed us to recommend educational birding trails, providing useful birdwatching information which includes the habitat and bird activity in the different seasons. This study could be used for generate a conservation aimed model using educational birding trails in similar areas in other cities of the country.

**S10.7 Calen, Ryan,** (Simon Fraser University, Vancouver, Canada); Alistair, Dawson (Centre for Ecology & Hydrology, Penicuik, Midlothian, Scotland); Peter J., Sharp (Roslin Institute, University of Edinburgh, Midlothian, Scotland); Tony D., Williams (Simon Fraser University, Burnaby, BC, Canada)

**TESTING THE PROLACTIN-BASED MODEL FOR AVIAN CLUTCH-SIZE DETERMINATION IN CAPTIVE ZEBRA FINCHES: INDIVIDUAL VARIABILITY IN HORMONE-TRAIT RELATIONSHIPS**

In many avian species clutch-size is one of the most important contributors to lifetime fitness in birds yet shows a great deal of individual variability. A multitude of ultimate explanations have therefore been proposed to explain variations in clutch-size, however surprisingly little is known about the underlying, proximate, physiological mechanisms involved in clutch-size determination. The role of prolactin in incubation behaviour is relatively well supported. However, the predominant model for hormonal control of clutch size, which predicts an inhibitory role of prolactin on follicle development, currently has very limited empirical support, despite widespread acceptance. Using a repeated-measures design, we investigated the role of prolactin in clutch-size determination in captive-breeding female zebra finches (*Taeniopygia guttata*). We used the dopamine receptor agonist, bromocriptine, in an attempt to manipulate prolactin secretion, and observed the effects on hormone levels and changes in clutch-size and other parameters of reproductive investment. We also manipulated clutch-size using an egg removal protocol, and examined effects on circulating prolactin levels. By tracking individual relationships between hormone levels and clutch-size, and individual responses to experimental treatment, our data raise important questions about the applicability of the current prolactin-based model for clutch-size determination, and the importance of considering phenotypic variability in avian physiology.

**W2.5 Calle, Leonardo,\*** (Florida Atlantic University, Boca Raton, United States); Gawlik, Dale; Xie, Zhixiao; Johnson, Brian (Florida Atlantic University, Boca Raton, FL, United States)

**PREDICTED CHANGES IN FORAGING HABITAT OF THE LITTLE BLUE HERON (*EGRETTA CAERULEA*) AS A FUNCTION OF SEA LEVEL RISE IN THE GREAT WHITE HERON NATIONAL WILDLIFE REFUGE, FL, USA**

Wading birds are restricted to feeding in shallow water because of their leg-length constraint, making them sensitive to small changes in water depth. In coastal systems, this sensitivity is pronounced because tidal fluctuations control both the spatial and temporal extent of available foraging habitat. Our objective was to determine the risk of the Little Blue Heron (*Egretta caerulea*), to sea level rise within the boundaries of the Great White Heron National Wildlife Refuge, in the Florida Keys, USA. Our approach to the problem was to develop a tide-driven simulation model to estimate foraging habitat availability (FHA). The FHA model incorporated fine-scale information on water depths used by the Little Blue Heron, predicted changes in habitat availability from the Sea Level Rise and Accretion Model, under 3 sea level rise scenarios. We validated the model's ability to predict available foraging habitat using locations of foraging Little Blue Herons (N=509) observed during 14 surveys (Dec 2010 - Jul 2011). Parameters to which the model was most sensitive were foraging water depth window, tide height, and the time of low tide, respectively. The model performed moderately well (78% correct classification using survey-specific FHA estimates), to very well (94% correct classification using mean annual FHA estimates), at predicting available foraging habitat. The majority (57%) of Little Blue Herons foraged at areas with tide-specific FHA values of >7hectare-minutes. Under all three sea level rise scenarios daily foraging habitat declined, with the most severe declines occurring between 2050 and 2075. Our results may be liberal because we excluded mangrove islands as foraging habitat. We suspect that as mangrove habitats become inundated for longer periods of time they will become suitable foraging areas, if they are not already. The fine temporal scale of the FHA model (from a single-tide to days, months) makes it potentially useful for addressing short- and long- term stressors to multiple wading bird species resulting from human disturbance or sea level rise. However, the sensitivity of the model to very small changes in tide height underscore the importance of having improved estimates of sea level rise at the local level.

**W5.2 Camfield, Elaine,** (Canadian Wildlife Service, Environment Canada, Gatineau, Canada); Kennedy, Judith (Canadian Wildlife Service, Environment Canada, Gatineau, PQ, Canada)

**ALL-BIRD CONSERVATION PLANNING IN CANADA**

Environment Canada is leading the development of 32 all-bird conservation plans in each of Canada's Bird Conservation Regions (BCRs) to serve as a basis for implementing bird conservation across Canada. The plans include six elements: 1) identification of priority species (both conservation concern and stewardship); 2) identification of habitats used by priority species; 3) development of population objectives for priority species (assessing current vs. desired population status); 4) threat assessment and ranking; 5) development of conservation objectives to outline a response to threats and identify information needs; and 6) identification of conservation actions to begin on-the-ground conservation to work.

Approximately one-third of all species are considered priority species in a given BCR. The proportion of priority species differs among the four bird groups (landbirds, waterbirds, shorebirds and waterfowl) with the highest percentage of priority species found among shorebirds and waterbirds; landbirds had the highest absolute number of species on the priority list. Conservation objectives and associated actions

tend to focus on land/water protection and management which reflects that habitat loss is the main mechanism by which priority species are affected by anthropogenic threats. Policy changes are also an important tool to facilitate conservation of birds and other biodiversity.

The completion of the BCR plans allows for the first comprehensive assessment of the status of birds in all habitat types across the country and therefore provides an opportunity to coordinate conservation across the landscape. Given the ubiquitous presence of birds in all habitat types, implementation of the BCR plans will serve to restore and protect habitat for all of Canada's wildlife. While current economic realities add to the challenges of on the ground conservation, coordinated effort from conservation partners to implement the recommendations in BCR plans has the potential for ecosystem conservation that benefits multiple taxa.

**SAT10.5 Camilleri, Sandra,\*** (University of North Carolina at Wilmington, Wilmington, United States); Koopman, Heather; Westgate, Andrew (University of North Carolina at Wilmington, Wilmington, United States); Gannon, Damon (Bowdoin College, Brunswick, United States); Mauck, Robert (Kenyon College, Gambier, United States); Kucklick, John (National Institute of Standards and Technology, Charleston, United States)

#### PROVISIONING OF CHICKS BY LEACH'S STORM-PETRELS: INSIGHTS INTO ENERGY CONTENT, LIPID CONTENT, AND CONTAMINANTS OF STOMACH OILS.

Many adult Procellariiformes provision chicks with oils concentrated from consumed prey in contrast to most seabirds that supply chicks with whole prey. This feeding strategy is considered adaptive because chicks are provided with relatively higher energy materials to better sustain them between parental foraging trips. However, because persistent organic pollutants (POPs) are lipophilic, chicks may be ingesting higher concentrations of POPs than if they ingested whole prey. Our goal was to evaluate the "oil" strategy by determining the energy content, lipid composition and organic contaminant concentrations in stomach oils of incubating adults and corresponding chicks of Leach's storm-petrels (LHSPs; *Oceanodroma leucorhoa*) from the Bay of Fundy, Canada (2010 n=84; 2011 n=147) and compare these with similar data from whole prey items. Stomach oils during incubation are very energy dense (mean 34.95 kJ/g, SD=7.2, n=65) and decrease during chick rearing (mean 20.32 kJ/g, SD=8.56, n=71). Wet weight values for potential prey items of other seabirds (herring 7.49 kJ/g; copepods 6.32 kJ/g) suggest that adult LHSPs can produce a significantly concentrated form of energy in stomach oils over the raw ingested prey items. Stomach oil (n=34) were comprised mostly of triacylglycerols (mean 73% SD=32.3) and wax esters (mean 25%, SD=30.84), however there was a wide range (0 to 90.2%) of wax ester content. This suggests variation in diet among brooding adults as various marine invertebrate prey species contain different amounts of waxes. Stomach oil samples were analyzed for PCB congeners and DDT and related compounds using gas chromatography mass spectrometry. Contaminant analyses of stomach oils (incubation n=11; posthatch n=22) revealed  $\Sigma$ PCB levels ranging from 51-2673 ng/g wet weight (incubation mean=864 ng/g; posthatch mean=251 ng/g),  $\Sigma$ DDT levels ranging from 24-424 ng/g (incubation mean=279 ng/g; posthatch mean=97). These values are higher than published wet weight values for zooplankton collected from the same area ( $\Sigma$ PCB 114-241 ppb,  $\Sigma$ DDT 14-23 ppb), suggesting that stomach oils concentrate contaminants; consequently chicks may be receiving oils with biomagnified

organochlorine concentrations compared to whole zooplankton and other prey items.

**PS1.13 Campbell, Greg,** (Bird Studies Canada, Sackville, Canada);

#### BICKNELL'S THRUSH - 10 YEARS OF MONITORING A RARE SONGBIRD IN NEW BRUNSWICK AND NOVA SCOTIA, RESULTS AND NEXT STEPS.

Bicknell's Thrush is a rare, range-restricted songbird breeding in northeastern North America. On its breeding grounds, it is a habitat specialist restricted to montane forests dominated by balsam fir (*Abies balsamea*). The species is typically found in chronically-disturbed stands of dense, stunted fir on exposed ridgelines or along edges of human-created openings, or in regenerating fir waves. These habitats are ephemeral in nature, making long-term monitoring challenging. Bird Studies Canada has been monitoring Bicknell's Thrush populations in the highlands of New Brunswick and Nova Scotia since 2002. Since then, populations have declined by 11.5% per year in New Brunswick and 7.4% per year in Nova Scotia. Using data from the monitoring program and from provincial forest inventories, we have estimated the total Bicknell's Thrush populations to be approximately 6 000 individuals in both provinces combined. Conservation and forest management implications, along with future research and monitoring directions, will be discussed.

**PS1.182 Campbell, Kyle,** (University of Alaska Museum, FAIRBANKS, United States); Braile, Thomas (University of Alaska Museum, Seattle, WA, United States); Winker, Kevin (University of Alaska Museum, Fairbanks, AK, United States)

#### GEOGRAPHIC DISTRIBUTION OF WITHIN-SPECIES GENETIC VARIATION AMONG 14 SPECIES OF PHILIPPINE BIRDS.

The distribution of within-species genetic variation can depart from a conventional model of increasing diversity with decreasing latitude. A central-peripheral model, in which the greatest genetic variation is found at the midpoint of a species' range, was recently found to best describe a Neotropical mainland avian assemblage. This 'mid-domain' effect is untested in tropical island systems. In the Philippines, species' distributions have likely experienced little Pleistocene fluctuation, and island bird populations are separated by water, probably presenting a significant barrier to gene flow. We examine the latitudinal distribution of within-species genetic variation among 14 species of non-migratory birds whose ranges encompass all or most of the Philippines (from 5.5°N to 18°N latitude) with populations separated by tens to hundreds of kilometers of water. Population genetic variation, estimated using the mtDNA gene ND2, is contrasted with mainland models and tested against a null model of uniformity. The results of this study have implications for avian conservation in island systems.

**SAT17.9 Campbell, Margaret,** (Bird Studies Canada, Sackville, Canada); Taylor, Phil (Acadia University, Wolfville, NS, Canada); Couturier, Andrew (Bird Studies Canada, Port Rowan, ON, Canada); Makepeace, Scott (New Brunswick Department of Natural Resources, Fredericton, NB, Canada); Stewart, Becky; Bredin, Kate (Bird Studies Canada, Sackville, NB, Canada)

#### USING BREEDING BIRD ATLAS DATA TO CONSERVE SPECIES AT RISK IN INDUSTRIALLY MANAGED ATLANTIC FORESTS

Breeding Bird Atlases are five-year, volunteer-based projects to determine the distribution, abundance and status of all birds within a defined geographic region. From 2006-2010, over 1,000 volunteers gathered data for the second Maritimes Breeding Bird Atlas, including conducting point counts and collecting location information for 78 species at risk. The result was an enormous geospatial dataset with location information for approximately 16000 points and 120 Maritimes breeding birds. Traditionally, the primary products of atlases are maps of abundance and breeding evidence, but the geo-referenced information gathered provides a myriad of opportunity to address additional questions, particularly when combine with other resource information. To determine Maritimes-specific species-habitat associations, habitat variables were extracted at 5 buffer sizes (50, 100, 200, 500, 100m) from provincial forest resource inventories for approximately 120 species. The results were used to describe habitat characteristics for forest species at risk in the Maritimes based on tree species, stand age, harvest regime, aquatic features and land use practices. Understanding region-specific habitat preferences is integral to developing effective management practices for high priority species and their habitats. In the Maritimes, a large proportion of forest ecosystems are subject to commercial and industrial forestry management practices. Habitat information based on breeding bird atlas data can be integrated into long-term planning to meet habitat targets and preserve key habitat features for species at risk over the short and long term. This type of relational habitat analysis could be applied to other breeding bird atlases to identify important habitat features for regionally rare species.

**PS2.146 Campomizzi, Andrew J.**, (Texas A&M University, College Station, United States);

#### OCCUPANCY MODELING OF BROWN-HEADED COWBIRD DISTRIBUTION

Brown-headed cowbirds (*Molothrus ater*), obligate brood parasites, are often implicated in population declines of some songbird hosts. Although much research is conducted on distribution of susceptible host species and relationships between parasitism and environmental variables, research has rarely explicitly explored relationships between cowbird distribution during the breeding season and environmental variables. We investigated relationships between cowbird occupancy at Breeding Bird Survey points in Texas with environmental variables that may be associated with cowbirds (e.g., livestock, agriculture, human developments, water). We evaluated how well models predicting cowbird occupancy correlated with parasitism frequency by comparing predicted probability of occupancy with observed parasitism frequency on black-capped vireos (*Vireo atricapillus*), an endangered, susceptible host. We found probability of occupancy was positively associated with density of cattle, increasing from 0.6 to 0.8 over the range of cattle density. Probability of occupancy also increased if the previous survey point was occupied by a cowbird. Other variables did not improve predictions of occupancy. Results improve our understanding of cowbird distribution across broad spatial extents and can be useful for conservation planning to improve the efficiency and efficacy of conservation decisions. Predictive models can be used to identify areas with relatively low probability of cowbird occupancy where songbird conservation may be more likely to succeed than areas with high cowbird occupancy. Additionally, predictive models can identify areas of relatively high probability of cowbird occupancy where vegetation management alone may be insufficient to aid recovery of species of conservation interest.

**F14.9 Canales, Ricardo**, (UNIVERSIDAD AUTONOMA DE NUEVO LEON, SAN NICOLAS DE LOS GARZA, Mexico); RUVALCABA, IRENE; FLORES, JOSE J.; GONZALEZ-ROJAS, JOSE I. (UNIVERSIDAD AUTONOMA DE NUEVO LEON, SAN NICOLAS DE LOS GARZA, NL, Mexico) POPULATION STATUS, DEMOGRAPHIC HISTORY, AND VIABILITY OF THE MEXICAN ENDANGERED SPARROW: SPIZELLA WORTHENI.

Worthen's Sparrow (*Spizella wortheni*) is a small, inconspicuous, and poorly known inhabitant of the shrubby grasslands of the Mexican Plateau. Although it was formerly more widely distributed, over the past 30 years, these sparrows have only been observed, either breeding or wintering, in a small area in southwestern Nuevo León and extreme southeastern Coahuila. Its limited range (25 km<sup>2</sup>), small population size (100–120 individuals), and declining population make the Worthen's Sparrow one of the most endangered avian species in North America. This sparrow is currently protected as endangered under Mexican law (SEMARNAT, 2010) and is listed as endangered on IUCN Red List of Threatened Species. Facing this scenario and the lack of basic information, it results essential to contribute to its knowledge in order to establish the foundations toward its conservation. Therefore, we defined the following objectives 1) Determine current and potential distribution, 2) Estimate its population size using censuses, 3) Determine reproductive success, 4) Estimate genetic diversity using mitochondrial DNA and demographic history inference, and finally 5) Estimate its potential distribution under climate change scenarios. We confirmed this species presence on 5 historic localities and 12 new ones. Ecological niche modeling widened its distribution in the Mexican Plateau, and some of these areas were confirmed. Censuses made in the reproductive sites indicated a population of 189 individuals; however, during the winter we counted a total of 1009 individuals, which increased 10 times the population size previously estimated. A total of 17% of breeding success was calculated based on 183 nests (2007-2010). Surprisingly, high diversity values were obtained and no signs of bottleneck were observed using neutrality tests. Also, through coalescent demographic inference it was confirmed that *S. wortheni* genetic data fits better to a constant population model. Despite the increase of its distribution range and population size, this species should be still considered endangered due to rapid grassland conversion into agricultural fields and the potential loss of habitat as a result of climate change.

**PS1.31 Cancellieri, Sarah**, (Portland State University, Portland, United States); Murphy, Michael (Portland State University, Portland, OR, United States)

#### AN EXPERIMENTAL INVESTIGATION OF NEST REUSE IN AN OPEN-CUP NESTING PASSERINE

Time and energy costs of nest construction are not trivial as it can require hundreds to thousands of flights. Nonetheless, open-cup nesting passerines rarely reuse nests, presumably because many suitable nest sites exist, or because nests deteriorate over time and/or harbor ectoparasites. Nest reuse, when it occurs, has the potential to save time and energy, which could enable birds to breed earlier and/or produce larger eggs or clutches. Alternatively, nest reuse may occur because few high quality nest sites exist. We used Eastern Kingbirds (*Tyrannus tyrannus*; hereafter kingbirds) breeding at Malheur National Wildlife Refuge (MNWR) in 2010 and 2011 to investigate why kingbirds at this site frequently reuse old nests (~10% of 341 nests) compared to kingbirds at other locations (<< 1%). We deployed artificial nests along a 5 km length of the Blitzen River at 100 m



intervals. Kingbirds used artificial nests significantly more often in 2011 (94%) than in 2010 (60%) even though breeding began significantly later in 2010. Nest material delivered to artificial nests weighed significantly less than natural nests, which presumably indicates less energy expenditure for lining artificial nests. Artificial nests provided no apparent reproductive benefits, except that less time was required to produce a replacement clutch if the female used an artificial nest. We conclude that the more frequent use of artificial nests in 2011 (the earlier year), and the absence of nearly any reproductive benefits support the hypothesis that nest reuse by kingbirds at MNWR occurs because of a shortage of quality nest sites.

**W9.6 Cann, Rebecca**, (University of Hawaii at Manoa, Honolulu, United States); Freed, Leonard (University of Hawaii at Manoa, Kailua, United States)

#### FEMALES LEAD DEMOGRAPHIC COLLAPSE OF THE ENDANGERED HAWAII CREEPER FROM COMPETITION WITH AN INTRODUCED BIRD

In most birds, the two sexes have similar adult survival. However, environmental changes may affect the two sexes differently, leading to a cascade of changes in survival and sex ratio. We document this in the Hawaii creeper (*Oreomystis mana*), an endangered Hawaiian honeycreeper, at Hakalau Forest National Wildlife Refuge during a long-term study from 1987-2006. Mark-recapture analysis indicated that both sexes were long-lived during 1987-2001, with no support for models with time dependent survival or interaction between time and sex for probability of recapture. The creeper is susceptible to competition with introduced Japanese White-eyes (*Zosterops japonicus*). When white-eyes increased in numbers, creepers had stunted growth and had the greatest changes in molt. Cohort analysis indicated that from 2002-2006, females but not males had lower survival. The cohort of older females reared in a better environment survived as before during the same years females reared in a poor environment had very low survival. This may be a severe example of delayed lower fitness associated with problems of early growth. Sexual conflict may also be involved since male creeper, which normally feed their mates throughout the breeding cycle, would be constrained to provide less food. Lower female survival eventually created a more male-biased adult sex ratio. There was especially low survival of second year females. Independent survey data collected over 3373 ha indicated that the creeper was rapidly declining in this major portion of the refuge during 2002-2007.

**PS1.85 Carbó Ramírez, Pilar**, (Universidad Autónoma del Estado de Hidalgo, Pachuca, Mexico); Zuria, Iriana (Universidad Autónoma del Estado de Hidalgo, Pachuca, Mexico)

#### OCCURRENCE OF BLOOD PARASITES IN BIRD COMMUNITIES FROM TWO SITES WITH DIFFERENT DEGREE OF URBANIZATION IN CENTRAL MEXICO

We evaluated how the occurrence of bird blood parasites varied in two zones with different degree of urbanization. The study was conducted in the city of Pachuca, Mexico. Two sampling sites were selected according to the degree of urbanization: the highly urbanized area (HU) and the area with lower urbanization (LU). The degree of urbanization was defined according to the cover percentage of the two main land use categories, urban vs. vegetation (HU, 64% covered by urban structures, LU only 12%). Birds were captured from March 2009 to September 2010 using mist nets, and a blood sample was taken. Then, blood smears were prepared and stained, and each smear was

examined for 30 min. A total of 471 blood samples were obtained from 34 bird species. We detected three protozoan genera (*Haemoproteus*, *Plasmodium* and *Trypanosoma*), one genus of bacteria (*Ehrlichia*) and the nematode *Microfilariae*. In HU the overall parasite prevalence was 10.3% and *Ehrlichia* had the highest prevalence (5.1%). In LU the overall prevalence was 21.2% and *Haemoproteus* had the highest prevalence (8.9%). Only in LU we recorded birds with more than one genus of blood parasites (*Toxostoma curvirostre* and *Melozona fusca*). The results of this study show that there are differences in the presence and prevalence of blood parasites between the two bird communities, and this may be the result of many ecological factors such as the presence and distribution of parasite-transmitting vectors and the ability of hosts to respond to infection.

**PS1.162 Cardenas, Laura**, (Selva, Bogota-COLOMBIA, Columbia); Bayly, Nicholas; Gomez, Camila (Selva, Bogota-COLOMBIA, Columbia)

#### SPECIES RICHNESS AND RELATIVE ABUNDANCE OF MIGRATORY LANDBIRDS DURING SPRING AND FALL MIGRATION IN THE DARIÉN OF COLOMBIA

The routes and stopover sites used by migratory birds in South America are poorly known and this lack of knowledge is inhibiting the design of effective conservation strategies that cover all stages of the life cycle. The Darién region represents a bottleneck between Central and South America and is expected to be an important corridor for migratory birds. We studied the composition and relative abundance of migratory landbirds through constant effort mist netting and observations during spring (May-March) and fall migration (September-November) in the Tacarcuna Reserve, in the Colombian Darién in 2011. Landbird migrant species richness was higher during fall migration (50 species) than in spring (37 sp.), as was the relative abundance of species based on mist net captures. Commonly occurring fall migrants included four species of conservation concern: *Empidonax traillii*, *Wilsonia canadensis*, *Protonotaria citrea* and *Setophaga castanea*. The diurnal movements of swallows (>13,900 individuals in spring and >180,000 in fall) and raptors (>1,500 in spring and >210,000 in fall) recorded during the study, highlight the importance of the Caribbean coast of the Darien as a major flyway for these species. We found a marked difference in species composition and abundance between spring and fall migration, indicating that our study area is primarily used as a flyway and stopover region during fall migration. Nevertheless, considering that we present data from just one site during one year, we cannot rule out that further study of annual variation and a greater range of habitats will not alter our initial conclusions. Further work is also needed to determine whether stopovers in this region make a significant energetic contribution to migration.

**S5.1 Carling, Matthew**, (University of Wyoming, Laramie, United States);

#### INTROGRESSION ON A GENOMIC SCALE: HARNESSING THE POWER OF NEXT-GENERATION SEQUENCING TO INVESTIGATE HYBRIDIZATION BETWEEN *PASSERINA AMOENA* AND *PASSERINA CYANEA*

Speciation is a critical component of biodiversity generation and understanding this dynamic phenomenon requires a thorough investigation of both the genetic basis for the evolution of reproductive isolation and the ecological context within which it occurs. While previous investigations of the hybrid zone between *Passerina amoena* (Lazuli Bunting) and *Passerina cyanea* (Indigo Bunting) have demonstrated that introgression

patterns differ among different classes of loci (mitochondrial, autosomal, sex-linked) and that hybridization patterns are influenced by patterns of environmental heterogeneity, these studies have analyzed relatively few loci. Here I expand on prior work by analyzing 1000s of loci collected using next-generation sequencing technologies. Such robust datasets allow for much greater detail in exploring the evolutionary and ecological forces influencing hybridization patterns. I will discuss how these data can be used to identify the genetic basis of reproductive isolation as well as how these data can elucidate the influence of environmental heterogeneity on the continued maintenance of reproductive isolation between these species.

**T16.8 Carlson, Jenna,** (The College of William and Mary, Williamsburg, United States); Cristol, Daniel; Swaddle, John (The College of William and Mary, Williamsburg, United States)

#### EFFECTS OF MERCURY ON FLIGHT PERFORMANCE AND MOLT IN EUROPEAN STARLINGS (*STURNUS VULGARIS*)

The effects of mercury on songbirds have not been adequately studied despite ample evidence of bioaccumulation of mercury in terrestrial ecosystems. We dosed 60 European Starlings (*Sturnus vulgaris*) with methylmercury through continuous dietary intake at 0.0ppm, 0.75ppm, or 1.5ppm and assessed molt pattern and flight performance for twelve months. To test flight performance we measured: (1) Take-off angle and speed combined into a metric of energy gained during flight (2) Velocity and angle while maneuvering around an obstacle in the flight path. We hypothesized that mercury would affect hormonal activity and thus alter the timing of molt. We also hypothesized that mercury dosed birds would exert less energy during take-off when presented with a predator stimulus as a result of some combination of reduced cellular respiration, inefficient oxygen consumption, changes in neuromuscular function, and lethargy. Results indicate that across all treatment groups there was a statistically significant relationship between individual blood mercury before molt and the rate of feather replacement during molt ( $p=0.02$ ,  $R^2=0.10$ ). Preliminary analysis of flight performance data suggests a possible decrease in energy over time during take-off flight for individuals dosed with mercury at the highest level (1.5ppm), however further tests are underway. These results indicate that low levels of mercury contamination in the wild may alter flight performance and timing of molt for terrestrial songbirds.

**PS1.124 Carnochan, Stacey,** (Natural Resources Institute - University of Manitoba, Winnipeg, Canada);

#### A GLANCE AT THE EFFECTS OF A 1-IN-300 YEAR FLOOD ON THE NESTING SUCCESS OF MIXED-GRASS PRAIRIE SONGBIRDS IN SOUTHWESTERN MANITOBA

The mixed-grass prairie has undergone major declines throughout its range, particularly in Manitoba. Habitat degradation, fragmentation and land-use conversion of the prairies have been the leading cause of the dramatic population declines observed in most species of prairie songbirds. In recent years, intense spring flood events have become more frequent and problematic for both humans and wildlife throughout the northern prairie landscape. Research during the 2011 spring and summer field season experienced a historical 1-in-300 year flood of the Assiniboine and Souris river systems resulting in prolonged periods of water saturation on many if not all of the study sites. Consequently, the data collected in 2011 seems to suggest a decrease in nesting success in comparison with success rates associated with more moderate environmental

conditions. In 2011, nests were located using a 20m rope drag within 9 hectare plots on 13 pastures; all nests located were tagged and monitored every 3 to 5 days to determine the outcome of the nesting attempt. Nest depredation rates, brown-headed cowbird parasitism and cattle movement seemed to increase in the flood-reduced dry pasture areas during the 2011 flood, and may have contributed to a lower nesting success. A second year of data collection in 2012 has allowed for a comparison in nesting success rates between flooded versus non-flooded conditions. Flood frequency in Manitoba has increased over the past century and this comparison may lend insight into how the increase in flood events could cause further troubles for already declining populations of grassland birds.

**PS1.159 Carter, Jeffrey,** \*U (Fort Hays State University Department of Biology, Hays, United States); Farley, Greg (Fort Hays State University Department of Biology, Hays, KS, United States)

#### CHANGES IN MIGRATION TIMING OF TWELVE PASSERINE SPECIES OVER A 45-YEAR INTERVAL IN THE HIGH PLAINS.

Many long-term data sets of short and long-distance migratory species have established standard patterns of the timing of migration. Several recent studies in North America and Europe have revealed changes in the timing of these events in some species. Changes in global climate have been hypothesized as one cause, suggesting these effects may be manifest in some species in all regions. Using two 15-year sampling intervals, 1966-1985 and 1996-2011, we compared migration timing of 12 passerine species. Data from standardized mist netting in autumn indicate three short-distance migrant: Ruby-crowned Kinglet, Brown Thrasher, and Dark-eyed Junco, and nine species of long-distance migrant: Lincoln's Sparrow, Clay-colored Sparrow, Orange-crowned Warbler, Nashville Warbler, Wilson's Warbler, Least Flycatcher, House Wren, Swainson's Thrush, and Gray Catbird exhibited little change in arrival date, median date of capture, or departure date. Significant differences were apparent in arrival date of Gray Catbird; individuals on average delay migration compared to the 1966-1985 sample, as this species is first captured 6.8 days later in fall. In contrast, Least Flycatcher appears to be initiating migration much earlier; a paired Wilcoxon test indicates a significant, 15-day earlier date of departure. It is also important to note some species, e.g., House Wren, have a nearly identical migration pattern in both time intervals, representing no change timing over the past 45 years. Studies such as these are important to investigate environmental factors influencing migratory species, and provide insight for possible effects and future conservation efforts.

**PS2.21 Casady, Mery,** (University of Nebraska at Kearney, Kearney, United States); Reichart, Letitia (University of Nebraska at Kearney, Kearney, NE, United States)

#### DIFFERENCES IN BEHAVIOR OF WILD WHOOPING CRANES (*GRUS AMERICANA*) USING NATURAL AND SUBURBAN WINTER HABITAT.

Environmental and human induced alterations have changed the winter habitat of the wild flock of whooping cranes (*Grus americana*) and some individuals in the current population now occupy suburban habitat on the wintering grounds. Thus, behavioral differences may exist between individuals found in suburban habitat versus those in natural habitat. In this study we determined time activity budgets for whooping cranes observed in natural and suburban habitats on wintering grounds. Natural areas were defined as all areas located at Aransas National

Wildlife Refuge (ANWR), where natural habitat is maintained. Suburban areas were defined as areas near ( $\leq 1$ km) or within suburban areas. We quantified the following whooping crane behaviors: foraging, locomotion, comfort/maintenance, interaction, alert, and resting. In both 2010 (N=298) and 2011 (N=292) foraging behavior was the most frequent behavior observed. During both years, whooping cranes spent significantly more time foraging in natural areas than suburban areas. In both years, cranes performed more comfort/maintenance behavior in suburban areas than in natural areas. In 2011, cranes were more alert in suburban areas than natural areas, but not in 2010. This is the first behavioral study of wild whooping cranes in areas outside of ANWR. Behavioral differences showed foraging behavior was less frequent in suburban areas than natural areas. These results may suggest that food availability is different or even limited in suburban areas. Less foraging behavior in suburban areas can also be caused by human disturbance, however, cranes were more alert in suburban areas only during 2011 but not in 2010.

**PS1.169 Casbourn, Garth,** (York University, London, Canada);

#### TRACKING THE MIGRATION OF DECLINING ONTARIO WOOD THRUSH (*HYLOCICHLA MUSTELINA*) USING GEOLOCATORS

The Wood Thrush (*Hylocichla mustelina*) is in decline in Ontario to the extent that its status was reviewed by COSEWIC in November of 2011. Being the most southerly of North America's thrushes, southern Ontario represents the northern edge of *H. mustelina*'s breeding range, and it is often at the edge of the range where change is most apparent when a population is under stress. This study uses geolocators, manufactured by the British Antarctic Survey, to determine the migration routes, stopover sites, and wintering grounds of two southern Ontario *H. mustelina* populations: one in the Waterloo Region, and the other near the city of Kingston. Previous mapping of Wood Thrush migratory patterns by the Stutchbury lab at York University has shown that the geographical separation between these two Ontario breeding sites may be sufficient for the birds from each to utilize different migratory routes and occupy different wintering grounds. The Waterloo birds likely travel to Honduras and Nicaragua, while the Kingston population may winter in Costa Rica. Deployment of the geolocators began in the summer of 2011, both in the Waterloo Region, which has experienced a marked decline in Wood Thrush over the past decade, and in the Kingston area where thrush numbers have been relatively stable. Additional geolocators were deployed in the winter of 2011-12, on *H. mustelina* in a cloud forest near Jinotega in the northern part of Nicaragua. Recapturing returning migrants in Ontario will begin in May 2012.

**PS1.219 Cavazos, Alejandra,** (Instituto de Biología, UNAM, Mexico City, Mexico); Klicka, John (UNLV School of Life Sciences, Las Vegas, United States); Escalante, Patricia (Instituto de Biología, UNAM, Mexico City, Mexico)

#### PHYLOGEOGRAPHY OF THE OLIVE SPARROW (*ARREMONOPS RUFIVIRGATUS*) AND THE GREEN-BACKED SPARROW (*A. CHLORONOTUS*) IN MÉXICO.

The Genus *Arremonops* is a group of small or medium size species, have the dorsal olive-colored body, the edge of wing yellow and gray ventral parts to a greater or lesser degree depending on the species. In Mexico there are two species, the olive sparrow (*Arremonops rufivirgatus*) and the green-backed sparrow (*Arremonops chloronotus*). Phylogeographic patterns are entirely unknown to the genus, and within the same

taxonomic position is unclear. In this study, we analyzed tissue samples from 95 individuals belonging to the genus *Arremonops* sp. 95 COI gene amplified were obtained and 49 samples of ND2 gene were amplified. The results for both markers shows that there is a very strong phylogeographic pattern within the olive sparrow, resulting in the separation of sequences into groups of haplotypes that are consistent with populations restricted to provinces or regions of *Arremonops rufivirgatus*. The phylogenetic data are consistent with the haplotype network where there is separation of 6 large groups, the genetically more conservative branch of the group of the Yucatán peninsula and corresponds to the morphological subspecies described as *A. r. verticalis*, the group is separated completely from the other branches where they are as the basal branch the group from northeastern Mexico (*A. r. rufivirgatus*) and the group that occupies the slope of the Gulf (*A. r. crassirostris*), they are probably closely related because they occupy a geographically contiguous distribution in the Gulf slope, from Tamaulipas to northern Veracruz. These two groups are joined by the branch of *A. r. chiapensis* from Chiapas. The last branch of the tree is made up of 2 groups, first is *A. r. sumichrasti* and as a more recent group *Arremonops chloronotus*. Given the phylogenetic relationships obtained through the different analysis performed, we conclude that the Mexican populations of the genus *Arremonops* sp. comply with the Category 1 wherein phylogeographic lineages occupy separate geographical regions within the distribution range of all species, the most likely explanation for genetic discontinuities showing a geographical orientation involving geographic barriers that limit the long-term gene flow, therefore conspecific populations occupy separate branches easily in intraspecific evolutionary trees.

**S4.7 Celis-Murillo, Antonio,** (University of Illinois at Urbana-Champaign, Champaign, United States); Deppe, Jill (Eastern Illinois University, Charleston, United States); Riddle, Jason (University of Wisconsin - Stevens Point, Stevens Point, United States); Ward, Michael (University of Illinois at Urbana-Champaign, Champaign, United States); Simons, Theodore (North Carolina State University, Raleigh, United States)

#### AN EXPERIMENTAL EVALUATION OF THE PERFORMANCE OF ACOUSTIC RECORDING SYSTEMS FOR ESTIMATING AVIAN SPECIES RICHNESS AND ABUNDANCE

Comparisons between field observers and acoustic recording systems, including omni-, stereo- and quadrasonic systems, have shown great promise for sampling birds using acoustics methods. These comparisons provide information about the relative performance of recording systems and field observers but do not provide a robust validation of their true sampling performance – i.e., precision and accuracy relative to known population size and richness. We used a 35-speaker bird song simulation system to experimentally test the accuracy and precision of two stereo (Telinga and SS1) and one quadrasonic recording system (SRS) for estimating species richness, abundance and total abundance (across all species) of vocalizing birds. We simulated 25 bird communities (consisting of 5-9 species and 7-13 individuals) under natural field conditions by placing speakers in a wooded area at 4.4 – 119.8 m from the center of the survey at differing heights and orientations. We assigned recordings randomly to one of eight skilled observers. Split-plot ANOVA and least squared means (LSM) were used to assess and compare the three recording systems in their ability to estimate abundance and richness. Split-plot analyses showed a significant difference among microphones in their ability to accurately estimate richness ( $p = 0.0019$ ) and total bird abundance ( $p < 0.0001$ ). LSM and contrasts demonstrated that

the Telinga system performed significantly better, i.e., with greater precision and accuracy, than SRS and SS1. When we examined the performance of microphones for sampling individual species, we found a significant difference among recording systems for five species (Acadian Flycatcher, Black and White Warbler, Black-throated Green Warbler, Hooded Warbler and Scarlet Tanager) and no difference for the remaining two species (Black-throated Blue Warbler and Ovenbird). LSM and contrasts indicated that Telinga and SRS performed equally well for surveying all but one species (Ovenbird) but significantly better than SS1. Our study demonstrates that acoustic recording systems can potentially estimate bird abundance and species richness accurately, however, their performance is likely to vary by its technical characteristics (recording pattern, microphone arrangement, etc.). These findings strongly support the importance of evaluating each recording system before its deployment in the field.

**PS2.187 Cerame, Blain A.**, (Louisiana State University, Denham Springs, United States);

#### GENETIC STRUCTURE OF BACHMAN'S SPARROW POPULATIONS IN LOUISIANA

Bachman's Sparrow (*Peucaea aestivalis*), a species native to longleaf pine (*Pinus palustris*) savannahs, has been designated a Species of Management Concern by the US Forest Service. Natural barriers to gene flow, such as the Mississippi River, and habitat fragmentation create discontinuous habitat. Natural barriers may produce distinct populations adapted to local environments whereas small habitat fragments may cause low genetic diversity and inbreeding, which can reduce reproductive success and survivorship. Understanding gene flow and population structure in Bachman's Sparrow populations would aid managers to protect genetically distinct populations and maintain gene flow among isolated habitat fragments.

The first objective of the project is to test whether populations on the east and west sides of the Mississippi River are genetically distinct. The second objective is to examine population differentiation and gene flow among habitat fragments.

Bachman's Sparrows were captured with mist nets and bled to obtain DNA samples. Phylogenetic and population analyses will be performed using data from two mitochondrial and 15 highly variable microsatellite loci to compare genetic variation among populations. Genetic differences and estimates of gene flow between populations on opposite sides of the river will be tested with AMOVA. Microsatellite genetic variation will be calculated using expected and observed heterozygosity and allelic richness. Data analysis will include calculations of population subdivision (FST), inbreeding (FIS) and effective population size (NE). An isolation-by-distance Mantel test will be implemented to assess population clustering. Results will show whether populations located on either side of the Mississippi River are genetically distinct and should be treated as separate ESUs. Fine scale genetic analyses used to assess gene flow, inbreeding and effective population sizes among habitat fragments should help managers to identify isolated areas that may require artificial gene flow and thus prevent inbreeding depression.

**PS2.138 Chabot, Dominique.** (McGill University, Ste-Anne-de-Bellevue, Canada); Bird, David (Avian Science and Conservation Centre of McGill University, Ste-Anne-de-Bellevue, PQ, Canada)

#### MODELING HABITAT RELATIONSHIPS OF LEAST BITTERNS (*IXOBRYCHUS EXILIS*) BREEDING IN A MAN-MADE WETLAND WITH NOVEL USE OF A SMALL UNMANNED AIRCRAFT SYSTEM

The least bittern (*Ixobrychus exilis*) is a low-key and poorly understood wetland-breeding heron whose populations appear to be declining. Since declines may be caused by loss of suitable natural wetlands, it has been proposed that man-made wetlands be managed in order to accommodate the species. Towards this end, we are studying least bittern habitat preferences in a 128-ha man-made wetland in Baie-du-Febvre (Quebec, Canada), which supports the largest known breeding population in the province. Given the species' propensity to forage along the open-water side of emergent vegetation while otherwise remaining concealed, we predict that it will show a preference for microhabitats characterized by highly interspersed passages of open water bordered by tall, dense vegetation. During the 2011 breeding season, call-response point counts were carried out at 30 locations scattered throughout the wetland in order to obtain data on relative bittern abundance. Ground cover, water depth and vegetation height data were also collected in 50-m radius plots surrounding each of these locations. To obtain extensive fine-scale ground cover data, we overflow the wetland with a small unmanned aircraft system (UAS) capable of producing sub-decimeter-resolution georeferenced imagery. Classification of ground cover in UAS imagery was accomplished with ArcGIS Spatial Analyst, using ground-based data to "train" a subsequent automated classification of the total area. Landscape metrics characterizing ground cover structure, including edge density and interspersed index, were then calculated in each of the 30 plots surrounding point count locations. These data will finally be combined with water depth and vegetation height data in order to model observed bittern distribution in relation to habitat structure.

**PS1.228 Chastant, Jennifer.** (Florida Atlantic University, Boca Raton, United States);

#### WADING BIRD STRESS RESPONSE TO PREY AVAILABILITY IN A MANAGED LAKE ECOSYSTEM

The restoration of wetlands in south Florida is largely based on the premise that hydrologic patterns, fish populations, and wading birds are tightly linked. Hormones play an essential role in regulating an animal's response to environmental disturbances and could determine how hydrologic patterns affect reproductive success and survival. Quantifying the physiological responses to environmental conditions will improve our understanding of how individuals react to immediate changes in resource levels as well as how long-term landscape habitat conditions may regulate reproduction and nesting patterns. Our study was conducted at Lake Okeechobee, a large (1732 km<sup>2</sup>), shallow (mean depth of 2.7 m), eutrophic lake located in central south Florida. Our goal was to determine the effects of prey availability across the Lake's littoral zone on stress levels of great egret (*Ardea alba*) and snowy egret (*Egretta thula*) adults and chicks. Stress was measured using egg androgens, cellular protein chaperones (HSP60) and steroid parameters (corticosterone). Preliminary results suggest prey availability may not have been a limiting factor for wading bird nesting in 2011, despite the low lake levels. We collected 21,034 aquatic animals from 128 random throw-trap samples at 64 random sites. Mean prey density was 164 ± 21 prey/m<sup>2</sup> with a maximum prey density of 936 prey/m<sup>2</sup>. Total biomass of all specimens was 1923 g; mean prey biomass was 16 ± 1.7 g/m<sup>2</sup> with a maximum prey biomass of 59.9 g/m<sup>2</sup>. Eighty chicks (n= 22 GREG and n= 58 SNEG) were classified into two age groups, young (≤ 2wks) and old (≥ 2wks). There was no

difference between species but young chicks had higher levels of HSP60 than older chicks. Similarly, a food-supplementation experiment with snowy egret chicks (n= 3 treatment and n=3 control nests) showed no drop in stress in the supplemented chicks, nor were there differences in stress levels as a function of hatch order. Additional years of data will help refine estimates of prey availability and hydrologic conditions that lead to a food limitation in wading birds on Lake Okeechobee.

**S5.3 Chen, Nancy**, (Cornell Lab of Ornithology, Ithaca, United States); Fitzpatrick, John (Cornell Lab of Ornithology, Ithaca, NY, United States); Clark, Andrew (Cornell University, Ithaca, NY, United States)

#### EVOLUTIONARY INFERENCE FROM GENOME-WIDE SNP ASSAYS OF THE FLORIDA SCRUB-JAY

A central challenge in evolutionary and conservation biology is to characterize the genetic basis of fitness and the mechanisms maintaining variation in ecologically important traits. By combining genomic tools with long-term demographic studies, we can identify regions of the genome associated with reproduction and survival in natural populations. The federally threatened Florida Scrub-Jay (*Aphelocoma coerulescens*, FSJ) is an excellent model species for evolutionary and conservation genetics research in the wild. A population of FSJs at Archbold Biological Station has been studied intensively since 1969, resulting in an archive of DNA samples as well as detailed phenotypic and demographic data for >4,000 pedigreed individuals. In addition, our study population has experienced several episodes of unusually high mortality (over 40% breeder mortality and 80% juvenile mortality in a few months), which appear to be caused by outbreaks of encephalitis viruses. We used genotyping-by-sequencing to generate a genome-wide database of 10,000 single nucleotide polymorphisms (SNPs) in the FSJ population. Reads were clustered based on sequence similarity before using known family relationships among individuals to identify SNPs within each cluster. In addition, we generated a preliminary assembly of the FSJ genome and compared the results of our reference-free approach with results obtained by aligning to the reference genome sequence. Annotation was performed with alignment to the zebra finch genome and the newly assembled FSJ genome. These SNPs will be used to generate a high-resolution linkage map and pinpoint genomic regions associated with fitness to provide insight into mechanisms of natural selection in the FSJ.

**PS1.206 Chesney, Ted**, (N/A, NA, Canada);

#### IBA CANADA POSTER FOR NAOC

BirdLife International has developed a set of global criteria for identifying Important Bird Areas (IBAs)—areas of particular importance to one or more species of birds at some stage of their life cycle. Nature Canada and Bird Studies Canada are BirdLife's Canadian partners and have identified approximately 600 IBAs. The majority are sites where large numbers of birds regularly breed, congregate or pass through on migration; others were identified because they are particularly important to one or more species at risk. The Canadian IBA program brings science and conservation together to protect bird populations through the partnership and efforts of national, provincial and local groups and individuals. Our poster will provide a program overview and history for NAOC delegates and participants including examples of volunteer involvement as IBA Caretakers in monitoring habitats and species populations.

IBA programs are an important tool in site-based approaches to conservation. IBA programs have also been developed in Mexico and the United States. This poster will provide an opportunity for delegates from south of Canada's border to see

how Canada is delivering its IBA program, and discuss why range-wide approaches to conservation are necessary.

The IBA program in Canada has many innovative elements such as its IBA Caretaker Network, an interactive, searchable website with accurate and detailed site and program information, and social media to support the program. At its root, IBA is a flexible tool that works on public lands, private lands, and indigenous homelands to enhance protection and awareness of birds that is based in science.

**SAT15.7 Chesser, R. Terry**, (Smithsonian Institution, Division of Birds, Washington, United States); Zyskowski, Kristof (Yale University, New Haven, United States); Claramunt, Santiago (American Museum of Natural History, New York, NY, United States); Derryberry, Elizabeth (Tulane University, New Orleans, LA, United States); Brumfield, Robb (Louisiana State Univ., Baton Rouge, LA, United States)

#### THE EVOLUTION OF NESTING IN THE OVENBIRDS, FAMILY FURNARIIDAE

Nests of furnariids are among the most diverse of any bird family. Although nests of most species are enclosed structures of one type or another, there is remarkable variation in materials and substrate, and in many instances nest structure differs dramatically from the basic form. In this study, we mapped nest characters onto a near-complete species-level phylogeny of the Furnariidae and used analyses of character evolution and of variation in diversification rates to address the following questions: (1) What are the basic patterns of diversification in furnariid nests? (2) Does the evolution of nesting in this family support the hypotheses of Collias and Collias (1984) concerning the evolution of nesting in birds as a group, and that of Skutch (1996) regarding the evolution of stick nesting in the Furnariidae? (3) How strong is the influence of phylogeny on nesting in this group? (4) Which seemingly homologous nest characters are in fact cases of convergence or parallelism, and what do they reveal about the evolution of nest behavior? (5) Have certain transitions in nest type occurred more frequently than others, and are particular environmental factors associated with these transitions? and (6) Has the appearance of new nest types in this family been associated with significant shifts in diversification rate?

**S5.6 Chevron, Zac**, (University of Illinois, Urbana, United States); Matthew, Jones; Matt, Carling (University of Wyoming, Laramie, WY, United States)

#### GENOMIC INSIGHTS INTO HIGH-ALTITUDE ADAPTATION IN RUFIOUS-COLLARED SPARROWS (*ZONOTRICHIA CAPENSIS*) REVEALED BY DEEP RNA-SEQUENCING

Theory suggests that local adaptation should often involve coordinated changes in the structure and expression of hundreds of proteins that participate in hierarchical biochemical pathways. As a result, a holistic understanding of adaptive evolution requires a genomic perspective. Elevational gradients are powerful systems to study mechanisms of adaptation because the selective pressures that vary with altitude impose well-known physiological challenges on endothermic vertebrates. We used massively-parallel sequencing of skeletal muscle transcriptomes (RNA-seq) to simultaneously examine the expression and sequence variation of over 7000 genes in Rufous-collared Sparrows (*Zonotrichia capensis*) that were collected along replicated elevational transects in the Peruvian Andes. Using a pathway-level population genomic approach, we examined 1.) whether levels of genetic divergence between high- and low-altitude populations were randomly distributed

among biochemical pathways, and 2.) whether gene expression divergence was correlated with sequence divergence both within and among pathways. We found that levels of genetic divergence were not randomly distributed among pathways. Instead, genes that participate in oxygen transport, aerobic metabolism, tissue vascularization and oxidative stress response were significantly over-represented among those exhibiting levels of divergence that exceeded neutral expectations. We also found a weak, positive correlation between sequence divergence and gene expression divergence, but the strength and direction of this relationship varied among pathways. Overall, nearly 450 genes exhibited extreme differences in allele frequency, significant differences in expression, or both. These results suggest that, even among closely related taxa, hundreds of structural mutations and regulatory changes likely contribute to local adaptation.

**T2.4 Chiavacci, Scott**, (University of Illinois, Illinois Natural History Survey, Champaign, United States); Benson, Thomas; Ward, Michael (University of Illinois, Illinois Natural History Survey, Champaign, United States)

#### FACTORS AFFECTING THE NEST SUCCESS OF SHRUBLAND BIRDS IN RURAL AND URBAN LANDSCAPES OF ILLINOIS

Shrubland bird populations have declined throughout North America, and in Illinois, populations of numerous formerly common shrubland bird species have declined by up to 66% over the last century. Our understanding of causative factors driving these declines is incomplete, but one potentially important factor is nest success rates. We examined shrubland bird nest success at sites embedded in two common landscape contexts in Illinois, urban and rural. We searched for and deployed time-lapse video systems at nests to document nest predators. We estimated daily nest survival rates and analyzed patterns in daily predation rates separately for snakes, mammals, and birds. We located and monitored 813 nests, 192 of which we monitored with video recording systems. Overall, nest success in urban landscapes (45%) was nearly double that in rural landscapes (23%). The additive effects of landscape type, nest stage, and nest height best predicted daily nest survival rates. The likelihood of a nest being depredated by a snake decreased as nest height increased and was greater in exotic relative to native substrates. Additionally, the likelihood of a nest being depredated by a mammal or bird increased with increasing nest site vegetation density. Patterns in shrubland bird nest survival were largely driven by patterns in nest predation, and our results suggest that shrublands in urban landscapes of Illinois may act as refuges from high nest predation rates experienced in rural shrublands. Our identification of characteristics that make nests vulnerable to certain predators should facilitate future management efforts to improve shrubland quality and the trajectory of shrubland bird populations in Illinois and elsewhere.

**PS2.48 Chilton, Glen**, (James Cook University, Townsville, Australia); Cantu Garza, Andrea (James Cook University, Townsville, Australia)

#### IMPACT OF SEVERE TROPICAL CYCLONE YASI ON BOWER USE BY THE GREAT BOWERBIRD, CHLAMYDERA NUHALIS, IN TROPICAL QUEENSLAND, AUSTRALIA.

In most species of bowerbirds (Family Ptilorhynchidae), promiscuous males attempt to attract females at structures known as bowers. Of the 20 species of bowerbirds, ten construct open-topped avenue bowers. The bowers of Great Bowerbirds,

*Chlamydera nuchalis*, are large with thick walls composed of hundreds of sticks. They are well-decorated with natural and man-made objects. These structures are, presumably, costly to construct and maintain, and are defended against other males who attempt to steal decorations and destroy the structure. Males exhibit high fidelity to specific bower sites. In successive years most bowers are reused and refurbished. Bowers may be used for many years or even decades, and are sometimes used by successive generations of males. In February of 2010, a category five severe tropical cyclone struck the north coast of Queensland. The effects of cyclone Yasi on plants and animals were immediate and ongoing. We had been monitoring the use of bowers by Great Bowerbirds in Townsville, Queensland, before Yasi, and were able to document changes in bower use in the following breeding season. None of the eleven bowers in use in 2010 were in use again in 2011. Eight new bowers were constructed for use in 2011. Beyond immediate damage to old bowers, it seems that landscape changes resulted in the placement of newly-constructed bowers in new localities. It will be possible to document bower use again in 2012 following a quiet cyclone season. Cyclones of the severity of Yasi are very rare, and are not likely to be a strong selective force in bower construction or placement.

**F3.5 Chin, Andrew**, (York University, Richmond Hill, Canada); Fraser, Gail (York University, Toronto, Canada); Tozer, Douglas (Bird Studies Canada, Port Rowan, Canada)

#### ASSESSING THE PERFORMANCE OF BIRD COMMUNITIES AS INDICATORS OF COASTAL WETLAND HEALTH: THE EFFECT OF GREAT LAKES WATER LEVELS

Coastal wetlands are one of the most threatened ecosystems. Thus, it is important to determine if indicator scores of wetland health are confounded with factors that mask the anthropogenic disturbances they are designed to track. This study assesses whether the Index of Marsh Bird Community Integrity (IMBCI) of coastal wetlands responds to the fluctuating water levels of the Great Lakes. The IMBCI functions on a generalist-specialist gradient, where lower scores indicate wetlands composed of mainly generalist species and higher scores indicate wetlands composed of mainly specialist species. We analyzed the long-term trend in IMBCI scores of coastal wetlands of Lakes Ontario and Erie from 1995 to 2010. Based on mean April-July water levels (hereinafter "water levels"), each lake basin experienced annual fluctuations. From 1995 to 2010, water levels in Lake Ontario were relatively stable, whereas water levels in Lake Erie had periods of high and low water levels. Overall, the water levels of Lake Erie gradually declined. Annual IMBCI scores tightly tracked yearly water levels in both Lake Ontario and Lake Erie. We suggest that Great Lakes water levels should be considered when interpreting indicator scores of wetland health.

**F13.8 Christa, Beckmann**, (Deakin University, , Australia); Shine, Richard (University of Sydney, Sydney, N, Australia)

#### IMPACTS OF THE INVASIVE CANE TOAD ON A GROUND-NESTING BIRD IN TROPICAL AUSTRALIA

To prioritize management of invasive-species impacts, we need to evaluate the relative vulnerability of a wide range of native species to the arrival of the invader. The intensity of invader impact may show strong spatial variation, because of variable characteristics of the local habitat, the native taxa, and/or the invader. Hence, spatial replication of impact studies is essential. We studied the impact of invasive cane toads (*Bufo marinus*) on ground-nesting birds (Rainbow Bee-eaters, *Merops ornatus*) in the wet-dry tropics of the Northern Territory. A previous study on interactions between these same two taxa in southeastern

Queensland (>2, 500 km from our own study site) concluded that toads were a major threat to nesting success of bee-eaters, and that toads actively sought out bee-eater nests for predation attempts. In contrast, our laboratory trials showed that toads generally avoided scent cues associated with bird-nesting, and field surveys showed that toads rarely usurped bee-eater burrows or caused nest failure. Rates of toad intrusion were high only for bee-eater nests (or artificially-constructed burrows) <60 m from the water's edge. Most bee-eater nests were in drier areas, where toad numbers were low. Our data emphasize the perils of forming any general conclusions about invasive-species impact without spatial replication of impact studies.

**PS2.29 Chua, Vivien**, (Louisiana State University, Baton Rouge, United States); Lim, Haw Chuan (Department of Entomology, Urbana, IL, United States); Oliveros, Carl H (Biodiversity Institute and Department of Ecology and Evolutionary Biology, Lawrence, United States); Moyle, Robert G. (Department of Ecology and Evolutionary Biology, Lawrence, KS, United States); Sheldon, Frederick H. (Louisiana State University Museum of Natural Science, Baton Rouge, LA, United States)

#### BIOGEOGRAPHIC POSITION OF PALAWAN FROM THE PERSPECTIVE OF THE RUFOUS-TAILED TAILORBIRD. (ORTHOTOMUS SERICEUS)

The dynamics of bird biogeography in the vicinity of Wallace's Line are relatively unstudied but of tremendous importance to understanding the evolution of biodiversity in insular Southeast Asia. The island of Palawan is in a crucial location for studying these dynamics. It lies on the Sunda continental shelf with Borneo and the other Greater Sunda Islands, but perches on the edge of Wallace's line and points into the heart of the Philippines on the eastern side. Palawan has been separated from the other Sunda Islands for a relatively long time (160,000 years), thus it has an avifauna which is largely Sundaic but of uncertain age and taxonomy. To explore the biogeographic position of Palawan, we examined the population genetics of the Rufous-tailed Tailorbird, *Orthotomus sericeus*, by nuclear and mtDNA sequencing and coalescence analysis. *O. sericeus* is the only lowland tailorbird on Palawan, whereas all other large Sunda and Philippine islands have two or three species. Phylogenetic evidence suggests *O. sericeus* is an old lineage and is probably the sister of the main clade of Philippine endemics. The Palawan population is the same subspecies as Borneo, but 2% divergent in mtDNA sequence from it. This is less than the difference between Bornean and Malayan populations. Our analysis consists of 10 nuclear and mitochondrial loci and takes advantage of known date of divergence and population differences to calibrate molecular rates. Overall, it will shed much needed light on the biogeographic role of Palawan in the birthplace of biogeography.

**T1.3 Cibois, Alice**, (Natural History Museum, Geneva, Switzerland); Thibault, Jean-Claude (Museum National d'Histoire Naturelle, Paris, France); Filardi, Christopher (CBC, New York, NY, United States); Watling, Dick (Environment Consultants Fiji, Suva, Fiji, Canada); Pasquet, Eric (Museum National d'Histoire Naturelle, Paris, France)

#### LANDBIRD COLONIZATION OF THE PACIFIC OCEAN: MOLECULAR PHYLOGENETICS AND BIOGEOGRAPHY OF THE FRUIT-DOVES (PTILINOPUS)

Fruit-doves (*Ptilinopus*, Columbidae) form a very large genus with 50 species found from South East Asia to the eastern part of Polynesia. Arboreal frugivores and strong fliers, fruit-doves

have successfully colonized many remote islands where they still play an important role in the dispersal of plants. We conducted a comprehensive multilocus phylogenetic analysis in order to clarify the fruit-doves systematics and to shed light into the biogeography of this group. New Guinea represents an important center of diversification for fruit-doves with 26% of the species. Our analysis suggested that New Guinea experienced several pulses of diversification, with a few old lineages and a large New Guinean clade that includes most of the central and east Polynesian species. We found several cases of long-distance dispersal within the Pacific Ocean. Multiple colonizations occurred in Melanesian and Polynesian archipelagoes, often on a very distinct time frame. In Fiji, an old lineage experienced in situ diversification, whereas more recently the archipelago was colonized again by two other species. In Eastern Polynesia, fruit-doves do not form a monophyletic group either, with a distinct colonization of the Marquesas Islands. Interestingly, the two Marquesan fruit-doves are both sympatric and sister-taxa in our phylogenetic tree, suggesting a complex mode of diversification within the archipelago.

**PS1.256 Cicero, Carla**, (Museum of Vertebrate Zoology, Berkeley, United States); Spencer, Carol; Koo, Michelle; Bloom, David; Wieczorek, John; Steele, Aaron (Museum of Vertebrate Zoology, Berkeley, CA, United States); Russell, Laura (University of Kansas, Lawrence, United States); Guralnick, Robert (University of Colorado, Boulder, CO, United States); Bart, Hank (Tulane University, Belle Chasse, United States)

#### VERTEBRATES IN THE CLOUD (VERTNET.ORG): ARE WE THERE YET?

The NSF-funded VertNet project brings together FishNet2, MaNIS, HerpNet, and ORNIS into a single cloud-based platform for querying, visualizing, and annotating distributed vertebrate biodiversity data. VertNet will combine the four vertebrate data networks into a single portal, making it easier for researchers to aggregate and synthesize data across all vertebrates. VertNet will provide five new and improved features, including: 1 - sustainable solutions (no local servers and fewer IT problems); 2 - improved performance and reliability (faster searching, better visualization, more mapping features); 3 - ease of discoverability (creating a thesaurus of synonyms for taxonomy and geography); 4 - data improvement (enabling annotations from users, potential crowd-sourcing); and 5 - better integrations with other projects (including Arctos and Specify, Map of Life, Encyclopedia of Life, AmphibiaWeb, iNaturalist). Development of VertNet APIs (Application Programming Interfaces) will be available to any online project for searching and visualizing VertNet data. For example, the Map of Life project will use VertNet APIs to display data points for species distribution maps while VertNet will display species range maps generated by Map of Life. In addition to infrastructure development, VertNet has been very active in outreach. Since January 2011, we have given six georeferencing workshops (in South Africa, Alabama, California, and North Carolina) that have trained 129 people from 13 countries. A Biodiversity Informatics Training Workshop held in June 2012 at Boulder, Colorado, trained an additional 25 students from 9 countries. We will work with institutions from existing networks over the next 6 months to put their data in the cloud, and the new prototype VertNet portal will be functional within the year.

**T15.1 Claassen, Andrea**, (University of Minnesota, Minneapolis, United States); Cuthbert, Francesca (University of Minnesota, St. Paul, United States)

#### BREEDING SUCCESS AND CONSERVATION OF SANDBAR-NESTING BIRDS ALONG THE MEKONG RIVER IN CAMBODIA

Birds are useful indicators of environmental change and ecological integrity. Species which nest on open, sparsely vegetated river sandbars are especially sensitive to habitat change, nest predation, and disturbance. In Southeast Asia, several species of riverine sandbar-nesting birds have experienced population declines in recent years, presumably due to anthropomorphic effects of egg harvesting by local people, predation by animals, intensification of land use activities, and hydropower development. However, ecological data on this group of birds is lacking. To address this, we investigated factors affecting reproductive success of five sandbar-nesting bird species: River Tern (*Sterna aurantia*), River Lapwing (*Vanellus duvaucellii*), Great Thick-knee (*Esacus recurvirostris*), Small Pratincole (*Glareola lactea*), and Little Ringed Plover (*Charadrius dubius*). In 2010-2011 we monitored nests of the five species and implemented a nest protection program along the Mekong River in Cambodia. We found that nest survival was influenced by species, nest initiation date, nest age, and whether or not nest protection was implemented. Environmental covariates did not significantly affect nest survival. Our results suggest that egg harvesting by people and predation by animals may currently be the most important causes of low nest survival rates of sandbar-nesting bird species along the Mekong River. However, environmental degradation and overall disturbance levels are predicted to rise in the future as a result of upstream hydropower dam development, together with rising human populations and intensification of land use. Therefore, although implementing site-specific nest protection may boost reproductive success rates in the short-term, a longer-term conservation strategy will be necessary for sustaining Mekong River sandbar-nesting bird populations in the future.

**W4.2 Claramunt, Santiago**, (American Museum of Natural History, New York, United States); Derryberry, Elizabeth; Remsen, J. V.; Brumfield, Robb (Louisiana State University, Baton Rouge, LA, United States); Cracraft, Joel (American Museum of Natural History, New York, NY, United States)

#### ANDEAN UPLIFT, CLIMATE CHANGE AND MACROEVOLUTIONARY PATTERNS OF DIVERSIFICATION IN THE FURNARIIDAE

Major climatic and geologic changes can stimulate diversification by creating new geographic barriers that trigger speciation. In addition, changes in climatic conditions can result in new selective pressures that stimulate phenotypic evolution. The most profound changes in the Neogene of South America were produced by global-scale climatic fluctuations and the rise of the Andes. For example, both Pleistocene glacial cycles and Andean uplift had been proposed as major events influencing recent diversification among South American biotas. The rise of the Andes not only transformed the geography and climate of Western South America but also had impacts on climate and geology throughout the entire continent. Here we explore macroevolutionary patterns of diversification in the Furnariidae and their correlates with major events in the climatic and geographic history of South America. We evaluated different evolutionary scenarios using a calibrated species-level phylogeny of the family. We found that the accumulation of lineages over time was approximately constant, without signs of an effect of climate change or Andean orogeny. On the other

hand, the pattern of morphological evolution through time is correlated with climatic fluctuations in temperature and humidity. An analysis of non-homogeneous diversification (MEDUSA) reveals that three clades have experienced significant increases in their rates of speciation but these increases do not coincide with occupation of a new biome, dispersal into the Andes or the onset of rapid Andean uplift. Finally, we investigated the relationship between altitudinal distributions and rates of diversification using quantitative-state models of speciation and extinction (QuaSEE). We found that, the relationship between altitude and speciation is not linear but unimodal, in which the speciation rate peaks at mid elevations; in addition, the extinction rate increase sharply at high elevations.

**W15.2 Clark, Anne**, (Binghamton University, Binghamton, United States); Lum, Koji (Binghamton University, Binghamton, United States); McGowan, Kevin (Cornell Laboratory of Ornithology, Ithaca, NY, United States); Spathis, Rita (Binghamton University, Binghamton, NY, United States); Townsend, Andrea (University of California, Davis, Davis, CA, United States); Vilar, Miguel (University of Pennsylvania, Philadelphia, PA, United States)

#### WANDERERS, COLONISTS AND URBAN DWELLERS: DRD4 GENE AND PHENOTYPIC VARIATION AMONG AMERICAN CROWS (CORVUS BRACHYRHYNCHOS)

Urban habitats provide an important context for studying how birds and other organisms colonize and adapt to new environments. Both species-typical characteristics and individual differences—including traits such as boldness, neophilia, and dispersal tendency—may facilitate moving into urban areas. Similar traits in humans are associated with allelic variation in DRD4, a dopamine receptor gene. This study relates DRD4 variation to phenotypic variation in behavior and life history in a long-term study population of American crows in and around Ithaca, NY. Crows have settled in US cities only 50-60 years ago, often adjacent to rural populations. In Ithaca, where crows settled in the 1970s, breeding dispersal between rural and urban/suburban areas has been almost non-existent in 23 years of banding. We are testing the hypothesis that DRD4 variation may underlie differences between urban and rural birds and between birds that tend to stay and breed successfully in urban vs. rural environments. Using mtDNA, we can characterize distance between urban and rural populations and relate DRD4 variation to lineage frequency and success in each environment.

We sequenced a 500 bp region of the crow DRD4 and identified seven snps, including two that result in amino acid change. We also sequenced 473 bp in the control region of the mtDNA. The current data set includes DRD4 and mtDNA haplotypes of >450 nestlings from 2001-2008. A preliminary analysis of 196 crows showed significant variation in snp frequency with territory type (urban, rural) and time spent off home territory prior to sexual maturity. We will describe the relationship between genetic and behavioral variation relevant to invading and remaining in urban habitats, including habitat preference, propensity to travel off territory, breeding dispersal distance, and age at breeding.

**PS2.117 Clark, Elisabeth**, (Northeastern University, Boston, United States); Jones, Gwilym (Northeastern University, Boston, MA, United States)

#### INFLUENCE OF CLIMATE, FRUIT AVAILABILITY AND NUTRITIONAL CONTENT ON BIRD SELECTION OF NON-NATIVE, INVASIVE (FRANGULA ALNUS) AND NATIVE (PRUNUS SEROTINA) FRUIT



By consuming fruit and defecating seeds, birds are an important dispersal factor for many plant species, including non-native, invasive species. The avian use of non-native, invasive glossy buckthorn (*Frangula alnus*) fruit was examined and compared with use of native black cherry (*Prunus serotina*) fruit over a two-year period (2009, 2010) in eastern Massachusetts. The climate, particularly total rainfall and mean temperature, varied dramatically between these two years. Using visual observations, apparent *F. alnus* and *P. serotina* fruit consumption by birds was recorded for a total of 166 hours at two sites with different plant composition. The comparative analysis of fruit use both spatially and temporally revealed that birds prefer *P. serotina* fruit; however *F. alnus* fruit is used in the absence of the native fruit option. Fruit use data was related to temperature and rainfall totals, fruit availability and nutritional content. The nutrient content of *F. alnus* fruit was determined for both sites in 2009 and 2010. Overall, *F. alnus* fruit had high total energy content ( $34.5 \pm 2.75$  kJ/g), a moderate amount of sugar ( $4.67 \pm 0.21\%$ ) and protein ( $9.8 \pm 1.34\%$ ) and low lipid content ( $0.04 \pm 0.01\%$ ). Comparisons of foraging frequency and nutrient content of fruit at both sites showed no relationships. Locally, analysis of the climatic differences between the two years revealed how temperature and rainfall affect fruit availability and avian fruit selection, and may shed more light on how global climate change may affect these intricate relationships.

**PS2.54 Cline, Mason**, (University of Georgia, Athens, United States); Conroy, Michael; Cooper, Robert; Hepinstall-Cymerman, Jeff; Shepherd, J. Marshall (University of Georgia, Athens, GA, United States); Stodola, Kirk (University of Illinois at Urbana-Champaign, Urbana, IL, United States)

#### A BIRD'S EYE VIEW OF CLIMATE CHANGE: RESEARCH AND DECISION-MAKING SKILL INSTRUCTION IN UNDERGRADUATE STUDENT CURRICULUM

We executed an integrated educational-research project to bring together undergraduate students, graduate students, and professors in a shared, problem-based learning environment to address a pressing ecological question: how will bird species respond to global climate change across multiple spatial scales in southern Appalachian forest ecosystems? The objectives of this project were to (1) educate undergraduate students about global climate and Earth Systems science and technology, (2) develop a priori models relating ecological processes to climate change, (3) integrate empirical data into these predictive models, and (4) provide adaptive feedback and support management decisions. Our multi-scaled approach to this project began with a course primarily focused on ecological modeling and experimental design and allowed students to develop multiple testable hypotheses about how climate change may affect our study system. In the second course, students assisted in conducting the field research necessary to test their hypotheses, analyzed their data using sophisticated modeling approaches, and prepared their results in the form of a scientific report. After data analysis, students updated their models to reflect the results of their data in an adaptive management approach. Short-term results and outcomes of this multi-year instructional project include undergraduate students gaining experience in model development, data collection, and informing models with new data. Longer-term results include undergraduates that will be able to address meaningful questions about ecological impacts of climate change, be prepared for graduate study, and be better equipped to make sound wildlife management decisions.

**W3.6 Cockle, Kristina**, (Louisiana State University, Baton Rouge, United States); Martin, Kathy (University of British Columbia, Vancouver, BC, Canada)

#### FROM STATIC TO DYNAMIC 'NEST WEBS': CHANGES IN THE ARCHITECTURE OF AN INTERSPECIFIC NETWORK OF CAVITY-NESTERS OVER 12 YEARS DURING AN OUTBREAK OF MOUNTAIN PINE BEETLE

In North American forest communities, 7–10 species of excavators, especially woodpeckers, generate a limited supply of tree cavities required for nesting by a rich assemblage of non-excavating cavity users. 'Nest webs' have been used since 1999 to describe the links among producers and users of tree cavities, but there has been little quantification of nest web architecture. We use network analysis on a 12-year data-set from interior British Columbia, Canada, to determine how nest-web properties change over time during a food pulse from an outbreak of Mountain Pine Beetle (*Dendroctonus ponderosae*). Prior to the beetle outbreak, non-excavator birds relied primarily on cavities excavated by Northern Flickers (*Colaptes auratus*), and management recommendations focused on preserving trees for flicker cavities. Over the course of the beetle outbreak, non-excavators increased their use of nesting cavities excavated by a variety of bark-insectivores that feed on beetles, resulting in reduced dominance of the Northern Flicker and an overall increase in network evenness. Our results show how a large-scale disturbance can lead to increased interaction diversity in a commensal interspecific network, and suggest that management strategies for cavity-nesters should be flexible enough to account for changes in the identity of key cavity producers in response to natural disturbance. By studying the dynamics of interspecies networks over time, we reveal important relationships that are missed with a static approach, and may be important for network resilience.

**SAT14.5 Coe, Sharon**, (USDA Forest Service, Rocky Mountain Research Station, Albuquerque, United States); Finch, Deborah (USDA Forest Service, Rocky Mountain Research Station, Albuquerque, NM, United States); Hawksworth, David (USDA Forest Service, Albuquerque, NM, United States)

#### RESPONSE OF AVIAN SPECIES ABUNDANCE TO WILDFIRE FUEL REDUCTION IN RIPARIAN WOODLAND

Riparian woodlands provide important habitat to a diversity of avian species. In the southwestern United States, riparian woodlands are critical to birds in part because they comprise a small percentage of total land area. The spread of non-native plant species into native woodlands has occurred throughout this region. One consequence of the increase in fuel loading is an increased risk of catastrophic wildfire. A project was implemented in central New Mexico (USA) in the Middle Rio Grande Bosque, a cottonwood gallery forest, to reduce risk of wildfire through removal of non-native understory species such as tamarisk (*Tamarix* spp.) and Russian olive (*Eleagnus angustifolia*). The treatment significantly reduced the density of tamarisk and Russian olive on treated sites (Smith et al. 2009). We evaluated whether the abundance of various bird species changed in response to non-native vegetation removal using a Before-After-Control-Impact study design. Point count transect surveys were conducted at both treatment and control sites (n=12) both before (2001, 2002) and after (2005-2007) non-native vegetation removal. We analyzed avian abundances using the program Unmarked which is implemented in the R statistical program. Based on this analysis, it appears that the abundances of three of the species that were detected most frequently during surveys (Black-chinned Hummingbird, Black-headed Grosbeak, Spotted Towhee) did not vary significantly in relation to the vegetation removal.

**S9.5 Cohen, Emily**, (Smithsonian Conservation Biology Institute, Migratory Bird Center, Washington, United States); Moore, Frank (The University of Southern Mississippi, Hattiesburg, MS, United States); Fischer, Richard (U.S. Army Engineer Research & Development Center, Vicksburg, MS, United States)

#### MOVEMENT ECOLOGY OF AN INTERCONTINENTAL MIGRATORY BIRD IN RELATION TO ENDOGENOUS AND EXOGENOUS FACTORS DURING SPRING STOPOVER

Movement decisions during songbird migration remain poorly understood despite their expected fitness consequences in terms of survival, energetic condition and timing of migration that will carry over to subsequent phases of the annual cycle. We took an experimental approach to test hypotheses regarding the influence of habitat, energetic condition, time of season and sex on the movement decisions of a songbird at spring stopover sites. To simulate arrival of nocturnal migrants at unfamiliar sites, we translocated and continuously tracked migratory red-eyed vireos (*Vireo olivaceus*) with and without energetic reserves that were released in two replicates of three habitat types throughout spring migration. Migrants moved the most upon release, during which time they selected habitat characterized by greater food abundance and higher foraging attack rates. Presumably under pressure to replenish fuel stores necessary to continue migration in a timely fashion, migrants released in poorer energetic condition moved faster and further than migrants in better condition and the same pattern was true for migrants late in spring relative to those earlier. Movement did not differ between sexes. Our study illustrates the importance of quickly finding suitable habitat at each stopover site, especially important for energetically constrained migrants later in the season. If an initial period prior to foraging were necessary at each stop along a migrant's journey, non-foraging periods would cumulatively result in a significant energetic and time cost to migration. Finally, we incorporate the experimental results as behavioral rules for migrant movement in an individual-based model to measure the fitness consequences of migrant-habitat interactions during spring stopover.

**T5.3 Collar, Stefanie**, (Oregon State University, Corvallis, United States); Roby, Daniel (U.S. Geological Survey, Oregon Cooperative Fish and Wildlife Research Unit, Corvallis, OR, United States); Lyons, Donald (Oregon State University, Department of Fisheries and Wildlife, Corvallis, OR, United States)

#### THERE GOES THE NEIGHBORHOOD: SITE FIDELITY AND GROUP ADHERENCE AT A CASPIAN TERN (HYDROPROGNE CASPIA) COLONY FACING HABITAT REDUCTION AND INCREASED PREDATION

Nest site fidelity is presumed to enhance reproductive success, but can be a liability if habitat suitability declines or predators target nesting birds as food resources. The Caspian tern (*Hydroprogne caspia*) colony on East Sand Island (ESI), Columbia River estuary, Oregon, is the largest in the world, supporting ca. 9,500 breeding pairs. During the 2011 breeding season, the ESI colony experienced two changes: a managed 35% reduction in available nesting habitat and the advent of on-colony predation of breeding adults by Bald Eagles (*Haliaeetus leucocephalus*). Habitat reduction made some previously used nest sites unavailable. Using a Leica TPS1200+ rangefinder, I pinpointed nest sites of banded birds in 2010 and 2011 and quantified inter-annual nest site fidelity and movements in response to reduced habitat availability. During two breeding

seasons individual terns used nest locations in close proximity, and retained individuals as neighbors. There was a significant increase in inter-annual distance moved for birds displaced by habitat reduction. During late incubation, eagle disturbance, coupled with intense egg predation by gulls (*Larus* spp.), resulted in an unprecedented total colony failure. Terns demonstrated three distinct responses to colony failure: serial re-nesting attempts on ESI (49%), re-nesting attempts at alternative colonies in coastal Washington (17%), and abandonment of nesting efforts with increased use of alternative roost sites (33%). After failure, birds displaced by habitat reduction were significantly more likely to stay at ESI than re-locate to another colony. Despite multiple stressors and alternative colony availability, terns exhibited high site fidelity to this super-colony in 2011.

**W16.1 Conkling, Tara**, (Mississippi State University, Mississippi State, United States); Martin, James; Belant, Jerrold; Adams, Heidi; Baker, Kristina; Riffell, Samuel; Burger, L. Wes (Mississippi State University, Mississippi State, United States); DeVault, Travis (USDA-APHIS National Wildlife Research Center, Sandusky, OH, United States); Wang, Guiming (Mississippi State University, Mississippi State, United States)

#### DISCREPANCY IN NEST SURVIVAL ESTIMATES BETWEEN SEARCH METHODS FOR GRASSLAND BIRDS

Multiple search methods are used in grasslands to detect bird nests, including systematic searches and incidental or behavioral observations (non-systematic). Researchers often assume that nests detected are a random and representative sample and subsequent parameters derived from the sample are also unbiased; however, these assumptions are rarely tested. We conducted this study May 2008 – July 2009 on 51 semi-natural field margins and from May – July 2011 on 16 8-ha semi-natural grassland plots in northeast Mississippi. Technicians located nests using bi-weekly systematic search techniques and opportunistically using behavioral observations. We used a hierarchical-model-selection approach to model daily nest survival of dickcissel (*Spiza americana*) nests in Program MARK. We tested multiple hypotheses that nest survival varied with search method, time, and vegetation characteristics.

We considered 12 models using 126 nests (those active during systematic searches). Variation in dickcissel nest survival was best explained by quadratic time, nest height, interaction between search methods and patch-type, and marginally by nest age ( $\omega = 0.43$ ; 2.38 times more likely than 2nd best model). The parameter estimate for systematic nests was 3.87 times lower than non-systematic nests. Our preliminary results suggest a discrepancy in predation risk among nests detected by various techniques, calling into question previous study results. It may be important to use systematic and non-systematic search methods to acquire a representative sample of nests for accurate survival rates for grassland birds.

**PS2.209 Connor, Nolan**, (Iowa State University, Ames, United States); Vleck, Carol; David, Vleck; Christopher, Foote (Iowa State University, Ames, IA, United States); David, Winkler (Cornell University, Ithaca, NY, United States)

#### DOES CARRYING AN INSTRUMENT PACKAGE CAUSE DNA DAMAGE? A TEST USING TREE SWALLOWS

As part of a long-term study on aging in Tree Swallows, *Tachycineta bicolor*, we placed 1g data logger backpacks on individuals at breeding sites in Iowa and New York, monitored return of backpacked birds and matched controls in the following year. A 1 g load is about 5% of swallow body mass and at the upper end of the range usually assumed to have

minimal effects on behavior and survivorship. In 2008-09 in IA, 43% of backpack (n=9) and 44% (n=12) of control birds returned. In 2009-10 in IA and NY, 23% of backpack (n=10) and 32% (n=12) of control birds returned. Telomere lengths declined significantly more ( $p=0.03$ ) in backpack birds (mean loss = 573 base pairs) than in controls (mean loss = 163 base pairs). Here we extend that work to further investigate whether there is increased DNA damage associated with the metabolic handicap. We are using an alkaline (pH=12.1) comet assay, a sensitive electrophoresis-based technique to detect DNA strand breaks at the level of individual cells, to test the hypothesis that the same oxidative stresses that shorten telomeres also contribute to other forms of DNA damage.

**T15.6 Conover, Ross**, (Glenville State College, GLENVILLE, United States); Dinsmore, Stephen (Iowa State University, Ames, United States); Burger, Wes (Mississippi State University, Mississippi State, United States)

#### DEMOGRAPHIC RESPONSES OF THE DICKCISSEL TO EARLY-SUCCESSION MANAGEMENT PRACTICES IN MISSISSIPPI

Integrating early-succession patches may convert intensive agricultural landscapes into usable space for breeding grassland birds, but this has not been evaluated under a broad context of avian demographic responses. This study evaluated the nesting density, survival, and fledgling survival and movement patterns of the Dickcissel (*Spiza americana*) in early-succession patches interspersed within intensive row-crop agriculture in the Mississippi Alluvial Valley (MAV) biogeographic region. The Dickcissel is a grassland bird of conservation concern that readily nests in suitable grassland habitat adjacent to row-crop agriculture. We characterized Dickcissel responses in four early-succession United States Department of Agriculture conservation practices, including (1) large forest blocks (6–8 year old trees), (2) riparian forest buffers (1–3 year old trees), (3) monotypic switchgrass (*Panicum virgatum*) buffer (no trees), and (4) diverse forb-native grass buffer (no trees) over three years (2005–2007). We modeled daily survival of dickcissel nests ( $n = 733$ ) as a function of nest-site, patch, and landscape covariates. Dickcissels nested at 3.5 times greater densities in large blocks than any buffers, and in non-wooded buffers they preferred those with diverse vegetation early in the breeding season. Dickcissel nest success was 22.9% on average and was similar among conservation practices except riparian forest buffers, in which they apparently suffered from high densities of red imported fire ants (*Solenopsis invicta*) and low vegetative cover. Dickcissel nest survival related positively to nest height, but negatively to grass cover, horizontal vegetation density, and proximity (<30m) to row-crop fields. We radio-tracked 416 Dickcissel fledglings twice daily up to 15 days post-fledging. Red imported fire ants and snakes caused  $\geq 65\%$  of all fledgling deaths. Mortality was greatest (83%)  $\leq 2$  days post-fledging, but decreased substantially with increasing age. Fledgling survival was much higher early in the season than later and positively related to fledgling mass and perch height. We recommend that conservation practices be managed for increased vegetation cover early in the breeding season (May to early June) and that riparian forest buffers within the geographic range of the invasive red imported fire ant incorporate alternative designs to reduce fledgling depredation.

**PS2.18 Consla, Donald**, (Allegheny College, Meadville, United States); Mumme, Ronald (Allegheny College, Meadville, PA, United States)

#### RESPONSE OF CAPTIVE RAPTORS TO AVIAN MOBBERING CALLS: THE ROLES OF MOBBER SIZE AND RAPTOR EXPERIENCE

The “move on” hypothesis for avian mobbing proposes that mobbing induces stress in potential predators, thereby provoking them into going elsewhere. We tested this hypothesis by subjecting captive owls, hawks and falcons to the mobbing calls of four species of co-occurring passerine birds that vary considerably in body size. Test subjects comprised 15 individuals of seven species of birds of prey housed at Tamarack Wildlife Rehabilitation and Education Center (TWREC) in northwestern Pennsylvania, USA. Playback treatments included mobbing calls of the Black-capped Chickadee, Blue-headed Vireo, Blue Jay, and American Crow, which vary in size from 12g (chickadee) to 500g (crow). A non-mobbing vocalization (chickadee song) was included in the playback treatments as a control. Three behavioral indicators of probable stress (head orientation toward the playback speaker, raising of feathers or spreading of wings, and changing of perch positions) were positively associated with size of the mobbing passerine. In addition, test subjects that had entered TWREC as adults generally responded more vigorously to the mobbing calls of large passerines (jays and crows) than did naive individuals that had entered the facility as fledglings or young juveniles. Our results are therefore consistent with the “move on” hypothesis and suggest (1) that the mobbing calls of large passerines are more effective in provoking stress and altering the behavior of potential predators than are the mobbing calls of small passerines, and (2) that a raptor’s previous experience with mobbing in the wild can exaggerate the strength of its response to mobbing calls, particularly those of large passerines.

**W11.11 Contina, Andrea**, (University of Oklahoma, Norman, United States);

#### PAST, PRESENT, AND FUTURE OF THE PAINTED BUNTING: WHAT CAN GENETIC MARKERS TELL US?

DNA microsatellites loci are short sequence repeats that often show length variation within individuals and among populations. We can exploit this characteristic and use microsatellites as markers to reconstruct the history and genetic structure of natural populations. In studies involving migratory species, microsatellites provide crucial information on past migratory occurrences and can resolve the origin of individuals. I investigated genetic population structure of a Neotropical migrant, the Painted Bunting (*Passerina ciris*), across its breeding and wintering range using DNA microsatellite. I analyzed a large dataset of samples ( $N=80$ ) from the Western and Eastern breeding populations as well as from the wintering grounds including Mexico, Nicaragua, and Costa Rica to investigate gene flow in ancestral populations and migratory connectivity. The Bayesian analysis at 12 loci identified 4 clusters (K) and suggested some similarities among birds from the Southern wintering grounds and the Eastern breeding population. I also combined the genetic approach with stable isotope markers, field observations on molting birds and geolocators. The comparison of preliminary data from experimental geolocator tags and DNA microsatellite revealed that different migratory routes were associated with birds that had highly divergent genetic signatures. This integrative approach confirmed the high potential of linking different markers to understand the natural history of Neotropical migratory birds. Finally, I examined recent historical population dynamics with a coalescent approach based on extensive MCMC simulations implemented in MSVAR. The analysis of some fundamental ecological parameters ( $\theta$ ,  $N_e$  and  $\mu$ )

allowed me to determine percentage and timing of past population size variations.

**W7.2 Contreras, Suzanne**, (Caesar Kleberg Wildlife Research Institute, Kingsville, United States); Ballard, Bart; Kuvlesky, Jr, William (Caesar Kleberg Wildlife Research Institute, Kingsville, United States); Brennan, Leonard (Leonard A. Brennan, Kingsville, United States); Morrison, Michael (Texas A&M University, College Station, United States)

#### BIRD MIGRATION PATTERNS IN THE LOWER GULF COAST REGION OF TEXAS

Although the Texas coast is recognized as a major migration corridor, many aspects of bird migration have not been sufficiently studied. We quantified the chronology, magnitude, and flight altitudes of birds during migration along the lower Texas coast using radar technology and investigated the effects of weather on these variables. We used dual marine radar systems to continuously monitor migrating birds at 2 coastal sites from 2007 to 2010. Our monitoring included 16,538 radar hours during 3 fall (15 August – 17 November) and 3 spring (15 March – June 1) migration periods. We found that average passage rates differed between sites, seasons, and flight altitudes. Our northern site had continually higher average passage rates than our southern site in both fall and spring. During fall, mean passage rates ranged from 582 to 1,738 targets/km/hr and most passage occurred during diurnal hours. In spring, passage rates ranged between 356 to 807 targets/km/hr and passage was highest during nocturnal hours. The majority of birds migrated at altitudes below 500 m, but birds were recorded up to 3,000 m. We found that ~80% of fall passage occurred below 1,000 m, while spring passage had a greater proportion of birds flying at altitudes >1,500 m. We found that the best predictors of passage rates below 500 m were wind direction, wind speed, and fog; however, passage rates were better explained by wind direction, barometric pressure, and temperature at higher altitudes. The results of our study provide the first quantitative assessment of fine-scale migration patterns along the lower Texas coast. This information will improve efforts to manage and conserve migratory birds within this changing coastal region.

**PS1.261 Contreras-González, Ana María**, (Universidad Nacional Autónoma de México, Estado de México, México); Arizmendi Arriaga, María del Coro (Universidad Nacional Autónoma de México, Estado de México, Canada)

#### SEED DISPERSAL AND SEED PREDATION BY BIRDS THAT EATING FRUITS OF ENDEMIC COLUMNAR CACTO FROM SEMI-ARID REGION OF CENTRAL MEXICO

In the tropical dry forest sites with cactus association, pollination and seed dispersal are important in the reproduction of this plants. Both seed dispersal and seed predation are considered key factors that determine the special structure of plants populations, these processes play an important role in the reproductive cycle of plants. In this study we evaluated the birds effects that feed on fruits of endemic columnar cacti of central Mexico (*Neobuxbaumia tetetzo*). We analyzed the effectiveness of seed dispersal of birds that eating of fruits of this cacti, we considered the quality and quantity components of seed dispersal. We considered the number of fruit removed and we take note of sites where the seed was deposited by foraging observations, and the effect of gut passage was estimated through of birds capture by mist net, and we estimated the proportion seed germinated that seed were consumed by birds in captivity. We found that the principal birds eating were birds

granivores (*Zenaida asiática* y *Ara militaris*), that presented the effectiveness seed dispersal of zero. Also two woodpecker species (*Melanerpes hypopolius* y *Picoides scalaris*) were observed feeding fruits of this cacto, these species of woodpeckers had the high germination proportion however this bird had a low effectiveness seed dispersal, because this birds after of eating they root in other cactos, and these site are inappropriate to seed germination and seedling establishment. Together these four birds may be affected the population of this endemic cacti of central Mexico.

**W2.2 Conway, Meaghan**, (AZ Coop Fish and Wildlife Research Unit, Tucson, United States); Conway, Courtney (USGS, ID Coop Fish and Wildlife Research Unit, Moscow, ID, United States)

#### EFFECTS OF A DRIER CLIMATE ON BREEDING PHENOLOGY AND CLUTCH SIZE IN BURROWING OWLS

Most climate models predict increases in climate variability and wider extremes in precipitation patterns. The southwest, in particular, is expected to experience more frequent and more severe droughts. Most efforts to assess the potential impact of climate warming on plants and animals have focused on estimating shifts in species distributions via climate envelope models, and have largely ignored the proximate effects of variation in weather patterns on fitness and productivity for species with large breeding ranges. We examined the effect of annual variation in precipitation on nest initiation dates and clutch size of burrowing owls at 3 study sites in Arizona and Washington. Precipitation in the months prior to the breeding season affected breeding phenology and clutch size of Burrowing Owls at all 3 of our study sites. Burrowing owls in southern Arizona delayed breeding and laid smaller clutches in years with less precipitation during the preceding winter. Burrowing owls at our 2 study sites in eastern Washington delayed breeding in years with less precipitation during the preceding spring. These results suggest that a warmer and drier climate is likely to have far-reaching impacts on species' life history strategies in addition to (or instead of) shifts in their distributions.

**SAT1.5 Cooke, Raylene**, (Deakin University, Burwood, Australia); Campbell, Catriona (Deakin University, Burwood, Australia); David, Milledge (Landmark Ecological Service, Suffolk Park, Australia); Hogan, Fiona (Monash University, Churchill, Australia)

#### MOLECULAR DATA CONTRADICTS THE ACCEPTED ORIGIN OF THE LORD HOWE ISLAND MASKED OWL, IMPLICATIONS FOR MANAGEMENT

The Tasmania masked owl (*Tyto novaehollandiae castanops*) was introduced onto Lord Howe Island (LHI) in the 1920's in an attempt to control the black rat (*Rattus rattus*), however, this was unsuccessful and consequently a complete eradication of the rodent has now been proposed. The concurrent eradication of the masked owl is also being considered as it is believed that the masked owl will predate more heavily on endemic species once the rodents are removed. The LHI masked owl (*Tyto novaehollandiae castanops*), however, is a species introduced to an island that is considered a pest there despite its reputed ancestral population, the Tasmanian race being listed as endangered. In this situation eradication of the masked owl from LHI may be controversial and other management options, such as translocation should be considered. Before translocation can occur the ancestry of the LHI masked owl must be confirmed, as it has been proposed that the Australian masked owl (*Tyto novaehollandiae*) was also introduced to the island.

This study therefore used genetic methods, mitochondrial sequencing and microsatellite genotyping, to assess the ancestry of the masked owl on LHI. Sequence divergence in the cytochrome b gene (mitochondria) showed that the ancestry of the LHI masked owl lies with the southern Australian population of masked owls and not the Tasmanian masked owl as previously published. Sequence divergence was also found between mainland individuals and Tasmanian individuals, and between individuals geographically separated on the mainland. Cross species amplification of microsatellite markers developed from the barn owl was successful in masked owls, with 19 of 20 markers being polymorphic. Three pairs of loci showed linkage disequilibrium and six loci significantly departed from HWE, which suggests sub-structure amongst the sample as a whole. A comprehensive genetic study should be undertaken on the entire Australian population of masked owls, including offshore islands, because the species is subject to patchy distribution on the mainland, without a genetic assessment it is unknown to what degree sub-speciation or even speciation has occurred. The findings from such a study will have implications for taxonomy and future management of Australian owls.

**F15.6 Cooper, Caren**, (Cornell Lab of Ornithology, Ithaca, United States); Voss, Margaret (Pennsylvania State University at Erie, Behrend College, Erie, PA, United States); Bartell, Paul (Pennsylvania State University, University Park, PA, United States); Cassone, Vincent (University of Kentucky, Lexington, KY, United States); Winkler, David (Cornell University, Ithaca, NY, United States)

#### LATITUDINAL, SEASONAL, AND PHOTOPERIODIC TRENDS IN CLUTCH SIZE: THE IMPORTANCE OF PERIPHERAL CLOCKS IN SONGBIRDS

Avian clutch size gradients resemble a Yule-Simpson paradox in which clutch size declines with date within sites but increases with date across sites arranged along a latitudinal gradient. We examined the Yule-Simpson paradox by comparing clutch size patterns based on different measures of time: relative to local biology, based on the human calendar, and represented by photoperiod. Avian biological clocks regulate the start, end, and rate of egg laying sequences. We tested whether this regulation is most likely through central clock (responds to photoperiod) or peripheral clocks (responds to the rate of change in photoperiod). We analyzed breeding data spanning a wide range of dates and natural and artificial photoperiod progressions for Eastern Bluebirds (*Sialia sialis*), Tachycineta swallows, and Stonechats (*Saxicola torquata*). We found evidence that change in photoperiod, the most predictable abiotic environmental feature, plays a proximate force shaping spatial and temporal trends in songbird clutch size, likely via regulation by peripheral clocks. We can gain other insights by integrating comparative chronobiology into life history theory.

**SAT6.4 Cooper, Robert**, (UGA, Athens, United States); ESTIMATING FOOD ABUNDANCE FOR INSECTIVOROUS BIRDS.

The estimation of arthropod abundance is still a problem in the study of the ecology of insectivorous birds. Caterpillars are an especially important group of insects for many forest birds, but estimation of their abundance is made difficult because different species are associated with different tree species, and have different patterns of emergence and abundance over the breeding season. We developed a method of estimating caterpillar abundance based on a sampling scheme stratified by tree species and time. Each of the 135 strata represented a combination of 27 tree species and 5 time periods. These were then

extrapolated to territories of our focal species, the Black-throated Blue Warbler (*Setophaga caerulescens*), based on the abundance of the tree species in each territory. We found that caterpillar abundance varied over space and time, and that provisioning rates, nestling weights and productivity in individual territories were all related to caterpillar abundance. We also compare this method of estimating caterpillar abundance to others, and discuss the advantages and shortcomings of each.

**PS2.32 Corbani, Aude**, (Université Laval, Québec, Canada); Desrochers, André (Université Laval, Québec, PQ, Canada) ESTIMATION OF SONGBIRD NESTING SUCCESS OVER AN ENTIRE BOREAL FOREST LANDSCAPE

Canada's boreal forests are famous for their role as major breeding grounds for billions of songbirds. However, broad patterns of nesting success of boreal songbirds remains poorly documented. In summers 2009 to 2011, we measured hatching success of territorial songbirds in a Quebec boreal forest in relation to weather, vegetation, topography, sampling hour, date and year. We visited 395 sites, each on three or four consecutive days. At each visit, we lured birds to playbacks of black-capped chickadee mobbing calls to enable sighting and assessing of parental status (n = 2290 songbird pairs). To account for imperfect detection of parental activity, we used MacKenzie et al.'s (2002) two-state model with all individuals seen, with states defined as no parental activity vs. parental activity (adult carrying food). The detection of parental activity was affected by sampling date and hour, as well as guild (ground, cavity or cup nest). After accounting for imperfect detection and based on multimodel estimates, the proportion of pairs with nestlings on a given day peaked at 67%. The probability of having a brood was highest in mid-July. Hatching success was lower near forestry roads and following warm weather (heat sum over 30 days). However, hatching success was not related to other local or landscape attributes. The design proposed could be implemented in national surveys such as breeding bird atlases to obtain quantitative estimates of avian nesting success in a region of interest.

**SAT6.1 Corkery, Catherine**, (Trent University, Peterborough, Canada); Nol, Erica (Trent University, Peterborough, ON, Canada)

#### TESTING THE MISMATCH HYPOTHESIS IN CHURCHILL, MANITOBA: DOES FOOD FOR A SUB-ARCTIC BREEDING PLOVER PEAK AT HATCH?

Avian migrants rely on consistent patterns of food availability on their breeding grounds to successfully complete their breeding cycle. Due to the ongoing warming of the sub-Arctic, there is potential for a mismatch between the peak in food demand for breeding shorebirds, and the peak in available invertebrate biomass. This project examines the relationship between the stage of breeding of Semipalmated Plovers (*Charadrius semipalmatus*) in Churchill, Manitoba and the insect biomass in the mudflats on which they forage. If Semipalmated Plovers do time their breeding so that their chicks have access to an optimal food supply, then their chicks should hatch within a few days of the peak in invertebrate biomass. Insect samples were obtained throughout the breeding season using soil cores, pitfall and emergence trap sampling techniques, and identified to family. Soil and air temperature were also measured at each sampling location. Insect biomass was compared to the time of various stages of the plovers' breeding season. Preliminary analysis indicates that there are no strong relationships between insect and weather variables, but a distinct peak in insect biomass was observed before hatching in both coastal and inland

habitats. Ideally, insect biomass should peak within a few days of the hatching of the majority of the plover chicks, as the first ten days after hatching are crucial in terms of growth and thermoregulation. No difference in growth was found between chicks hatching at various distances from the food peak. This indicates that a high food supply may be more crucial during the laying period.

**T17.7 Cornett, Christina**, (Hawaii Cooperative Studies Unit, Hawaii National Park, United States); Hess, Steven (U.S. Geological Survey, Hawaii National Park, United States); Misajon, Kathleen (National Park Service, Hawaii National Park, United States); Hu, Darcy (National Park Service, Hawai'i National Park, United States); Jeffrey, John (Jack Jeffrey Photography, Pepeekeo, United States)

#### MOVEMENT ECOLOGY OF ENDANGERED HAWAIIAN GOOSE

The endangered Hawaiian Goose (*Branta sandvicensis*), or Nene, underwent a severe population decline in the early 20th Century. Nene were reintroduced throughout Hawai'i Island from captivity since 1960, however, traditional movement patterns did not become reestablished among several subpopulations until recently. We used satellite telemetry with GPS capacity to study three aspects of reestablished Nene movement patterns: seasonal movements in altitude; multi-scale habitat selection; and home range. Many tropical bird species make seasonal movements between elevation zones, hypothesized as a surrogate behavior for latitudinal migration. Nene moved 678 m (95% CI +/- 33) in elevation between seasons on average, from low- and mid-elevation breeding and molting areas in September–April, to remote high-elevation areas during the non-breeding season of May–August in the opposite direction of most tropical bird species. Habitat selection is a central component in understanding important life history dynamics of populations. We determined factors influencing habitat selection by Nene at two scales using binomial Generalized Linear Models. Meso-scale habitat modeling revealed that Nene preferred alien grass and human-modified landscapes while breeding and molting, and native subalpine shrubland during the non-breeding season. The best model supported by QAICc ( $w_i = 0.91$ ) included: season, elevation, distance to water, land cover class, elevation x land cover class, and season x distance to water. Fine-scale habitat modeling included all predictors from the top-ranked meso-scale model and three additional predictors, but yielded little additional resolution. Results were consistent with historical records, although dissimilar from previous habitat preference studies of other subpopulations of Nene. Creating Brownian bridge movement models to identify home ranges of migratory animals throughout their annual cycle is a relatively new technique. Brownian bridge analyses showed well-defined movement routes of multiple subpopulations of Nene along sequential seasonal home ranges between breeding and molting and non-breeding seasons. Previously isolated subpopulations of Nene are using common movement routes and moving seasonally between elevation zones to access preferred habitats. Restoration of endangered tropical bird species throughout their entire altitudinal range may be important for reestablishing traditional movement patterns and appropriate seasonal behaviors.

**F16.3 Correll, Maureen**, (The University of Maine, Orono, United States); Olsen, Brian (University of Maine, Orono, ME, United States); Hodgman, Thomas (Maine Department of Inland Fisheries and Wildlife, Bangor, ME, United States)

#### PREDICTING TIDAL MARSH BIRD POPULATIONS VIA REMOTE SENSING: A POTENTIAL TOOL FOR COASTAL CONSERVATION

Tidal marshes along the northeastern seaboard of the United States are vulnerable to habitat loss due to impacts of human development and climate change, particularly sea-level rise. Obligate and near-obligate tidal marsh breeders such as the Saltmarsh Sparrow (*Ammodramus caudacutus*), Nelson's Sparrow (*A. nelsoni*), and Willet (*Tringa semipalmata*), are especially at risk from the conversion of the high-marsh zone (above the mean high tide line) to low marsh or open water with sea-level rise. Collaborators with the Saltmarsh Habitat and Avian Research Program (SHARP) conducted avian and vegetation surveys ( $n=1660$ ) in the summer of 2011 in selected tidal marshes between the Chesapeake Bay and the Canadian border to collect data on abundance and distribution of tidal marsh birds in the northeast. We then explored the relationship between these data and vegetation index values such as the Normalized Difference Vegetation Index (NDVI), the Normalized Difference Moisture Index (NDMI) and Thematic Mapper (TM) bands from Landsat images collected within the time frame of our surveys. In the analyses conducted to date, we found significant differences in NDVI and NDMI values between survey points where Willets were detected versus survey points where they were not. We also found significant differences in NDVI and NDMI values at survey points where Sharp-tailed Sparrows (Nelson's and Saltmarsh Sparrows) were detected versus points where they were not. These preliminary results are the beginning of a larger analysis to develop a cost-effective tool for use by managers in monitoring marsh-bird populations in the northeast. The analyses proposed here will provide managers with an increased ability to understand and prioritize conservation of northeastern North America's fragile coastal habitat.

#### PS2.236 Cortes-Ramirez, Gala, (UNAM, Mexico, Mexico); ECOMORPHOLOGICAL DISTRIBUTION OF THE TYRANNIDES IN MEXICO

The patterns of disparity of a clade depend on historical and/or environmental factors influencing the life history traits of an organism, promoting the diversification of lineages, and are of major importance for understanding evolutionary processes. In order to explain the patterns of evolution of lineages and to propose scenarios of character evolution, we need to improve the knowledge of how organisms' traits are distributed in the morphological, geographical, and environmental space. Herein, I addressed the question of whether morphological traits in a widely distributed morphologically and ecologically diverse avian clade (the Tyrannides) are more related to geographic barriers or environmental factors. I relate patterns of morphological disparity to geographic and environmental factors in order to explore the proximate mechanisms that may have generated and maintained adaptive variation across clades. I used morphological, ecological, and distributional data of the Tyrannides distributed in Mexico. I examined size and shape variation and analyzed if morphological variation could predict group membership. Then I determined whether each Tyrannides clade differed in environmental space. Finally, I examined the correlation between the morphological and environmental variation. Results showed that group membership cannot be predicted reliably for Mexican Tyrannides under morphological basis, only Tyrannidae/Fluvicolinae differ in environmental space with the other groups and that morphological variation is little correlated with the environmental variation. The ecological variables used in this study does not explain the morphological

variation of Mexican Tyrannides so it may have probably more influence from historical geographic or phylogenetic factors.

**T14.9 Coulton, Daniel,** (Golder Associates Ltd., Yellowknife, Canada); Virgl, John (Golder Associates Ltd., Saskatoon, SK, Canada); English, Colleen (Diavik Diamond Mines, Yellowknife, NW, Canada); Dagenais, Lynnette (Golder Associates Ltd., Saskatoon, SK, Canada)

#### RAPTOR OCCUPANCY AND PRODUCTIVITY NEAR A BARREN-GROUND DIAMOND MINE, NORTHWEST TERRITORIES

We evaluated whether sensory disturbance from two diamond mine developments has resulted in negative impacts to Arctic breeding raptors in the barren-grounds of the Northwest Territories. A total of 20 peregrine falcon (*Falco peregrinus anatum-tundrius* complex), gyrfalcon (*Falco rusticolus*), and rough-legged hawk (*Buteo lagopus*) nests were sampled within 30 km of the EKATI and Diavik diamond mines between 1998 and 2010. These nests were used to test the relationships between nest occupancy and success rates and distance from the mines, weather, and prey abundance. Nest success was also compared to 12 nests monitored over a similar time period in an adjacent, undeveloped area as a relative response control. We also examined whether nest success was correlated with mine activity levels within 7 km of the Diavik mine, which is the noise attenuation distance for jet aircraft traffic at the mine. Model selection results supported a quadratic model that indicated raptor nests within 5.5 km (95% CI: 4.6 to 6.5 km) of the mines were more likely to be occupied. Results for nest success supported negative effects from spring storm rainfall. Nest success and productivity were similar between mine and control areas, and both indicated similar declines in nest success over the study period. Mine activity level was not correlated with the success of nests within 7 km of the Diavik mine. Of factors considered, prey and study year had the largest effect on occupancy and nest success, respectively. Although natural and anthropogenic effects were generally weak and imprecise, the body of evidence suggests that the observed declines in success are more likely the result of natural factors operating at a regional scale than more localized effects due to the presence of development.

**F12.11 Courter, Jason R.,** (Clemson University, Clemson, United States); Johnson, Ron J. (Clemson University, Clemson, SC, United States); Hubbard, Kenneth G. (High Plains Regional Climate Center, Lincoln, NE, United States)

#### PREDICTING AVIAN NESTING DATES USING GROWING DEGREE-DAYS

A major global issue is producing food and fiber for growing human needs while conserving birds and other species that contribute important ecosystem services such as pest suppression, pollination, and value to bird watching. Decision tools are needed to facilitate mutual benefits between farming and birds, especially during critical life cycle stages. 'Growing degree-days (GDD)' is a concept familiar to farmers and based on the principle that accumulated heat units can predict insect and plant development, independent of calendar date. Because of the strong trophic linkage between birds and their food resources, we suspect GDD may also be useful for predicting avian nesting dates. We calculated mean nesting for Eastern Bluebird, House Wren, and Tree Swallow throughout the eastern United States from 2001-2010, using > 20,000 records reported by citizen volunteers through Project NestWatch. We matched mean nesting dates with growing degree-days calculated using base temperatures 5°C and 10°C, and start dates of January 1,

March 1, and a spatially explicit start-of-season date calculated from remotely sensed NDVI data. Preliminary results indicate that growing degree-days predict avian nesting dates at broad spatial scales, and using spatially-explicit start-of-season dates reduces variability. Because plants and insects also respond to temperature, these findings may provide a yardstick of temperature response across trophic levels. Moreover, specific management recommendations to benefit birds could be communicated to farmers on websites that farmers regularly visit for up-to-date pest and crop information. While it is unlikely that most farmers would shift management regimes solely to promote bird conservation, benefits such as enhanced insect suppression and a potential "bird-friendly" farm designation may eventually make such efforts cost effective.

**F9.3 Covino, Kristen,\*** (University of Southern Mississippi, Hattiesburg, United States); Moore, Frank (University of Southern Mississippi, Hattiesburg, United States); Sara, Morris (Canisius College, Buffalo, United States)

#### NOT JUST A BREEDING HORMONE? TESTOSTERONE PRODUCTION IN SONGBIRDS THROUGHOUT SPRING MIGRATION.

If we are to understand the biology of migratory species, we must understand how phases of the annual cycle interact. Testosterone may be an important signal for the onset of vernal migration, and early arriving males on breeding grounds generally have higher circulating androgen levels. We determined testosterone levels for 52 male and 45 female Magnolia Warblers (MAWA; *Setophaga magnolia*) and 30 male and 32 female Northern Waterthrushes (NOWA; *Parkesia noveboracensis*) at two stopover sites representing different distances remaining to the breeding grounds. Testosterone levels were higher at our northern site in male MAWA and NOWA as well as in female MAWA. There were no differences between male and female MAWA within a site, however, male NOWA at our northern site had higher testosterone levels than females at that site. Further, testosterone levels increased over the 40 days in which male NOWA were captured at our southern site. While there was no effect of age on testosterone in NOWA, second-year male MAWA had lower testosterone levels than after-second year males. Testosterone levels seen in this study are higher than generally seen in wintering warblers. Additionally, the levels seen in male NOWA at our northern site are typical of breeding male songbirds. Our study indicates that songbirds are increasing testosterone production throughout spring migration. It is intriguing to consider the role testosterone may play in mediating behavior of en route migrants as they make the transition from spring migration to breeding. Our study also suggests that young birds may be less capable of producing testosterone possibly because they are undertaking the process of gonad re-genesis and hormone production for the first time.

**PS2.133 Cox, James A.,** (Tall Timbers Research Station, Tallahassee, United States); Scopel, Lauren; Matthew, Klostermann (Tall Timbers Research Station, Tallahassee, FL, United States)

#### BROWN-HEADED NUTHATCH OCCUPANCY IN CENTRAL FLORIDA AND ITS RELATIONSHIP TO ENVIRONMENTAL GRADIENTS, FOREST STRUCTURE, AND RED-COCKADED WOODPECKERS

The Brown-headed Nuthatch (*Sitta pusilla*) is listed as a species of conservation concern throughout most of its range. Forest conditions that support the imperiled Red-cockaded Woodpecker (*Picoides borealis*) are thought to provide

excellent habitat for nuthatches, but ambiguity exists because nuthatches have disappeared from some areas where woodpeckers have persisted. We studied Brown-headed Nuthatches in two forest types that spanned an environmental gradient in central Florida and also differed in terms of forest structure and the presence of woodpeckers. Sandhill forests had mature timber that supported a large woodpecker population (ca. 70 territories); flatwood forests were dominated by younger pines and supported no Red-cockaded Woodpeckers. Repeated surveys incorporating playback vocalizations were used with patch-occupancy analysis to assess variation in nuthatch occupancy and detection in relation to forest type, four structural covariates (snag density, pine and hardwood basal area, and pine diameter), and proximity to Red-cockaded Woodpecker territories. Occupancy and detection varied in relation to forest type and pine basal area in our best model. Occupancy and detection probabilities were higher in the younger flatwood forests and averaged 0.96 (SE = 0.07) and 0.75 (SE = 0.05) as compared to 0.56 (SE = 0.27) and 0.37 (SE = 0.04), respectively, in older sandhill forests. Occupancy and detection were not influenced by proximity to Red-cockaded Woodpecker territories. The higher encounter rates observed for younger flatwood forests likely stemmed from differences in habitat quality, while variation attributable to forest structure and woodpecker distributions warrants further study.

**F12.7 Cox, W. Andrew**, (University of Missouri, Columbia, United States); Thompson, Frank (U.S.D.A. Forest Service Northern Research Station, Columbia, MO, United States); Faaborg, John (University of Missouri, Columbia, MO, United States); Reidy, Jennifer (University of Missouri, Columbia, United States)

#### HIGH TEMPERATURES REDUCE AVIAN PRODUCTIVITY IN HIGH QUALITY HABITAT

Increased temperatures and weather patterns associated with global climate change can interact with other factors that regulate animal populations, but many climate change studies do not incorporate other threats to wildlife in their analyses. We used 20 years of nest monitoring data from study sites across a gradient of forest fragmentation in Missouri, USA, to investigate the relative influence of climatic variables (temperature and precipitation) and landscape factors (forest cover and edge density) on nest survival, fledging success, and productivity per nest attempt for three species of songbirds. Model-selection results indicated that increased landscape forest cover and decreased edge density generally increased nest survival for survival for Acadian Flycatchers (*Empidonax vireescens*) and Indigo Buntings (*Passerina cyanea*), whereas Northern Cardinal (*Cardinalis cardinalis*) nest survival exhibited a strong landscape  $\times$  edge density interaction. Typical precipitation levels had a marginal influence on nest survival for all three species, but survival was lower at extreme precipitation values for flycatchers and buntings. Fledging success of flycatchers and buntings declined with decreased landscape forest cover largely because of brood parasitism, but cardinal fledging success was not associated with forest cover. Productivity per nest attempt exhibited a strong forest cover  $\times$  temperature interaction. Greater forest cover resulted in greater productivity per nest attempt for two of three species, but greater temperatures reduced productivity in highly forested landscapes but had no effect in less forested landscapes. Our results underline the difficulty of managing wildlife in response to global change such as forest fragmentation and climate warming, as the most productive habitat for flycatchers and buntings was also that most negatively influenced by high temperatures.

**SAT11.5 Cracraft, Joel**, (American Museum of Natural History, New York, United States);

#### HOW TO CLASSIFY BIRDS: THE HOWARD & MOORE CHECKLIST OF BIRDS

Classifications are information systems. Their hierarchical structure communicates information about phylogenetic relationships. Relationships, in turn, are predictive about the biology of the included taxa. Although classifications have fallen out of favor with many investigators whose major interests are reconstructing phylogenetic relationships, how we represent those relationships in classifications is still important for a very broad user community of ornithologists, including professionals and nonprofessionals, in providing a comparative, organizing framework for their activities. The Howard & Moore Complete Checklist of the Birds of the World is the premier, authoritative list of avian diversity, and a new edition will be available within a year. Over the last decade we have witnessed huge advances in our knowledge of higher-level avian relationships. There are many ways to reflect this new knowledge in classifications. How we might do this and still make the classification most useful to the ornithological community is a major challenge. This talk reviews some of those challenges and discusses how the taxonomic arrangement of the Checklist will reflect this new knowledge and yet still continue to be a new, but familiar, resource for predictive, comparative studies of avian biology.

**SAT17.3 Craig, Catherine**, (Acadia University, Wolfville, Canada); Villard, Marc-André (Université de Moncton, Moncton, NB, Canada); Taylor, Phil (Acadia University, Wolfville, NS, Canada)

#### MULTI-SCALE HABITAT SELECTION AND NEST SUCCESS OF BLACK-BACKED AND AMERICAN THREE-TOED WOODPECKERS IN MANAGED, CONIFER FORESTS OF NORTHERN NEW BRUNSWICK

Timber harvesting alters the distribution of habitat types across a landscape, typically replacing old forest stands with younger ones and reducing amounts of dead wood. In the highlands of northern New Brunswick, Black-backed and American Three-toed Woodpeckers are expected to be especially sensitive to forest management due to their dependence on dead wood. In this study, we 1) quantified the characteristics of habitat selected by Black-backed and American Three-toed Woodpeckers during the breeding season; 2) related nest success of these species to those habitat characteristics; and 3) investigated differences in habitat selection and nest success between the two species. We found 36 nests, 24 (67%) of which were located within or at the edge of variable retention cutblocks. Logistic regression models provided evidence for an effect of nest location on success; nests situated in or at the edge of cutblocks were more likely to fledge young than those located in unharvested forest (79% versus 50%). There was no evidence that this differed between the two species, although the sample size is small for American Three-toed Woodpecker (n=12). Foraging by both species took place almost exclusively within unharvested forest. These findings indicate that while cutblocks can provide successful nest sites, they are always located near unharvested, mature forest, which provides important foraging habitat. Reasons for the apparent success of nests located within or near cutblocks are currently unknown.

**W14.5 Craig, Elizabeth**, (Cornell University, Ithaca, United States); King, Tommy (United States Department of Agriculture, Mississippi State, MS, United States); Elbin, Susan (New York City Audubon, New York, NY, United States);



Sparks, Jed; Curtis, Paul (Cornell University, Ithaca, NY, United States)

#### DO WINTER FORAGING DECISIONS AFFECT BREEDING CONDITION OF DOUBLE-CRESTED CORMORANTS? EXPLORING SEASONAL INTERACTIONS IN A MIGRATORY WATERBIRD.

The reproductive success (fitness) of an animal depends on its ability to survive and reproduce, and may be influenced by factors affecting its physical condition throughout all times of the year. However studies of migratory animals are highly skewed towards observations during the breeding season only. This bias has left a large gap in our understanding of factors influencing fitness in migratory animals. This study seeks to address this issue by exploring the relationship between winter foraging decisions and body condition in a migratory waterbird, the Double-crested Cormorant (*Phalacrocorax auritus*). Using a novel tri-isotope approach ( $\delta^{15}\text{N}$ ,  $\delta^{13}\text{C}$  and  $\delta^{34}\text{S}$ ) we can unambiguously identify the type of aquatic habitat (aquaculture, marine, or natural freshwater) in which adult cormorants forage in winter. We measured the isotopic signatures of these elements in feathers grown during the winter (nuptial crests) in both wintering and breeding birds. Winter samples were collected from birds captured on aquaculture ponds, marine habitats, and natural freshwater habitats in Mississippi and Alabama. Breeding season samples were collected from birds near breeding colonies on the Atlantic Coast, Lake Champlain, Eastern Lake Ontario, Western Lake Erie, and Lake Michigan. Principal component analysis was used to create an index of body condition. Body condition varied significantly among wintering and breeding locations ( $p$ -value = 0.0023 and <0.0001 respectively). Within breeding locations, winter foraging habitat significantly influenced body condition as well. Foraging decisions made on the wintering grounds influence summer body condition, indicating that seasonal interactions play an important role in the life history of this migratory species.

**T14.7 Craig, Erica**, (Aquila Environmental, Fairbanks, United States); Craig, Timothy (USF&WS, Kanuti National Wildlife Refuge, Fairbanks, United States); Fuller, Mark (USGS, Forest and Rangeland Ecosystem Science Center, Boise, United States); Craig, Heather (Dept. of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, United States)

#### USE OF PREDICTIVE MODELS TO DESCRIBE GOLDEN EAGLE WINTER DISTRIBUTION IN THE WESTERN UNITED STATES RELATIVE TO WIND-POWER DEVELOPMENT PROJECTS

In some areas, blade strikes at wind-power facilities are a major source of mortality for golden eagles, *Aquila chrysaetos*. Rapid expansion of renewable energy development within the range of the golden eagle is occurring at the same time that other anthropogenic changes, wildfires, invasive plants, drought, and climate change are altering the eagles' native habitats on an unprecedented scale. However, the potential effects of any of these factors on continental golden eagle populations and the current status of the species is unknown. It is particularly difficult to evaluate potential effects of wind-power facilities on wintering eagles because there is little information about winter use and distribution patterns. We present preliminary results of predictive models for golden eagle winter distribution in Idaho, Oregon, Utah and Nevada. The models were developed using historical golden eagle winter records derived from multiple sources, environmental GIS layers, and stochastic gradient boosting. We evaluate model accuracy using external, independent data, and we identify factors having the greatest influence on predicting eagle winter distribution. Our model

results can be useful for: 1) helping to identify important golden eagle winter use areas, 2) identifying potential areas of greatest likely conflict between wintering eagles and proposed development projects, 3) providing information useful for analysis of cumulative risks to wintering eagles, and 4) highlighting potential areas in need of additional research at other spatial scales.

**PS2.164 Craig, Heather R**, (Department of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, United States); Powell, Abby (U.S. Geological Survey, Alaska Cooperative Fish and Wildlife Research Unit, University of Alaska Fairbanks, Fairbanks, AK, United States); Kendall, Steve (Hakalau Forest National Wildlife Refuge, Hilo, HI, United States); Wild, Teri (Department of Biology and Wildlife, University of Alaska Fairbanks, Fairbanks, AK, United States)

#### EFFECTS OF SEX AND AGE ON SURVIVAL OF SMITH'S LONGSPURS IN NORTHERN ALASKA

Very little is known about survival of Smith's Longspurs (*Calcarius pictus*). They are a species of conservation concern in Alaska, thus accurate estimates of annual survival are important for conservation and management plans for the species. We captured adult birds (42 males, 31 females) using mist nets and individually color-banded them from 2007-2011 in Atigun Gorge in the Brooks Range. Nestlings ( $n = 163$ ) were captured on nests and marked with cohort color bands. We resighted banded birds during breeding seasons following their initial banding. Program MARK was used to determine the influence of age and sex on apparent survival. The data presented here are preliminary results; banding and resighting efforts are ongoing. The top model suggested no difference between apparent survival of breeding males and females, with an overall survival estimate of 0.60 (95% CI: 0.46 - 0.72). The encounter probability for adults varied among years, probably due to differences in capture and resight efforts. Maximum longevity observed for females was at least 6 years, while for males observed longevity was at least 5 years. Only 10 hatch-year birds were resighted during subsequent years; estimated survival was about half that of adults, at 0.35 (95% CI: 0.11 - 0.70). Contrary to most passerine survival patterns, where male mortality is higher, we suggest that the Smith's Longspurs polygynandrous breeding strategy and increased male parental investment lowers male survivability, leading to relatively equal mortality rates between sexes. Additionally, overall survival of adults and hatch-years were fairly consistent with estimates from other passerines.

**W16.4 Crampton, Lisa**, (Hawaii Division of Forestry & Wildlife, Pacific Cooperative Studies Unit, Hanapepe, United States); Brink, Kevin; Camp, Richard; Gorresen, Marcos (University of Hawaii, Hilo, Hawaii National Park, HI, United States); Heindl, Barbara (Hawaii Division of Forestry & Wildlife, Pacific Cooperative Studies Unit, Hanapepe, HI, United States)

#### OCCUPANCY SURVEYS FOR A CRITICALLY ENDANGERED, HIGHLY CRYPTIC, SINGLE ISLAND ENDEMIC, THE PUAIOHI

The federally endangered Puaiohi is endemic to Kauai and is thought to number between 200-800 individuals. The species is cryptic and restricted to deeply incised, meandering streams, and using standardized point transect surveys to determine abundance and distribution is problematic. Here we describe the development of a survey technique based on occupancy analysis to improve accuracy and precision of population estimates, and

report preliminary estimates from two years of range-wide surveys. In the pilot year (2011), we established 20 stations along each of five streams; three with high Puaiohi density and two with low density. We surveyed each station six times during the breeding season. Each 17.5 minute survey consisted of two 4-minute "base" count periods and an 8.5 minute count period consisting of three 30-s playbacks of Puaiohi vocalizations interspersed with silence to determine whether playback improved detection. In each period we recorded any Puaiohi detected and noted if it was detected previously. Analyses indicated that 1) more detections occurred in the first base period than the second, 2) compared to base periods, playback increased detection probability by 5%, and 3) detection increased with additional visits until the 5th visit. Based on these results, we refined the protocol, and in 2012 we surveyed two low and three high density streams, resurveying one high density stream to control for temporal variability. We then estimated occupancy probability of high and low density streams and used this estimate as well as habitat information to produce a preliminary model of Puaiohi population size and distribution.

**PS2.155 Crandall, Ross**, (Craighead Beringia South, Missoula, Canada); Bedrosian, Bryan; Craighead, Derek (Craighead Beringia South, Kelly, Canada)

#### DETERMINING INFLUENCE OF LANDSCAPE CHANGE ON A BREEDING GOLDEN EAGLE POPULATION IN SOUTH CENTRAL MONTANA

Golden Eagles (*Aquila chrysaetos*) in the western U.S.A. have received increased attention due to an apparent decline in the number of annual migrants and expected increased risk from energy development. Factors influencing the negative trend in migrating Golden Eagles are unknown and it remains unclear if this trend is indicative of a declining population or changes in migratory behavior. Unlike Golden Eagles nesting in higher latitudes, resident birds that breed in the western U.S.A. are typically non-migratory or do not follow typical migratory pathways. Unfortunately, long-term research focused on resident, breeding Golden Eagles in this region is rare and sorely needed to assess the status of the population as a whole. Beginning in 2010, we revisited a historically surveyed study site in south central Montana to compare the current status of the Golden Eagle breeding population to that from the 1960's. Since the 1960's this area has undergone increased rural development, changes in land use and an increased human population. Contrary to our predictions, we have documented a near 100% occupancy rate of historic territories and a marked increase in the overall number of breeding pairs. In addition, the overall number of young has not changed resulting in a decline in the overall productivity rate. To investigate this variation further we examined the degree of landscape change and influence of environmental factors on breeding Golden Eagle density and productivity. The longevity of data collected in this study area allows for one of the longest-term comparisons of Golden Eagle nesting density and success in the West and provides invaluable insight into the landscape factors responsible for influencing breeding Golden Eagle populations.

**PS1.161 Crewe, Tara**, (Bird Studies Canada, Port Rowan, Canada); Hudson, Marie-Anne (Environment Canada, Ottawa, ON, Canada); Gahbauer, Marcel (McGill Bird Observatory, Ste-Anne-de-Bellevue, PQ, Canada); Camfield, Alaine (Environment Canada, Gatineau, PQ, Canada); Mackenzie, Stuart (Long Point Bird Observatory, Port Rowan, ON, Canada)  
THE CANADIAN MIGRATION MONITORING NETWORK  
- RÉSEAU CANADIEN DE SURVEILLANCE DES

#### MIGRATIONS: ADVANCING MIGRATORY BIRD RESEARCH ACROSS CANADA.

The Canadian Migration Monitoring Network - Réseau canadien de surveillance des migrations (CMMN-RCSM) was formed in 1998 as a cooperative venture among a dozen independent bird observatories with migration monitoring programs, Bird Studies Canada and Environment Canada's Canadian Wildlife Service. The network has since expanded to more than 25 independent bird observatories across Canada, monitoring over 375 species annually, many of which breed in Canada's boreal and tundra regions that are poorly monitored by the Breeding Bird Survey. As a large-scale collaborative network, CMMN-RCSM is uniquely positioned to contribute to the understanding of various aspects of bird migration at a national scale. These include effects of weather and climate change on bird migration, stop-over ecology, timing of migration (e.g. chronology/phenology), as well as energetics, physiology, disease, productivity and survival of birds. CMMN-RCSM has recently participated in four collaborative national research projects: 1) contributing to the DNA barcoding of North American species, 2) contributing to modelling the spread of infectious disease into Canada through tick-borne vectors, 3) delineating catchment basins and place of origin of Canadian birds based on their isotopic signature, and 4) calculating trends in migratory bird populations across Canada. Trends were calculated for 14 stations with at least 10-years of data; Prairie and Eastern regions showed predominantly declining populations for all species guilds examined, whereas Ontario and Western regions showed predominantly increasing populations. Summarizing across Canada, about half of the species in most landbird guilds showed population increases, while the other half showed population declines. A better understanding of how regional population trends relate to specific geographical regions and overall national trends is a priority for the CMMN-RCSM. An upcoming synthesis of feather isotope analysis paired with band recovery data will strengthen our ability to do so. Additional collaborations among CMMN-RCSM members and with outside partners are being pursued to improve our understanding of the movement and population dynamics of Canada's birds.

**W16.2 Crewe, Tara**, (University of Western Ontario, London, Canada); Taylor, Phil (Acadia University, Wolfville, NS, Canada)

#### EFFECT OF RANDOM VARIATION AND SAMPLING INTENSITY ON THE USE OF RAPTOR MIGRATION COUNT DATA FOR POPULATION MONITORING

Long-term population monitoring often provides a first indication of population change, leading to directed research on why changes are occurring. For raptors that migrate seasonally between breeding and wintering habitats, hourly counts of individuals passing through stationary sites during migration provide an important source of data on population change. The use of hourly counts to estimate population change relies on the assumption that counts are a consistent and representative sample of the migratory population. However, many factors unrelated to real population change, including the influence of spatial variation in migration route and of sampling intensity on detection, can influence migration counts at a site, and therefore our ability to reliably estimate population change. We used simulated raptor migration count data to test how random variation in migration counts influences our ability to recover long-term population change (30% in ten years, or -3.89%/year), and how the accuracy and precision of population estimates are influenced by sampling intensity (e.g., daily vs. weekend sampling). Data were simulated to represent a range in annual, daily and hourly variation observed in Broad-winged Hawk

(super-flocking), Sharp-shinned Hawk (SSHA; common) and Merlin (rare) data observed at several north-eastern North American hawk watch sites (3 species \* 4 levels variation \* 1000 simulations = 12000 datasets). Model fit was compared among Generalized Linear Models with Poisson and negative binomial distributions, and Generalized Linear Mixed Models (GLMM) with Poisson and over-dispersed Poisson distributions using AIC, which suggested over-dispersed Poisson GLMMs provided the best fit for all species and variance levels (98% of simulations). Surprisingly, sub-setting daily data to weekends only (a 5/7 reduction) resulted in only a slight reduction in precision of trend estimation. For example, for 1000 SSHA simulations with high annual/daily variation, mean (std.dev.) trend estimate was -3.4%/year (0.07) for daily sampling and -3.4%/year (0.09) for weekend sampling. As expected, probability of detecting a significant trend declined from 0.21 to 0.17. This suggests that on average the population signal (direction and magnitude) of change is not greatly impacted by a reduction in sampling intensity, but the probability of detecting a significant change is.

**PS2.199 Crimmins, Theresa**, (USA-National Phenology Network, Tucson, United States); Kellermann, Jherime; Weltzin, Jake (USA-National Phenology Network, Tucson, United States)

#### A BIRD'S EYE VIEW OF THE USA NATIONAL PHENOLOGY NETWORK: EXPANDING THE SCALE OF PHENOLOGICAL RESEARCH IN AVIAN ECOLOGY

Phenology, the timing of life cycle events, is highly sensitive to environmental variation and thus provides a valuable index for assessing ecological impacts of climate change. However, these impacts are not uniform across species or biogeographic regions. Forecast models of ecological effects of climate change will require high-quality continent-wide data at unprecedented scales. The USA National Phenology Network (USA-NPN, [usanpn.org](http://usanpn.org)) was created to monitor and understand the influence of climate on the phenology of plants, animals, and landscapes through Nature's Notebook, a nationwide observation program providing protocols for recording phenological events, coupled to an online data clearinghouse and National Phenology Database (NPDb) for the entry, storage, and dissemination of current and historical phenological information. The USA-NPN is comprised of federal and state agencies, universities, NGOs, and volunteers working to develop decision support tools on critical environmental concerns affected by environmental change including ecosystem management, agricultural production, and public health. Although phenology has long been recognized as an important component of avian ecology, many projects still do not gather phenological data on habitat and resources. The phenology data available in Nature's Notebook can be a vital resource for ornithological scientists wishing to include phenological data in their research and analyses. Data on phenological synchronies of plants and animals at or across project-specific study sites add significant insight into analytical models containing avian response variables (e.g., local abundance, nest date and success, productivity and survival) and explanatory covariates (e.g., vegetation community composition and structure, disturbance events, and climate). Further, integration of project data into the NPDb may facilitate ecological inference at larger spatial and temporal scales and extents. The data housed in the NPDb can be integrated with other large public databases such as eBird ([ebird.org](http://ebird.org)) to assess continental scale dynamics. We provide a summary of the nearly one million records on over 700 plant and animal species currently housed in the NPDb and summarize an analysis examining leaf out in deciduous tree

species (from the NPDb) and bird migration (from eBird) in response to an anomalously warm spring in 2010 in the northeast United States.

**T16.9 Cruz, Luis**, (University of Calgary, Calgary, Canada); Smits, Judit (University of Calgary, Calgary, AB, Canada)

#### EMISSIONS FROM THE ATHABASCA OIL SANDS AND THEIR EFFECTS ON WILD BIRDS

The oil sands in western Canada represent the world's second largest reserve of crude oil. The processing of oil produces contaminants in the form of liquid tailings and emissions. While birds are more susceptible to airborne contaminants than mammals and may be at higher risk of exposure, the impact of emissions has been largely neglected. We are investigating the toxicity from exposure to oil sands-related emissions on free-living American kestrels (*Falco sparverius*), with initial experimental studies in captive birds. We exposed Japanese quail (*Coturnix japonica*) (control, low and high dose exposures) and American kestrels (control and exposed groups) to environmentally relevant mixtures and concentrations of inhaled benzene, toluene, nitrogen dioxide and sulphur dioxide for 2 hrs/day 5 days/wk / 5 wks. We evaluated the birds' physiological, immunological and stress responses. Results to date show that quail in the high exposure group were heavier compared to controls ( $p=0.01$ ), and no significant differences were found on the T cell phytohemagglutinin skin test, although there was a trend towards a stronger response in the exposed groups. Kestrels in the exposed group had increased relative liver weights ( $p=0.003$ ). The chronic stress response is being evaluated by measuring corticosterone concentrations in feather tissue grown during the exposure periods. Results of this procedure along with updates of the project field studies will be presented. The fast development of the oil sands makes it imperative to assess the health of wild avifauna since the region's boreal forests provide important breeding sites for migratory and local bird species.

**F11.5 Cruz-Nieto, Javier**, (ITESM, Monterrey, Mexico); Ortiz-Maciel, Sonia Gabriela; Torres Gonzalez, Luz F. (ITESM, Monterrey, NL, Mexico)

#### NESTING CHARACTERIZATION AND REPRODUCTIVE BIOLOGY OF THICK-BILLED PARROT (*RHYNCHOPSITTA PACHYRHYNCHA*) IN FIVE REGIONS OF SIERRA MADRE OCCIDENTAL, CHIHUAHUA, MEXICO

Thick-billed Parrot (*Rynchopsitta pachyrhyncha*) is an endangered and endemic species inhabits temperate forests of Sierra Madre Occidental in Mexico, nests in trees at high altitudes in Chihuahua state. We have documented and analyzed structure changes in nesting trees, due systematic productivity studies of this species during 17 years in five nesting areas: Tutuaca, Madera, Mesa de las Guacamayas, Campo Verde and Papigochic. Statistical analysis indicated no significant differences in the proportion of fledglings per laid eggs at the five nesting areas. However we found significant differences among different years in proportion of fledglings per hatched eggs for these five areas. Madera represented the nesting area with the highest non hatched eggs with 28%. 1999 and 2000 represented the years with the lowest productivity for all nesting sites. We documented changes in nesting trees structure, when comparing historic data on nests trees species and its status (dead or alive) we observed significant differences, almost 30 years ago snags and big pines represented the most used for nesting, nowadays Thick-billed Parrots use more aspen, alive and narrow trees for nesting, this situation can be due to species

adaptability to forest changes, which represents a challenge and an opportunity to save this unique and endangered bird.

**T1.1 Cuervo, Andres M.,\*** (Louisiana State University, Baton Rouge, United States); **Brumfield, Robb T.** (Louisiana State University, Baton Rouge, LA, United States)

#### EVOLUTIONARY ASSEMBLY OF THE ANDEAN AVIFAUNA: A COMPARATIVE PHYLOGEOGRAPHIC STUDY OF DIVERSIFICATION AND ELEVATIONAL DISTRIBUTION

The species-rich avifauna of the Neotropical cloud forests has long fascinated ornithologists, yet the fundamental evolutionary and ecological mechanisms that underlie its diversity remain poorly understood. We investigated the evolutionary assembly of the Andean avifauna, with an emphasis on examining the geographic and temporal mode of lineage accumulation and diversification, and testing the contribution of elevational zonation and physical barriers in shaping genetic differentiation. First, we elucidated common phylogeographic patterns in 40 bird species with dense sampling across their range. To do this we sequenced mitochondrial DNA for over 3,400 specimens and implemented a statistical phylogeographic framework to test different hypothesis of congruence among species histories. Second, we tested for associations between genetic differentiation and elevational range by estimating divergence between communities on opposite sides of major barriers and along the elevational gradient. To do this, we sequenced over 2,700 specimens collected along elevational transects (1000-3100 m) on both sides of a number of Andean barriers and representing over 120 species. Overall, we found remarkable phylogeographic structure in the 40 co-distributed Andean species. Although a few common geographic themes were shared among a number of species when considered at a large spatial scale (e.g. north-to-south differentiation), there was substantial variation among species in the timing of divergence, as well as in the spatial pattern when examined at a finer scale. The amount of genetic divergence between populations examined in the multi-species analysis was correlated positively with mean elevation, and negatively with the amplitude of elevational distribution. There was a large amount of variation in the divergence exhibited by any one species when examined in different parts of its range. That there is variation in the species pool diverging at different biogeographic breaks along the Andes results from an interplay among idiosyncratic dynamics of individual species histories (e.g. local extinction and recolonization) and the time since that species has occurred in an avifauna at a given region. The present-day cloud forest Andean avifauna is the result of constant flux of lineages and ongoing diversification, where the effect of physical barriers is modulated by zonation of bird distributions along elevational gradients.

**SAT14.7 Culp, Leah,** (University of Maine, Silver Spring, United States); **O'Brien, Kathleen** (Rachel Carson National Wildlife Refuge, Wells, ME, United States); **Hodgman, Thomas** (Maine Department of Inland Fisheries and Wildlife, Bangor, ME, United States); **Olsen, Brian;** **Glanz, William** (University of Maine, Orono, ME, United States)

#### ROADS IN TIDAL SALT MARSHES: ARE TIDAL RESTRICTIONS A CONCERN FOR NESTING SHARP-TAILED SPARROWS?

Even seemingly minor habitat modification may have negative consequences for tidal marsh denizens like the sharp-tailed sparrow (*Ammodramus caudatus* and *A. nelsoni subvirgatus*). Roads and bridges that bisect marshes restrict tidal flow and

alter natural hydrology. Their removal is currently under consideration by land managers. We investigated sharp-tailed sparrow habitat quality (use, nest flooding, and daily nest survival) on state and federal lands in two tidally restricted salt marshes and two unrestricted marshes in Maine, USA. Restrictions were categorized as moderate ( $\geq 25$  m wide and no additional downriver restriction) and severe (3 m wide and one additional downriver restriction). On restricted rivers, flooding of available high marsh habitat was reduced by 50% above severe two-road restriction. However, use by nesting sparrows was highest downriver, above one moderate restriction. Flooding of nests did not differ between restricted and unrestricted marshes or between low and high river reaches. Nest survival also did not differ between restricted and unrestricted marshes but did vary by distance upriver. On low reaches, timing of clutch completion relative to spring tide cycle was a significant predictor of nest survival (survival probability decreased by 34% for every day clutch completion was delayed past peak high tide). On high reaches, timing was less important (probability decreased by 4% for every day of delay). These relationships were the same regardless of restriction. Precipitation increased flooding of available habitat and was correlated with lower probability of nest survival (although not nest flooding). Our results suggest that on the restricted rivers presented here, areas above one moderate tidal restriction may be of higher quality than areas located below restriction or areas located above more severe two-road restriction. The negative effect of precipitation on nest survival suggests sharp-tailed sparrows may be highly vulnerable to global climate change. In addition to rising sea levels, which are predicted to reduce sparrow nesting habitat, climate change is also expected to increase storm intensity and frequency in the Northeast, USA. In the face of changing climate and hydrology, managers should consider carefully before removing tidal restrictions such as those included in this study. Moderate tidal restriction may preserve sharp-tailed sparrow nesting habitat, while more severe restriction appears to have some negative impacts.

**S1.6 Cumming, Steven,** (Université Laval, Québec, Canada); **Schmiegelow, Fiona** (University of Alberta, Edmonton, AB, Canada)

#### INTEGRATING AVIAN HABITAT MODELS AND CONSERVATION PLANNING ACROSS NORTH AMERICA'S BOREAL FOREST.

Spatially extensive datasets of songbirds and waterfowl are now routinely synthesised into species distribution models (SDMs) to generate maps e.g. of predicted species densities. Developments in systematic conservation planning enable the design of representative conservation networks over large areas such as the Canadian boreal region. The same spatial data types are used as SDM covariates and as ecological representation criteria, namely remote sensed products (e.g. landcover and productivity) and interpolated climate data; it is easy to see how the two domains might be bridged by reconciling covariate sets. However, the continental scale of forest management in the Canadian boreal poses challenges in a third domain. Effective conservation must consider the economic costs of fully or partially protected areas, the contribution of "the matrix" to conservation objectives, and the dynamics of both natural and managed forests. This requires SDMs that are sensitive to forest management, and tools that integrate conservation strategies across both natural and managed forests so as to project management actions and ecosystem responses. This depends on SDM using only projectable climate and vegetation data. We present a national spatial simulation framework designed to integrate conservation planning, forest management and avian

SDMs, based on a new national assemblage of forestry data, and illustrate its application to a SDM for Canada Warbler. We remark on the new sensitivities required of SDMs to capture spatial processes, the challenges of projecting vegetation dynamics, and the potential of this approach to support adaptive strategies.

**PS2.232 Cunningham, James**, (Dominican Univ. of California, San Rafael, United States);

VARIATION IN THE RAINCALLS OF NEW ZEALAND CHAFFINCHES (*FRINGILLA COELEBS*)

The Chaffinch (*Fringilla coelebs*) is a native songbird of Europe, North Africa, and Central Asia. The species was first introduced into New Zealand in 1892 by local Acclimatization Societies and today is one of New Zealand's most widespread species being found in urban, agricultural and native and non-native forests. In addition to songs, male Chaffinches also produce single syllable calls or "raincalls". Although raincall variation has been studied extensively in Europe, at present little is known about its variation in an isolated introduced population like New Zealand. To correct this we undertook an investigation of variation of raincalls throughout the South Island of New Zealand. All recordings used in this investigation were made using a parabolic dish and a Marantz cassette tape recorder. Raincalls were analyzed sonographically using the sound analysis software RAVEN. Our recordings were made from 1981 - 1983 and also 2007. We describe how raincalls vary throughout the South Island and compare this variation with that found in Europe. South Island raincalls are much less variable than these calls in Europe. We also found that at least in one location raincall structure was stable over a 24 year period.

**PS1.134 Cunningham, Jenny**, (University of Missouri - Columbia, Columbia, United States); Kesler, Dylan (University of Missouri - Columbia, Columbia, MO, United States); Lanctot, Richard (U.S. Fisheries and Wildlife Service, Anchorage, AK, United States)

EFFECTS OF EXPERIENCE ON MALE AND FEMALE BREEDING HABITAT SELECTION IN ARCTIC-BREEDING SHOREBIRDS

Breeding habitat selection in birds results from a series of innate and learned choices intended to maximize reproductive success. In many species, reproductive outcome of one breeding season can affect choices made in the next, specifically the choices to remain faithful to mate and site. In territorial, monogamous species, males and females play different roles in establishing the location of their nest-site, and dispersal or divorce may result in a change in habitat selection for individuals of each sex. To better understand the differing roles males and females play in breeding habitat selection, we examined marked populations of Dunlin (*Calidris alpina*) and Semipalmated Sandpiper (*Calidris pusilla*) over seven seasons at a breeding site in Barrow, AK. Nests within fixed study plots were located and monitored over nine seasons and adults were trapped and banded (Dunlin=445, Semipalmated Sandpiper=324). Nests of returning birds were noted and individuals granted a status of 'faithful male', 'faithful female', 'divorced male', and 'divorced female'. Satellite photographs, a digital land-cover classification map, and extensive ground-surveys of the study plots were used to attribute habitat information to nests. Habitat data from nests of individuals will be fitted to models that indicate how status affects change in nest-site habitat between years. This study is part of a larger investigation on the multiple parameters influencing shorebird nest-site selection in the Arctic. Results of this study will inform how nesting shorebirds may react to a

changing Arctic landscape and assist in future management decisions of this essential breeding habitat.

**PS1.111 Curry, Claire**, (Department of Zoology, University of Oklahoma, Norman, United States); Patten, Michael (Oklahoma Biological Survey, University of Oklahoma, Norman, OK, United States)

EVOLUTION OF SONG VARIATION ACROSS A COMPLEX HYBRID ZONE IN TUFTED AND BLACK-CRESTED TITMICE

Hybrid zones are excellent systems in which to study mechanisms involved in the evolution of reproductive isolation and how intrinsic and extrinsic factors affect selection across gradients. The objective of this study is to examine natural and sexual selection pressures driving the song differences across a hybrid zone between two passerine sister species, Tufted (*Baeolophus bicolor*) and Black-crested (*B. atricristatus*) titmice, which interbreed extensively in an older zone in Texas and a younger zone in Oklahoma. To examine why songs differ across these hybrid zones, we recorded songs, measured vegetation structure to test the acoustic adaptation hypothesis; measured three beak dimensions to test for morphological constraints; and conducted male playback experiments with conspecific and heterospecific song. Frequency, phrase spacing, and phrase length change in songs across the younger hybrid zone, while frequency, number of phrases per song, and notes per phrase change across the older hybrid zone. Vegetation structure is correlated with two characteristics predicted to change by the acoustic adaptation hypothesis. Beak dimensions correlate with song characteristics predicted to be morphologically constrained but explain only a small amount of variance, indicating they may only influence individual variation. Black-crested time to first response is not correlated with distance to other Black-crested songs only nor for responses to both species. Tufted Titmouse response does not change with distance for Tufted songs only nor for responses to both species. The disparity in song characteristics between the two regions suggests differences in selection pressures over time since contact or different environmental selection in each region. Although we did not find a significant change in response to playback with distance, a priori power analysis estimated a larger sample size will be needed. If male agonistic behavior still shows no relationship with distance or species after additional data collection, female mate choice may still differ in a future planned experiment. Continued lack of differences in response would indicate other mechanisms, such as ecological specialization or plumage-based species recognition, are maintaining this hybrid zone.

**SAT11.7 DaCosta, Jeffrey**, (Boston University, Boston, United States); Sorenson, Michael (Boston University, Boston, MA, United States)

RAD PHYLOGENETICS: HARNESSING NEXT-GENERATION SEQUENCING FOR MOLECULAR SYSTEMATICS OF PARASITIC FINCHES (VIDUIDAE)

Recent theoretical, simulation, and empirical studies have highlighted the likelihood of inconsistencies between gene trees and species trees, and have stimulated a philosophical shift in molecular phylogenetics. Researchers have developed a greater appreciation for the effects of stochastic lineage sorting above the population level and there is now a trend towards multi-locus data sets and more sophisticated analytical methods for estimating species trees while accounting for genealogical stochasticity. Despite this trend, the field has been slow to harness the power of next-generation sequencing technology to

produce massive data sets and greatly increase phylogenetic signal. One major hurdle in this endeavor is the need to sequence homologous loci across samples from different taxa in an efficient and cost-effective way. A recently developed method combines the functionality of restriction enzymes with the power of next-generation sequencing to recover broadly overlapping sets of thousands of loci in multiple samples by sequencing restriction-site associated DNA (RAD) markers. RAD sequencing is a cost-effective tool that can produce massive data sets, and since it requires no advance knowledge of genome sequence for primer/probe design it can be applied to almost any organism. The utility of this new method in population-level analyses has been demonstrated, but it also holds promise for species-level phylogenetic analyses. Here we explore the utility of RAD sequencing for estimating phylogenetic relationships among parasitic finches (family Viduidae), which comprise 19 *Vidua* species (indigobirds and whydahs) and the monotypic *Anomalospiza* (cuckoo finch). In an mtDNA phylogeny of the family, the basal nodes within *Vidua* are poorly resolved, reflecting short internal branch lengths and resulting in a polytomy of four main lineages. Using RADseq we identified ~2400 loci that were variable, mapped to a single location in the zebra finch genome, and produced genotypes for all 14 sampled species. Using these data, we explored methods to infer phylogenetic relationships with thousands of loci and tested the phylogenetic utility of RAD markers in resolving relationships within *Vidua*. We also measured the “decay” of shared RAD loci with increasing evolutionary divergence.

**PS1.145 Dale, Brenda**, (Environment Canada, Edmonton, Canada); Wiens, Trevor (Apropos Consulting, Calgary, AB, Canada)

#### DOES DISTANCE TO WETLANDS INFLUENCE UPLAND GRASSLAND BIRDS?

If distance to water influences the occurrence of grassland birds then controlling the number and placement of watering sites or the size of fields may be tools to manage grasslands to create sites suitable for declining species. Two studies in North Dakota and southern Alberta found very different responses by upland grassland birds to distance to water. The two year North Dakota study concluded some bird species responded to the increase in vegetation height with distance from water developments brought about by grazing. Their study was limited by the maximum distance from water being 800m. The two year Alberta study was able to examine a broader spectrum of distances and concluded birds responded to the wetland edge itself and not to cattle alteration of vegetation structure. In our four year comparison of avian response to fall and summer grazing at the Onefour Agricultural Research station in southern Alberta each field had only one available source of water for the cattle - a well located in a field corner. The few existing dugouts and natural wetlands were fenced. Because of these circumstances we had the opportunity to measure the distance (up to 2 km) of our count centers to the nearest wetland visible to birds and to the field's cattle water source to determine if one or both influenced bird distribution and abundance. We predicted: vegetation biomass would increase with distance from cattle water source; songbird occurrence and abundance would be most influenced by distance to the cattle water source; and, shorebirds would be most influenced by distance to visible wetlands.

**F9.6 Dale, Catherine**, (Queen's University, Kingston, Canada); Nocera, Joseph (Ontario Ministry of Natural Resources and

Trent University, Peterborough, ON, Canada); Ratcliffe, Laurene (Queen's University, Kingston, ON, Canada)

#### REPRODUCTIVE CONSEQUENCES OF ALTERNATIVE MIGRATORY STRATEGIES IN A PARTIALLY MIGRATORY PASSERINE

Partial migration, where only some individuals in a breeding population migrate, is perhaps the most common form of migration. Two theories exist regarding the maintenance of partially migratory systems over evolutionary timescales. The first suggests that migration and residency result in equal fitness returns, while the second proposes that one strategy (usually migration) is always inferior. Recent studies comparing fitness between migrants and residents in partially migratory systems suggest that migrants often have lower reproductive success than their resident counterparts, supporting the theory that migration is an inferior strategy and migrants are ‘making the best of a bad job’. Our study investigated whether reproductive success differed between individuals with different migratory strategies in a partially migratory population of Western Bluebirds (*Sialia mexicana*) breeding in the Okanagan Valley of British Columbia, Canada. We used stable hydrogen isotope analysis of claw tissue to determine individual migratory strategy, and monitored nests regularly to determine the timing and success of nesting attempts. There was no significant difference in the number of successful nests produced or the number of nestlings fledged by migrant and resident Western Bluebirds, suggesting that in this system, there is no reproductive advantage to remaining resident.

**PS2.132 Dallas, Tyson**, (University of Illinois Urbana-Champaign, Champaign, United States); Benson, Thomas (University of Illinois, Champaign, IL, United States)

#### HABITAT USE OF RED-HEADED WOODPECKERS BREEDING IN ALTERNATIVE HABITAT TYPES IN WESTERN ILLINOIS

The Red-headed Woodpecker (*Melanerpes erythrocephalus*) was once widespread and common throughout much of eastern North America. Because of several factors, including habitat loss and limited availability of snags for nesting and foraging, Red-headed Woodpecker populations have experienced range-wide declines over the last several decades, including especially steep declines in the Midwestern U.S. Red-headed Woodpeckers are known to use areas with herbaceous ground-cover and scattered trees, including savannas and open woodlands. However, this species also uses a range of other habitat types, including the edges of closed-canopy forests, and floodplain forests. Despite being historically common, detailed knowledge of Red-headed Woodpecker habitat use and demography in the Midwest is lacking. To begin filling this information gap and provide information useful to natural resource managers, we examined habitat and nest-site characteristics of Red-headed Woodpeckers at several sites, including upland, lowland, open-canopy, and closed-canopy habitats, in western Illinois. We conducted point-count surveys and searched for nests from May through August, and quantified habitat structure and composition at used and unused locations as well as nests and randomly selected non-nest points. Red-headed Woodpeckers used a range of habitat types, but were often found in low densities. Our results suggest that, although Red-headed Woodpeckers use multiple habitat types, management is needed to improve habitat quality.

**S4.11 Damoulas, Theodoros**, (Cornell University, Ithaca, United States); Farnsworth, Andrew (Cornell Lab of Ornithology, Ithaca, NY, United States)

## MACHINE LEARNING TECHNIQUES FOR AUTOMATED FLIGHT CALL DETECTION

NAOC-V Symposium: Recent Advances in Acoustic Monitoring of Birds Ecology and Sustainability science are becoming data-driven fields due to increasing ease and extent of data-collection efforts, citizen science and remote sensing. Machine Learning (ML) techniques are increasingly relevant for addressing key ecological questions in a quantitative manner. In this talk we will highlight an area within bioacoustics, flight call monitoring, and identify key ML techniques that can be employed to address some of the core issues and biological questions. Flight calls are usually single note vocalizations that are species-specific, often less than 250 ms and between 1-11 kHz. Their short durations and stereotyping within species make flight calls excellent classes of signal for ML investigations. Flight call monitoring is often undertaken with an objective of quantifying a metric estimating the number of calls for each vocal species of nocturnal migrant. Here, we present a novel ML approach for automated flight call detection and classification that employs dynamic time warping to describe the similarity between such acoustic signals, and offers a powerful non-linear feature space for multinomial classification with probabilistic kernel machines. We also provide a broad overview of relevant methodology, paired with ecological questions of interest (including how does species-specific calling phenology relate to other metrics of bird migration as quantified by radar and observers and influenced by meteorology) and will attempt to identify both available tools for immediate deployment and also areas of future computational research for better understanding the complex ecological processes in place.

**W4.4 Danner, Julie**, (Smithsonian Institution, Washington, United States); Moore, Ignacio (Virginia Tech, Blacksburg, United States); Danner, Raymond; Fleischer, Robert (Smithsonian Institution, Washington, United States)

## CULTURAL DIVERGENCE AS A DRIVER OF GENETIC DIVERGENCE IN A TROPICAL BIRD

Among tropical taxa, many species exhibit divergence in phenotypic traits and neutral genetic markers over short geographic distances; however, few studies examine components of reproductive isolation. Our previous research has shown divergence in female preferences for male song dialects over short geographic distances (25 km) in a tropical bird. Preference for local dialects may lead to assortative mating, creating a mechanism where cultural divergence drives genetic divergence on a small spatial scale. We tested this mechanism further by examining dialectal differences in relation to genetic differences among 8 populations across the Andes Mountains, spanning the east/west and elevation boundaries of a widespread bird, the Rufous-collared Sparrow (*Zonotrichia capensis*). Specifically, we examined 22 fine structural measurements of male songs and found high dialectal differences among sites. We also assessed variability at 13 microsatellite loci and found significant variation in allele frequencies across all samples (N=189). Genetic isolation increased with geographic distance for all population pairwise comparisons. Dialectal differences increased with geographic distance for populations on the same sides of the Andean ridge. Song variation was high among sites, leading to high assignment based on discriminant function analyses. Genetic differences in relation to dialectal differences were variable and showed no discernable pattern. For example, sites within the same genetic cluster displayed significantly dissimilar dialects. We predict that dialectal differences among populations may be attributed to the high mutation rate in songs, environmental variables, and restricted movement between populations due to various topographic features. The high song

variation among sites and population structure over short distances suggests that culture plays a role in genetic divergence.

**W14.6 Danner, Raymond**, (Smithsonian Institution, Washington, United States); Greenberg, Russell (Smithsonian Migratory Bird Center, Washington, United States); Danner, Julie (Smithsonian Institution, Washington, Canada); Walters, Jeffrey (Virginia Tech, Blacksburg, United States)

## EXPERIMENTAL SUPPORT FOR ADAPTIVE MASS REGULATION IN A TEMPERATE MIGRANT

Several species of migratory birds exhibit decreases in body mass throughout the latter part of the nonbreeding season. Two main hypotheses address this pattern. The first states that energetic reserves (fat and muscle) decrease because food supplies are depleted throughout the winter. Evidence for this has been found in long distance migrants that experience late winter dry seasons. The second hypothesis states that energetic reserves decrease in response to changing needs for thermoregulation as weather warms (“adaptive mass regulation”). We tested these hypotheses with a plot-wide food supplementation experiment on a temperate migrant, the swamp sparrow (*Melospiza georgiana*), in eastern North Carolina. We used repeated measures mixed-models to describe scaled mass index and fat change in January–March over three years on four plots and selected best fitting models with AICc. In years two and three, we supplemented food (millet and mealworms) at two of the four plots. Following food addition, scaled mass increased, indicating that food was limiting. Throughout each winter, scaled mass and fat levels declined, even when food was supplied ad libitum, supporting adaptive mass regulation. Day-to-day changes in scaled mass were correlated to temperature, further supporting adaptive mass regulation and indicating that temperature, not photoperiod, was the cue for mass change. Our results provide novel experimental support for adaptive mass regulation in temperate migrants.

**PS1.93 Darveau, Marcel**, (Ducks Unlimited Canada & Laval University, Quebec City, Canada); Barker, Nicole K. S.; Roy, Christian (Laval University and Ducks Unlimited Canada, Quebec City, PQ, Canada); Cumming, Steve G. (Laval University, Quebec City, PQ, Canada)

## USING PRE-EXISTING SURVEYS TO ANSWER NEW QUESTIONS ABOUT BIRDS

In remote areas where human infrastructures are rare, wildlife and environmental data are generally scarce. In boreal Canada, this lack of knowledge is currently becoming highly conspicuous as there is a rapidly increasing demand for natural resource extraction and hydroelectric projects. Meanwhile, governments are inclined to cut bird monitoring programs in an effort to mitigate budget deficits. These cuts may entail consequences on bird research or environmental impact assessments because bird survey data are regularly used for such secondary purposes. We reviewed the use by researchers of the two most important bird surveys across boreal Canada: the United States Fish & Wildlife Service Waterfowl Breeding Population and Habitat Survey (WBPBS) and the Canadian Wildlife Service / Black Duck Joint Venture (CWS/BDJV) survey. The WBPBS has used fixed-winged aircraft to fly annual surveys in the traditional (western) and the eastern areas since 1955 and 1990, respectively, while the CWS/BDJV survey has used helicopters to annually survey hilly areas in the East since 1990. The first aim of these surveys is to provide integrated waterfowl population estimates in relation to harvest, but they have also been used for secondary purposes. We found 35 and 12 papers or theses using the WBPBS and CWS/BDJV

survey, respectively. Investigations on the causes of species declines (scaup, pintail, Barrow's goldeneye), habitat model building in natural and altered landscapes (American black duck), and evaluation of harvest strategies (mallard) were the three most common goals of these studies. Other uses included: migration timing, effects of climate change, and statistical method or software demos. The survey protocols were also used in environmental impact assessments, allowing reciprocal benefits from enlarged data sets (more plots in a given area or repeated sampling during nesting and brood-rearing seasons). Obviously, waterfowl population surveys are the corner stone of our scientific knowledge in boreal Canada. As the databases grow, we see fascinating new opportunities to exploit the data and increase our knowledge of boreal aquatic birds and facilitate their conservation through sound management practices.

**F4.2 Dauphine, N Suzanne,** (Dept Marine & Wildlife Resources, American Samoa, Pago Pago AS, United States); Kolani, Zebigou (Zoological Society of London, London, United Kingdom)

#### AVIFAUNA DECLINES IN WEST AFRICAN LOGGING CONCESSIONS

Counteracting ongoing deforestation and wildlife extirpations in West African logging concessions will require investigating and investing in sustainable forest management practices such as forest certification and forest wildlife protection. An estimated 75% of West Africa's rain forests have been destroyed during the last 60 years to support a rapidly increasing and expanding human population. In Ghana, where the population has quintupled since 1950, at least 80% of the forest has been cleared for human use and less than 1% of forest is included in protected areas for wildlife. We examined understory forest bird communities in logging concessions and forest protected areas in Ghana, West Africa, at 27 forest sites in 3 age-classes of successional forest (~3, ~10, and ~20 years post-logging) and unlogged forest. Timber extraction levels ranged between ~1 and ~6 trees/ha. We sampled birds using constant effort mist netting, using a sample effort of ~5400 mist net hours to capture 964 individuals of 42 species. Bird abundance decreased significantly and continuously with time since logging, with abundance in forest ~20 years post-logging an average of 40% lower than that in unlogged forests. Likewise, bird species richness decreased significantly and continuously with time since logging, with species richness in forest ~20 years post-logging an average of 34% lower than that in unlogged forests. Results are compared and contrasted with two previous studies on forest bird responses to logging in Ghana, and with other studies of avian responses to logging in other tropical forests. In Ghana, logged forests may be legally logged a second time following a 40-year waiting period, but it is uncertain whether this time period is sufficient to allow bird community recovery. No recovery from damage sustained by bird communities in response to logging appeared to ensue within the first 20 years following logging. The negative impacts of logging damage to forest and bird community structure may be compounded by a high level of human disturbance in Ghana's forests, including illegal logging and poaching, which often follow on the heels of legal logging operations. We recommend increasing forestry and wildlife law enforcement efforts in logging concessions to protect Ghana's forest avifauna.

**PS1.262 Dauphine, N Suzanne,** (Dept Marine & Wildlife Resources, American Samoa, Pago Pago AS, United States); Lepczyk, Christopher A (University of Hawaii, Honolulu HI, United States)

#### COMMON MYNA (ACRIDOTHERES TRISTIS) INTRODUCTIONS, IMPACTS, AND MANAGEMENT ON ISLANDS: A GLOBAL REVIEW WITH AN EMPHASIS ON THE TROPICAL PACIFIC

Invasive species, together with habitat loss and climate change, are considered to pose one of the greatest threats to global biodiversity, and their negative impacts are often magnified on islands compared to mainland ecosystems. The Common (or Indian) Myna (*Acridotheres tristis*; hereafter "myna") is native to much of continental Asia and has been widely introduced, both deliberately and accidentally, to tropical oceanic islands. Once established, non-native mynas may compete with native bird species for nest and foraging sites and in some cases may predate the nestlings and eggs of other birds. Its high degree of success as a human commensal, together with concerns about its impacts on native avifauna, have contributed to the nomination of this myna as one of the "world's worst" invasive species by the IUCN. Mynas are currently distributed across many Atlantic (e.g., Canary Islands, St. Helena, Ascension Island), Indian (e.g., Réunion, Maldives, Seychelles) and Pacific Ocean (e.g., Fiji, French Polynesia, Hawaiian archipelago, Samoan archipelago) islands that are also home to many of the world's endemic, endangered, and range-restricted birds. Because the myna's range as an invasive species appears to be expanding in the tropical Pacific and many local populations appear to be increasing, we provide a detailed review of this species and its impacts on Pacific islands. Specifically, we synthesize myna introductions to islands globally, with an emphasis on recent range expansions, and their known or hypothesized mechanisms in the tropical Pacific. While most current knowledge of myna invasions in the Pacific is anecdotal, we compile empirical evidence on the spread and negative effects of mynas on native birds in this region, including their interactions with other invasive species. We also consider research from urban environments suggesting that mynas' competitive impacts on some native birds may be minimal. Finally, we evaluate attempted and successful eradication campaigns. Effective actions to control the spread and negative impacts of invasive mynas will require careful planning and implementation.

**S12.6 Davidson, Ian,** (Nature Canada, NA, Canada); Clay, Rob (Canada)

#### A HEMISPHERIC PERSPECTIVE ON NEOTROPICAL MIGRATORY BIRD CONSERVATION: WHERE DO WE GO FROM HERE?

The U.S. and Canadian State of the Birds Reports highlight significant declines in landbird species, especially aerial insectivores, grassland dependent birds and high arctic species. Despite our efforts over a 25 year period, it is increasingly clear that we are seriously challenged by the enormity of the task to conserve Neotropical migratory landbirds. Not only do we lack sufficient knowledge of species movements, distribution and abundance, but even with this knowledge, our conservation actions are limited by available funds, differing priorities and a lack of capacity. Nonetheless, in the last ten years we have seen a growth in innovative, multi-stakeholder driven, cross-sectoral efforts to conserve Neotropical migrants. Perhaps the most exciting developments are coming from the large landscape initiatives in Latin America and the Caribbean that focus on flagship landbird species such as the Golden-cheeked Warbler *Dendroica chrysoparia* of the pine oak forests of Mesoamerica, Bicknell's Thrush *Catharus bicknelli* of the Greater Antilles, Bobolinks *Dolichonyx oryzivorus* of the pampas, and Cerulean Warbler *Dendroica cerulea* of the northern Andes. These "joint venture initiatives" or "species alliances"



demonstrate the value of partnerships and offer a platform for un-raveling the mysteries of species life-cycles. The results can then inform the development of effective strategies to tackle the conservation challenges facing Neotropical migrants. The Partners in Flight Tri-National Vision for Landbird Conservation provides an important road map for conserving migratory birds in North America. However, if we are to successfully conserve Neotropical migrants, we will need to reach beyond political borders and embrace the complete life-cycle of migratory birds. We present highlights from successful migratory bird conservation initiatives and based on these, propose strategies for bringing a hemispheric-wide vision to the ground.

**T8.3 Davidson, Pete**, (Bird Studies Canada, Delta, Canada); Butler, Rob (Bird Studies Canada, Delta, BC, Canada); Lepage, Denis (Bird Studies Canada, Port Rowan, ON, Canada)

#### USING CITIZEN SCIENCE DATA TO TEST HYPOTHESES ON SHOREBIRD POPULATION CHANGE

Ecological processes operating at large geographic scales can be beyond the reach of ordinary research methods. The value of citizen science and electronic technologies to advance this field is now being realised. Shorebirds are one of the bird groups to have received long-term study through citizen science programs, and present an opportunity in this regard. Recent technological advances in data management relating to large-scale citizen science projects enable hypotheses to be tested that were not possible only a short while ago. Citizen science is a practical way to achieve the geographic reach required to document ecological patterns and address ecological questions at scales relevant to shorebird species range shifts, patterns of migration, broad-scale population trends, and impacts of environmental processes like landscape and climate change. We present a case study of a hypothesis-driven approach to investigate Western Sandpiper and Dunlin distribution and abundance changes on their wintering grounds and migratory stopover locations on the Pacific Flyway combining conventional and citizen-science methods.

**PS2.74 Davidson, Pete**, (Bird Studies Canada, Delta, Canada); Couturier, Andrew; Lepage, Denis (Bird Studies Canada, Port Rowan, Canada)

#### CONSERVATION DATA TOOLS FROM LARGE-SCALE CITIZEN SCIENCE PROGRAMS

Public participation programs focused on birds are increasingly important conservation tool at a variety of spatial scales. Two of the primary reasons for this are i) recent advances in data management, mapping and dissemination through web-based platforms, and ii) the ornithological community has very large body of amateur experts capable of achieving large spatial coverage and long time series in a very cost-effective manner. We describe the development of a suite of web tools that make large scale bird monitoring datasets and interpretive products, from programs like Breeding Bird Atlases, the Canadian Migration Monitoring Network, and the British Columbia Coastal Waterbird Survey, freely available to the public in standard formats. The web interfaces combine data entry, management, download and analytical functions in one central location, globally connected to the Avian Knowledge Network. We describe how these tools are being used by government agencies, environmental consultants, land and resource management interests, including land acquisition organisations and forestry companies complying with regulatory frameworks and forest certification standards, and academic institutions advancing research, conservation and management at a landscape scale. Our poster will be complemented by on-site

computer demonstrations of these functions at Bird Studies Canada's booth in the Exhibitors Hall.

**PS2.126 Davis, Glen**, (Geo-Marine, Inc., Millville, United States);

#### BIRDS AND WIND POWER IN NJ: THE TASKS OF A BASELINE STUDY

The New Jersey Department of Environmental Protection and Geo-Marine, Inc conducted the Ocean/Wind Power Ecological Baseline Studies from January 2008 through December 2009. The avian investigations were an enormous undertaking utilizing a vigorous and highly-repeated sampling strategy; line-transect visual surveys collected bird data in the 4665 km<sup>2</sup> study area with vessel tracklines covering >18,000 km. The resultant dataset (176,217 individuals of 153 species) has provided for a rich variety of analysis options. In the future, these may be geared to any number of conservation and natural resources (e.g., wind power) concerns.

Predictive modeling methods, including kernel density, spatial regression, and GAM's, have enabled the integration of the avian data with environmental, geographic, and temporal covariates. Major results from these analyses included distance-from-shore values, fine-scale hotspot evaluation, and temporal and seasonal variations.

Categorization of spatial and altitudinal distributions in the study area further resolved avian usage throughout the three dimensional space. These percentile distributions resolved bird occurrence on a variety of scales. These results, along with the covariate effects on overall bird densities, can provide investigators and developers with the needed insight to make responsible decisions concerning the implementation of wind/ocean energy technologies. We present an overview of the avian predictive modeling, and spatial and altitudinal distribution results from this two year investigation.

**F11.3 Davis, Jennifer**, (New Mexico State University, Las Cruces, United States); Desmond, Martha; Gould, William (New Mexico State University, Las Cruces, United States)

#### LOCAL AND LANDSCAPE FACTORS INFLUENCING NEST SURVIVAL AND PRODUCTIVITY OF WESTERN BURROWING OWLS (ATHENE CUNICULARIA HYPUGAEA) ACROSS GREAT PLAINS GRASSLANDS

Burrowing Owl (*Athene cunicularia hypugaea*) populations are declining across western North America. Interestingly, in contrast to declines in the north, data indicates population increases in the highly fragmented southern plains. Researchers have suggested declines are due to fragmentation and degradation of prairie dog colonies and Great Plains habitat. However, this has not been well studied. To address this, we monitored 1559 Burrowing Owl nests in 89 prairie dog colonies across six Great Plains sites including Buffalo Gap, Grand River, Pawnee, Comanche, Kiowa, and Rita Blanca National Grasslands and Janos-Nuevos Casas Grande, Mexico during 2006, 2009, and 2010. Nest failure ranged from 24.6% to 41.1%. Local and landscape factors influencing productivity and nest survival were examined using Akaike Information Criterion and a priori models. Productivity and nest survival were influenced by study area: Pawnee consistently had the highest productivity and nest survival. Contrary to expectations, habitat fragmentation appeared to have little effect on nest survival or productivity. Instead, factors at the nest and colony scale, including nearest neighbor fledging success, distance from the colony edge, prairie dog colony size, and active prairie dog burrow density had the greatest influence on nest survival and productivity. Productivity and nest survival were positively related to nearest neighbor fledging success, active prairie dog

burrow density and distance from the colony edge, suggesting owls benefit from prairie dog presence and a buffer from colony edges.

**PS2.122 Davis, Mikaela**, (Simon Fraser University, Burnaby, Canada); Williams, Tony (Simon Fraser University, Burnaby, BC, Canada); Elliott, John (Science & Technology Branch, Environment Canada, Delta, BC, Canada)

#### TEMPORAL AND SPATIAL VARIATION IN THE DIET OF GLAUCOUS-WINGED GULLS (*LARUS GLAUCESCENS*): IMPLICATIONS FOR ECOTOXICOLOGY MONITORING

Monitoring programs to track contaminant levels in the environment are critical to understanding variation in pollutant concentrations, exposure routes, and spatial and temporal contaminant trends. Persistent organic pollutants (POPs) accumulate in the tissues of high trophic level predators, such as seabirds. Gulls (*Larus* spp.) have been used for over 35 years to monitor POPs in the Great Lakes. Recently, an ecosystem monitoring program utilizing the Glaucous-winged Gull (*Larus glaucescens*) has been launched to track legacy and emerging contaminants on the west coast of Canada. However, the utility of the Glaucous-winged Gull as a marine monitoring species hinges on its consumption of a marine-based diet, and there is a lack of recent and reliable diet data for this species. Using conventional diet analysis and stable isotopes, we studied diet at 2 breeding colonies to elucidate intra-colony dietary shifts over the breeding season, examine inter-colonial spatial variation, and compare findings with historical studies. Conventional diet results suggest that pre-lay and incubating adults in the Salish Sea consume more human refuse and are less piscivorous than provisioned chicks in the rearing phase. On the west coast of Vancouver Island adults consume almost entirely marine invertebrates during the pre-lay period, while chicks were provisioned almost entirely with fish. Diet samples from our west coast colony did not contain any incidences of human refuse while the Salish Sea colony, in closer proximity to urban centers, had visible human refuse items in the diet samples and colony area. Current adult diet varies significantly from historical records in the Salish Sea, with a lower prevalence of anthropogenic sources and elevated fish compared with 1980. In contrast, adult diet on the west coast of Vancouver Island is consistent with historical data, remaining marine-based. Between 1980 and present years, fish dominated chick diet at all colonies. However, significant variation in chick diet between 2009 and 2010 indicates that diet on a short-term scale can vary considerably. No significant difference in chick diet was found on the west coast. Stable isotope analysis corroborates conventional findings. Ongoing ecotoxicology monitoring should be accompanied by stable isotope analysis to reveal fluctuating yearly diet trends.

**PS2.77 Davis, Suzanne**, (Institute of Jamaica, Kingston, JAMAICA, West Indies, Bahamas);

#### IMPACT OF AN INVASIVE FERN ON BIRD DIVERSITY IN A JAMAICAN RAMSAR SITE

The Mason River Protected Area (MRPA), located in central Jamaica, encloses an upland scrub-savanna ecosystem and Jamaica's only reported upland bog. About 11% of the over 400 plant species and a quarter of the 60 bird species found in this wetland are endemic to Jamaica, contributing to its declaration as a Ramsar site under the Ramsar Convention for Wetlands. Over the decades, a fern *Dicranopteris pectinata*, has expanded its range across the ~82-hectare area and threatens to reduce the biodiversity of the MRPA. Although native to Jamaica, the fern is invasive to the scrub-savanna ecosystem and threatens bird habitat by preventing the growth of plants for feeding and

nesting for birds. This study highlights the impact of *D. pectinata* on the bird diversity of the MRPA and promotes the establishment of a control programme for the invasive fern.

Baseline data from a point count survey and inventory of the birds of MRPA, conducted in 2000/2001, is reviewed to show the lower species richness of birds and changes in species composition in habitat invaded by *D. pectinata*. Consideration is also given to 2012 observations of bird species in invaded and non-invaded habitat. A Chi-square analysis is used to explore the statistical significance of any differences in species richness between invaded and non-invaded bird habitat.

Any effective bird conservation programme for the MRPA must place high priority on controlling the spread of the invasive fern. The information from this study will be relevant to similar bird conservation challenges in other Caribbean islands.

**F10.2 Davros, Nicole**, (University of Illinois at Urbana-Champaign, Champaign, United States); Wheeler, Stephanie (University of Illinois at Urbana-Champaign, Champaign, United States); Hoover, Jeffrey (Illinois Natural History Survey, University of Illinois at Urbana-Champaign, Champaign, United States); Brawn, Jeffrey (University of Illinois at Urbana-Champaign, Urbana, United States)

#### KEEPING UP WITH THE JONESES: BREEDING MALE PROTHONOTARY WARBLER (*PROTHONOTARIA CITREA*) RESPONSES TO INCREASED CONSPECIFIC DENSITY

Despite being recognized as a conceptual cornerstone of population biology, clear evidence for density-dependent phenomena in songbirds remains elusive. Crowding associated with high densities is thought to intensify resource limitation and agonistic interactions, and may alter behaviors and activity patterns during the breeding season. Understanding how behaviors like song rates and foraging maneuvers of males are affected by conspecific crowding throughout the nesting cycle can provide insights into the role that crowding mechanisms play in determining potential density effects. From 2008-2010, we used an experimental approach to test for effects and mechanisms of density dependence in the Prothonotary Warbler (*Prothonotaria citrea*), a secondary-cavity nester that readily accepts nest boxes. By eliminating nest predation and manipulating the density of boxes on a grid system, we created subplots with low and high densities of warblers. In 2010, when our warbler densities reached their highest observed levels, we conducted >4 hrs of behavioral observations on 44 breeding adult males across all stages of the nesting cycle. We quantified song, foraging attack, hop, walk, and flight rates for each male and used generalized linear mixed models to determine the influence of neighbor density, nest stage, and their interaction on these rates. We found that males sang at a significantly higher rate when they had more neighbors, especially during the pre-incubation and incubation stages. We also found that males hopped and walked more during the nestling and fledgling stages when they had more neighbors. Our results suggest that male-male competition increases with conspecific density and is greater during the early nest stages when males are establishing territories, guarding females, and soliciting extra-pair copulations. This crowding may then limit food later in the nesting cycle when nestlings are being fed. We conclude that although males in crowded areas may incur higher costs than less-crowded males, these costs may be offset by the potential for increased fitness benefits (i.e., increased mating opportunities) with more neighbors.

**PS1.109 Deane, Petra**, (Cornell University, Ithaca, United States); Harrison, Richard; Lovette, Irby (Cornell University, Ithaca, NY, United States)

#### CONSPECIFIC SONG PREFERENCE IN MELOSPIZA SPARROWS: A TRANSCRIPTOME OF CANDIDATE NEURAL GENES

Premating barriers to gene flow play an important role in the origin and maintenance of species boundaries, but how does selection establish and maintain premating barriers if the trait used for species recognition is learned? Birdsong is a classic example of a trait that seems to have been elaborated across lineages for the purpose of species recognition, but oscine songs are culturally inherited phenotypes. Males must learn species-appropriate songs from a conspecific tutor during development. If there is no genetic basis to oscine song, how could it respond to selection for species recognition? Juvenile Swamp Sparrows (*Melospiza georgiana*) raised in acoustic isolation demonstrate an innate preference for their own songs over Song Sparrow (*M. melodia*) songs, a closely related species with whom they co-occur during the breeding season. I generate a transcriptome of genes expressed in neurons of the auditory pathway to characterize the heritable basis of conspecific song preference in Swamp Sparrows and Song Sparrows. Juveniles of both species were raised from the egg in a controlled laboratory setting to remove the effect of conspecific-biased auditory experience, allowing characterization of the innate genetic mechanisms by which songbird brains are tuned to preferentially respond to syllables of their own species' song. This research suggests that genetically heritable learning preferences may allow learned behaviors to play a stable role in the evolution and maintenance of reproductive isolation.

**PS2.34 Deaner, Lauren**, (Georgia Southern University, Statesboro, United States);

#### SEX ROLES IN BREEDING WILSON'S PLOVERS AND THEIR IMPLICATIONS FOR DIET, HABITAT USE, AND REPRODUCTIVE SUCCESS

Sex-role differences in parental care may have consequent differences in prey availability, habitat use, and predation risk which in turn may affect overall reproductive success. Wilson's Plover (*Charadrius wilsonia*) partition incubation roles by daylight with females incubating during the day and males at night. Therefore, each sex has different patterns of daily activity during the breeding season and may face important constraints on where and how they meet their daily energy demand. While physiology suggests Wilson's Plover are best adapted to forage at night, males must forage during daylight to attend the nest at night. We explore the relationships between parental care, foraging success, and diet in each sex of breeding Wilson's Plovers on the coast of Georgia to provide a more complete picture of Wilson's Plover breeding ecology.

**PS2.60 DeFisher, Luke**, (Cornell University, Ithaca, United States); Bonter, David (Cornell Laboratory of Ornithology, Ithaca, NY, United States)

#### IMPACT OF THE INVASIVE EUROPEAN FIRE ANT (*MYRMICA RUBRA*) ON THE REPRODUCTION OF THE HERRING GULL (*LARUS ARGENTATUS*) ON APPLIEDORE ISLAND, MAINE.

As globalization contributes to movement of species beyond their native ranges, the effects of invasive species on endemic species are of growing concern. Invasive ants are particularly disruptive to native ecosystems, and several ant species negatively affect the reproductive success of native bird populations following a diversity of nesting strategies. The

European red ant, *Myrmica rubra*, is invasive in northeastern North America, yet no study has examined the effect of this species on North American bird populations. We examined the impact of the ant at a Herring Gull (*Larus argentatus*) colony on Appledore Island, Maine, during the 2011 nesting season. We examined the distribution and activity of ants in relation to gull nests, quantified the behavior of incubating adults on nests with and without ants, and measured chick growth and survival relative to the presence of ants. Adults displayed significantly more erratic incubation behavior when ant activity was observed at the nest, which is consistent with the behavior documented in other bird species exposed to aggressive invasive ants. Chicks in nests without ant activity grew more rapidly than chicks in nests with ant activity, demonstrating that the presence of *M. rubra* negatively influences chick growth. We conclude that *M. rubra* has the potential to negatively affect the reproductive success of Herring Gulls in the ant's non-native range.

**PS1.200 del Hoyo, Josep**, (Lynx Edicions, Bellaterra (Barcelona), Spain);

#### UNVEILING THE FUTURE OF THE HANDBOOK OF THE BIRDS OF THE WORLD (HBW) PROJECT

In 1989 the Handbook of the Birds of the World, the first work to treat and illustrate all the birds of the world, began its journey. Last year, Volume 16 appeared, covering the last families of the series. People may think this means that the journey has come to its end, but this is far from the intention of the work's creators. Plans for the near future include the HBW online project—HBW ALIVE—that will make use of the increasing power of internet and all the new technologies.

The multiple, complex and complementary projects that will allow everyone to continue enjoying HBW will be unveiled at the North American Ornithological Conference.

**PS1.58 DeLap, Jack**, (University of Washington, Seattle, United States); John, Marzluff (University of Washington, Seattle, United States)

#### COMMUNITY DYNAMICS IN SUBURBANIZING FORESTLANDS OF THE PACIFIC NORTHWEST

Suburban development in the Pacific Northwest is rapidly converting native forestlands to a mosaic of human dwellings, transportation infrastructure, miscellaneous vegetation and relictual greenbelts. Development occurs in planned communities of variable housing density and at variable rates of forest clearing and subsequent building. From 1998 until 2010 we surveyed avian communities in ten forest reserves and newly initiated suburban development projects in the Central Puget Sound region of Washington State. Forest reserves sites (4) were largely intact second-growth mixed coniferous/deciduous, while suburbanizing sites were classified as either small-scale projects (4), with approximately 25-100 units/km<sup>2</sup>, or large-scale projects (3), with home density in the range of 1500-2500/km<sup>2</sup>. Species turnover was substantial among all three classes, with the highest annual rate in the large-scale developments (39.8%), followed by the forest reserves (35.7%), and the least turnover among the small-scale developments (29.9%). Species richness was lowest in forest reserves, reached maximums in the small-scale developments, and intermediate values in the large-scale developments. Species richness was greatest during the 'middle' years of the study in both sets of suburban developments; while remaining relatively unchanged, though variable, among forested sites. Subsequently, the curvilinear species richness results are consistent with the intermediate disturbance hypothesis for the both spatial extent and temporal intensity of landscape change resulting from

suburbanization among our study sites. Finally, while additional species were gained (7) as a result of suburbanization (colonization) when compared to the forest reserves, no species were completely lost (extinction) among all development sites over the course of the twelve year study.

**W17.7 DeLeon, Emma,** (Louisiana State University, Baton Rouge, United States); Stouffer, Philip (Louisiana State University, Baton Rouge, LA, United States)

#### HABITAT ASSOCIATIONS AND FLOCK CHARACTERISTICS OF RUSTY BLACKBIRDS (EUPHAGUS CAROLINUS) WINTERING IN LOUISIANA

With an estimated annual population loss of 5-12%, the Rusty Blackbird is one of the most rapidly declining birds in North America. Reasons for decline remain uncertain, but degradation of wintering habitat in wooded wetlands may be a contributing factor. We used citizen science observations throughout Louisiana combined with repeated surveys at 93 sites over two winters to examine transience, flock size, interspecific interactions, and habitat associations. Although Rusty Blackbird abundance was low and flocks were small (mean = 19), naïve occupancy ( $\Psi = 0.68$ ) and detectability ( $P = 0.30$ ) were reasonable for use in occupancy models. Top models indicated that wet leaf litter and shallow water were positively related to presence and within-season persistence at sites, with larger flocks more dependent upon wet leaf litter. An unexpected positive association with lawns, and lack of dependence on distance from forest suggest birds did not avoid open areas at a scale of up to 100 m. There was no evidence of biased sex ratios in flocks. Rusty Blackbirds frequently associated with Red-winged Blackbirds (56% of detections) and Common Grackles (42% of detections), but the nature of these relationships was unclear and requires further investigation. Overall results imply some dependence of larger flocks on forested habitat, and indicate that reduced shallow water availability in any habitat could negatively affect wintering Rusty Blackbirds.

**PS2.242 Delgado-Carrillo, Oliverio,** (Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Mexico); Herrerías-Diego, Yvonne (Laboratorio de Fauna Silvestre, Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Mexico); Quesada Avendaño, Mauricio (Canada)

#### EFFECT OF FOREST FRAGMENTATION ON BIRD COMMUNITY CONSUMING FRUITS OF THREE SPECIES OF TROPICAL TREES IN MICHOACÁN

Tropical dry forest shows a marked seasonality presenting two periods; in dry season some of resource constraints are water and food. Due to this, fruiting tree species at this time are important for maintaining vertebrates, such as birds. In addition, birds help to regulate plant populations. These interactions are likely to be modified due to forest fragmentation. The aim of this study is to evaluate the effects of forest fragmentation on the use of food resources by the community of birds in three species of tropical trees (*Astronium graveolens*, *Bursera simaruba* and *Spondias purpurea*) in two conditions (i.e. continuous forest and fragmented forest) of tropical dry forest. The study was conducted in the central part of the Mexican Pacific coast, at two private properties. We monitored 10 focal fruiting trees for each study site during the late dry season of 2011 to observe the use of food resources by birds. Diversity indices were obtained, as well as using generalized linear model using the GLM procedure (SAS 2000). At the end of the dry season we were registered 415 individuals and 29 species of birds consuming fruit during 68.6 hours of observation. It is possible that forest fragmentation

change patterns in the consumption of food resources, as in the case of the fruits used by birds during the dry season of a fluctuating environment, resulting in modifications to the dispersal and predation seed of plants in tropical dry forest remnants, which may influence the dynamics and diversity of tropical forests.

**T3.4 Delmore, Kira,\*** (University of British Columbia, Vancouver, Canada); Easton, Wendy (Canadian Wildlife Service, Environment Canada, Delta, BC, Canada); Irwin, Darren (University of British Columbia, Vancouver, BC, Canada)

#### TRACKING SWAINSON'S THRUSHES ALONG DIVERGENT MIGRATORY PATHWAYS USING LIGHT-LEVEL GEOLOCATORS

Intraspecific variation in migratory orientation has been documented in many species, with populations that breed adjacent to one another using different routes to get to their wintering grounds. Contact zones between these populations, termed "migratory divides," have been described using limited band-recovery data and/or indirect methods. Differences in migratory orientation could have important implications for the evolution, ecology and conservation of migratory species, making it important to confirm the existence of these divides using more direct methods. We used light-level geolocators to reveal differences in the migratory routes employed by individuals on either side of a narrow hybrid zone between coastal and inland Swainson's thrushes (*Catharus ustulatus*) in western North America. We fit 39 birds with geolocators in 2010 and recaptured 10 of these birds in 2011. Coastal birds migrated along the west coast and wintered in southern Mexico and Central America; inland birds employed a more southeastern route and wintered in South America. Previous work by Ruegg suggested that inland and coastal thrushes are partially reproductively isolated from one another and that differences in migratory orientation could contribute to this isolation. Our work supports this suggestion and lays the foundation for evaluating this hypothesis further. Details on the migratory routes, long-term stopover and wintering sites employed by these birds advance our understanding of their ecology and identify important locations to consider when establishing conservation strategies for migratory songbirds in western North America.

**F12.1 DeLuca, William,** (University of Massachusetts, Amherst, United States); King, David (Northern Research Station, USFS, Amherst, United States); McFarland, Kent; Rimmer, Christopher (Vermont Center for Ecostudies, Norwich, Canada)

#### BLACKPOLL WARBLER (SETOPHAGA STRIATA) BREEDING ECOLOGY ALONG AN ELEVATION GRADIENT: CONSEQUENCES OF TEMPORAL AND SPATIAL VARIATION IN CLIMATE

Climate is an important determinant of bird distribution, habitat quality, and reproductive success. In light of a changing climate, several studies have examined the effect of temporal variation of climate on the timing of breeding and species' distribution. However, the spatial variation of climate in the compressed climatic zones within a habitat type that exists along the elevation gradient in montane forests provides a novel opportunity to examine the role of climate in determining habitat quality for birds. The objectives of this study were to examine how temporal and spatial variation in climate affects the reproductive ecology of a montane forest, neotropical migratory songbird, blackpoll warbler (*Setophaga striata*). We collected

15 years (1994-2008) of nesting data from the Green Mountain National Forest to determine whether annual variation in climate lead to changes in the onset of blackpoll nest initiation. We also collected extensive reproductive and demographic data for blackpolls in the White Mountains, NH between 2007 and 2009. We found that temporal climate variation was an important factor for determining blackpoll nest initiation. We also found substantial evidence to suggest that spatial variation in climate with increasing elevation drives a gradient of habitat quality for montane birds. Abundance, nest survival, fecundity, pairing success and age increased with increasing elevation. Because our elevation gradient represents a gradient of climatic conditions predicted for northeastern North America under various climate change scenarios, our findings provide important insight to the response of high elevation bird communities to a changing climate.

**SAT13.7 Demko, Alana,** (Dalhousie University, Halifax, Canada); **Reitsma, Len** (Plymouth State University, Plymouth, NH, United States); **Staicer, Cindy** (Dalhousie University, Halifax, NS, Canada)

#### TWO SINGING MODES IN A WOOD-WARBLER WITH A COMPLEX REPERTOIRE, THE CANADA WARBLER (*CARDELLINA CANADENSIS*)

Males of many North American wood-warblers (e.g., *Setophaga* spp.) divide their repertoires into two song categories used in different social contexts. In some species, a distinct singing mode (pattern of song delivery) is also characteristic of each category. We described song repertoire structure and modes of vocal delivery in the Canada Warbler (*Cardellina canadensis*). We recorded 231 song bouts from 60 males during May-July 2010 and 2011 at a site of high population density in Canaan, New Hampshire. Males had average repertoire sizes of 12 phrases (range: 7-16), and 55 song variants (range: 11-134). Principal components analysis on structural and temporal variables of 20-consecutive-song bouts showed considerable separation on the first axis (61.9% of total variance), suggesting that males have two singing modes. In Mode 1, males sang slowly and regularly, with less variable songs. In Mode 2, males sang complex songs rapidly, with more variable rhythm and frequent chipping between songs. Canada Warblers do not have two discrete song categories, but use of singing modes is similar to that in other parulids. Males sang Mode 1 proportionally more often during the day, when unpaired and early in the nesting cycle, and near a female. Mode 2 bouts were frequent at dawn, during the post-fledging period, and near another male. This study is the first detailed quantitative analysis of vocal behaviour among the little-studied *Cardellina*, and may help elucidate singing behaviour of congeners with multiple song types (e.g., Red-faced Warbler *C. rubrifrons*).

**W16.9 d'Entremont, Marc,** (University of Northern British Columbia, Prince George, Canada); **Otter, Ken;** **Hartley, Isobel** (University of Northern British Columbia, Prince George, BC, Canada)

#### DEVELOPMENT OF ANALYTICAL PROTOCOLS FOR BIRD MIGRATION DATA COLLECTED BY RADAR - TOOLS AND TECHNIQUES

Radars are the primary mode of tracking nocturnal bird movements around wind farms. Marine surveillance radars are typically used because they provide a relatively inexpensive way to record bird migration and provide information on bird behavior, passage rates, flight direction and flight altitudes. However, real-time analysis of radar migration data has a number of potential limitations: 1) the inability to record all

targets on the radar screen during busy periods of migration; and 2) observer bias in recording accurate distance and bearing information from the radar. From 2008 to 2011, we collected digital radar migration data at the Dokie Wind Energy Project in northeastern British Columbia using standard Furuno open array radars equipped with signal digitization hardware (XIR3000C, Russell Technologies Inc.). We analyzed this data under different target filtering and tracking parameters in radR – an open source platform for acquiring and analyzing radar data. Samples of raw digital radar data were examined manually to establish bird passage counts. Each sample (n=29) was analyzed under 36 different blip filtering and tracking parameters in radR to determine the optimal values for blip processing that would identify the most accurate number of targets (with the lowest standard deviation) when compared to the manually-tracked results. The top candidate model had a strong correlation between manual and automated-tracking ( $R^2=0.91$ ) with a strong linear relationship, allowing for correction factors to provide an accurate measure of bird passage. This technique will allow large expansion of analysis of radar tracking data in relation to human development.

**S9.3 Deppe, Jill,** (Eastern Illinois University, Charleston, United States); **Ward, Michael** (University of Illinois at Urbana-Champaign, Champaign, United States); **Diehl, Robb** (U.S. Geological Survey, Bozeman, United States); **Smolinsky, Jaclyn** (University of Delaware, Newark, United States); **Zenzal, Thomas** (University of Southern Mississippi, Hattiesburg, United States); **Celis-Murillo, Antonio** (University of Illinois at Urbana-Champaign, Champaign, United States); **Moore, Frank** (The University of Southern Mississippi, Hattiesburg, Canada); **Paxton, Eben** (USGS Pacific Island Ecosystems Research Center, Hawaii, United States); **Enstrom, David;** **Beveroth, Tara** (Illinois Natural History Survey, Champaign, United States); **Benson, T.J.** (Illinois Natural History Survey, University of Illinois, Champaign, IL, United States); **Delaney, David** (CERL, Champaign, United States); **Cochran, William** (Illinois Natural History Survey, Champaign, Canada)

#### TRACKING THE MOVEMENT AND SURVIVAL OF INTERCONTINENTAL MIGRANTS ACROSS THE GULF OF MEXICO

Migratory flights across ecological barriers are a conspicuous and risky, yet common, feature of avian migration. However, critical details of these journeys remain unknown, especially for small birds that are notoriously difficult to precisely track. We deployed two automated radio telemetry tracking systems along the Gulf of Mexico, one in coastal Alabama and another spanning the northern Yucatan Peninsula coast, to track Red-eyed Vireos (*Vireo olivaceus*), Swainson's Thrushes (*Catharus ustulatus*), Gray Catbirds (*Dumetella carolinensis*), Indigo Buntings (*Passerina cyanea*) and Ruby-throated Hummingbirds (*Archilochus colubris*) across the gulf in fall 2009-2011. Our objectives were to document connectivity between stopover sites and provide the first empirical study of flight duration and survival across the gulf (i.e., minimum crossing success) in relation to age, body condition, wing length and departure direction. All four songbird species were detected in Mexico, although the percent of tagged birds detected varied among species and years. Swainson's Thrush had the highest detection rate and was the focus of our analyses. We detected 23% (n=22 tagged birds) and 42% (n=31) of tagged thrushes in the Yucatan Peninsula in 2009 and 2010, respectively, providing a minimum estimate of crossing success. We detected 22% (n=9) and 6% (n=49) of tagged vireos in 2009 and 2010, 4% (n=25) of catbirds

in 2009, and 4% (n=27) of buntings in 2010. Equipment failures in 2011 prevented us from estimating crossing success of thrushes and hummingbirds tagged that year. Arrival of thrushes in Mexico was related to departure direction from Alabama and body condition, but not age or wing length. Birds arriving in Mexico were in better condition upon capture in Alabama than those that did not arrive. Thrushes crossed the gulf in 20.4 hrs ( $\pm$  4.8 SD, n=13). Five thrushes reverse migrated (i.e., departed to the north in the fall) and arrived in Mexico 15.2 d ( $\pm$  5.4 SD) later. Young thrushes tended to have shorter flight times across the gulf than adults. Thrush body condition and wing length had no effect on flight duration, although body condition influenced departure direction. Fat birds preferred to depart toward the southeast, whereas lean ones departed in a broad range of directions. Our results provide empirical insight into the behavioural strategies and consequences of small birds migrating across an ecological barrier.

**PS2.1 Derrickson, Kim**, (Loyola University Maryland, Baltimore, United States);

#### BIRDS DO NOT SEE THEIR EGGS

The proximate mechanisms by which birds detect that their nest has been depredated have been insufficiently investigated. Nest failure is common and selection should favor rapid detection. Birds are extremely visual and it would be suspected to play an important role. However, behavioral responses reported here indicate birds do not use vision. I monitored behavior at the nest before and after clutch removal in 10 Wood Thrushes (*Hylocichla mustelina*). Surprisingly, females returned to and incubated at empty nests 2.3 times, on average, before deserting. Seven returning for multiple visits and two returned four times. The interval from landing on the rim to stepping into the cup to initiate incubation did not differ between pre- and post-depredation visits. Incubation bouts (averaged 68.6 min for the 10 females pre-treatment) dropped to an overall average of 17.3 min but in a stepwise fashion where typically each subsequent bout post-depredation got shorter. The reverse occurred with incubation breaks (pre-depredation average, 11.4 min; post-depredation average, 79.6 min), again typically in a stepwise fashion with each subsequent break increasing in duration. The time to first movement overall and specifically to the rim after initially settling into the cup were significantly shorter in post-depredation visits. An ~10X increase in the number of positional changes also occurred during post-depredation visits. Most surprising, nest building movements, never seen during normal incubation, increased in frequency with subsequent visits. Two American Robins (*Turdus migratorius*) behaved similarly. Videos will show these dramatic, unanticipated changes in behavior.

**PS1.167 DeSando, Samantha**, (Rochester Institute of Technology, Rochester, United States); Wink, Gloria; Miller, Allyson; Smith, Susan; Pagano, Todd (Rochester Institute of Technology, Rochester, NY, United States)

#### NUTRITIONAL VALUE OF NATIVE AND INVASIVE FRUITS FOR MIGRATING SONGBIRDS IN THE WESTERN FINGER LAKES REGION OF NEW YORK

Many songbirds rely on seasonal wild fruits as an important food resource during critical refueling periods at stopover sites used during autumn migration. However, the nutritional value of these fruits may have important implications on the energetics of birds during migration. We conducted nutritional analyses on the fruits of four native shrub species (Gray Dogwood (*Cornus racemosa*), Silky Dogwood (*Cornus amomum*), Red Osier Dogwood (*Cornus sericea*) and Highbush Cranberry (*Viburnum trilobum*)) and three invasive shrub species (Common

Buckthorn (*Rhamnus cathartica*), Multiflora Rose (*Rosa multiflora*) and Bush Honeysuckles (*Lonicera* spp.)) collected at two stopover sites in Rochester, NY. The nutritional analyses included water content, fat content, energy density, and total soluble solids of the fruits. In addition, an improved method for the analysis of the phenolic content of the fruits was investigated. We also conducted a fruit consumption experiment to compare fruit removal rates among focal native and invasive fruiting shrub species throughout fall migration. There was a positive correlation between energy density and fat content of the fruits, and fruits of native dogwoods had higher fat and energy content than fruits of invasive species. Native dogwood fruits were consumed by migrating birds at higher rates than invasive species over the fall migration period. Our results suggest that the fruits of native shrubs may be of higher nutritional value to migrating songbirds than the fruits of invasive shrubs during fall migration in the western Finger Lakes region of New York.

**SI.12 DeSante, David**, (Institute for Bird Populations, Point Reyes Station, United States); Saracco, James; Kaschube, Danielle (The Institute for Bird Populations, Point Reyes Station, CA, United States)

#### USING MAPS VITAL RATES TO IDENTIFY DEMOGRAPHIC CAUSES OF POPULATION TRENDS

We used 15 years (1992-2006) of constant-effort mist netting data from the Monitoring Avian Productivity and Survivorship (MAPS) program to model annual variation in population change, adult apparent survival, residency, and recruitment from Pradel and Cormack-Jolly-Seber capture-mark-recapture models, and productivity and post-breeding effects on recruitment from generalized linear mixed models for 140 landbird species. Recruitment was generally much more important than adult survival in driving annual variation in population change, but adult survival was relatively more important for declining Neotropical-wintering migrants and increasing permanent residents than for other species groups. Post-breeding effects, that include first-year survival and immigration of adults, were generally more important than productivity in driving annual variation in recruitment, and were most important for species with stable populations and for temperate-wintering migrants. For Wood Thrush (*Hylocichla mustelina*) for example, a declining Neotropical migrant, adult survival was nearly as important as recruitment in driving annual variation in population change, productivity was only weakly positively correlated with population change and recruitment, post-breeding effects were strongly positively correlated with adult survival, recruitment and population change, and adult survival was strongly positively correlated with recruitment, suggesting that both breeding and wintering populations were highly unsaturated and that population regulation was effected during the non-breeding season by survival of both young and adult birds. In contrast, for Ovenbird (*Seiurus aurocapilla*), a stable Neotropical migrant, productivity was weakly negatively correlated with population change and recruitment, and adult survival was strongly negatively correlated with population change, recruitment and post-breeding effects, suggesting that populations were saturated on both the breeding and wintering grounds and that population regulation was effected during both the non-breeding and breeding seasons by survival of young and limitations on recruitment, respectively. These examples illustrate the importance of long-term, large-scale demographic monitoring for informing landbird conservation.

**F11.2 Desnoyers, Nicole**, (Institute for Wildlife Studies, San Diego, United States); Stahl, Justyn; Bridges, Andrew (Institute for Wildlife Studies, San Diego, CA, United States); Garcelon, David (Institute for Wildlife Studies, Arcata, CA, United States); Booker, Melissa (U.S. Navy, Coronado, United States)  
CHANGES IN NESTING SUBSTRATE USE BY SAN CLEMENTE LOGGERHEAD SHRIKES IN A RECOVERING LANDSCAPE AND IMPLICATIONS FOR RECOVERY

The San Clemente Loggerhead Shrike is a federally endangered subspecies endemic to San Clemente Island, California. Habitat degradation resulting from the presence of non-native grazers from the late 1800s until 1993 resulted in the decline or local extirpation of several avian subspecies and the near extinction of the shrike. The U.S. Navy has instituted a number of recovery efforts, including the release of captive-bred shrikes, control of non-native predators, and habitat enhancement, resulting in the population of shrikes steadily increasing from a low of 14 individuals in 1998 to a high of 179 in 2009. As the population continues to increase, determining the carrying capacity of the island becomes more important for establishing population recovery goals. While historical data are limited, most early reports place shrikes in canyons and the majority of nests were located in canyon trees at the beginning of population monitoring efforts. As the island has continued to recover from grazing damage, an increasing diversity of substrates have become available for shrike nesting and we investigated the differences in nesting success and fledgling survival in a variety of substrate types over time. We analyzed 687 nests from 2001–2011, occurring in 21 natural (and 1 artificial) substrates. We grouped nest substrates into four categories based on structural similarities: trees, shrubs, lemonade berry and morning glory. We found a significant difference in nest success among the four groups, with nests in shrubs showing highest probability of success (52.8%). Nests in shrubs also fledged significantly more young (4.02) than nests in trees (3.43), lemonade berry (3.15) and morning glory (2.75). Similarly, the number of young that survive to independence (41 days post-hatch) was higher for nests in shrubs (3.13) as compared to trees (2.64), lemonade berry (2.25) and morning glory (2.50). These findings broaden our definition of suitable shrike nesting habitat. Large areas of shrub-dominant habitat are reemerging on the island as the landscape recovers from feral grazer damage. If shrikes continue to utilize this growing resource, breeding habitat availability on San Clemente Island may not become a primary limiting factor as the population continues to grow and recover.

**S4.8 Desrochers, André**, (Université Laval, Québec, Canada); Cumming, Steve; Lévesque, Denis (Université Laval, Québec, PQ, Canada)

#### NETWORKING AUTOMATED RECORDING UNITS USING WIRELESS TECHNOLOGY

Avian monitoring provides key information to help land managers build effective, science-based, conservation policy. Increasingly, scientists and land managers rely on automated recording units (ARUs) to obtain reliable data, especially in the case of difficult-to-identify or cryptic species. Yet, costs for sending highly qualified personnel to remote areas to repeatedly retrieve recordings keep increasing and funds available are well below what would be required to meet demand for new data. Fortunately, new technological opportunities such as portable solar power, high memory capacity, energy-efficient circuitry, digital acoustics, and cellular or WiMAX telecommunications now make it increasingly feasible to meet demands for low-cost, high-quality acoustic data. We built and tested an ARU designed to selectively record acoustic data and transmit them digitally

over a cellular (wireless) network. Our ARU sends not only acoustic data, but also a suite of technical information associated with them, such as signal strength, gain, time, etc. Our prototype allows flexibility in data sampling and transmission schedules particular to each ARU, using a suite of internet-based client-server programs. We will discuss the strengths and weaknesses of our low-maintenance concept compared to alternative ARU deployment strategies.

**PS2.3 Desrosiers, Michelle**, (Colorado State University, Fort Collins, United States); Sillett, Scott (Smithsonian Migratory Bird Center, Washington, United States); Ghaleb, Cameron (Colorado State University, Fort Collins, United States); Angeloni, Lisa (Colorado State University, Fort Collins, CO, United States)

#### THE SOCIAL CONTEXT OF EXTRA-PAIR PATERNITY AND INTRASPECIFIC AGGRESSION IN BREEDING ISLAND SCRUB-JAYS

The relative costs and benefits of high local breeding densities is expected to differ between the sexes. High densities may decrease the amount of resources pairs have to raise young, but males may accrue positive benefits if they can sire extra-pair offspring in the nests of neighboring pairs. We have been studying the social dynamics of Island Scrub-Jays (*Aphelocoma insularis*) and have found that some young pairs, as early as their first breeding season, attempt to acquire territorial space between established territory holders and breed. Preliminary data on extra-pair paternity indicate that those young pairs are sometimes cuckolded by neighboring established males. Thus, we have conducted a playback experiment to test the relative level of aggression by breeding males and females towards a single male intruder (EPP threat to territorial male), versus a male intruder accompanied by a female (potential reproductive opportunity for male, loss of resources for young). Using taxidermic mounts and playbacks, this experiment tests if established males exhibit differential aggression towards solitary males that could be a threat to paternity, compared to pairs that might provide increased opportunities for EPP. We expected established males to be less aggressive in response to a paired intruder versus a single intruder, and females to respond relatively more aggressively to the pair than the territorial male. The combined use of genetic parentage data and breeding history used here provide insight into the potential social context determining EPP rates and patterns of aggression.

**T7.1 DeVries, Susan**, (University of Southern Mississippi, Hattiesburg, United States); Winters, Caitlin; Jawor, Jodie (University of Southern Mississippi, Hattiesburg, MS, United States)

#### ELEVATED TESTOSTERONE MIGHT NOT BE NECESSARY TO SUPPORT FEMALE AGGRESSION IN INCUBATING NORTHERN CARDINALS (*CARDINALIS CARDINALIS*)

Testosterone's (T) influence on male aggression has been well established in many vertebrate species, but the impact of T on female aggressive behavior is poorly understood. Among birds, a link between elevated T and female aggression is plausible, as females of many species exhibit a seasonal peak in T concentrations at the onset of breeding when social instability is greatest. However, investigations examining the relationship between T and female aggression have yielded conflicting results, with elevated T supporting aggressive behavior in females of some species, but not others. We examined the relationship between endogenous levels of T and female aggression in the Northern Cardinal (*Cardinalis cardinalis*), a

resident temperate species in which pairs exhibit prolonged territoriality (9+ months), females have measurable levels of T year-round, and they lack a seasonal peak in T at the onset of breeding. Using simulated nest intrusions, we assessed aggressive responses of incubating females to intrasexual 'intruders' at the nest and quantified T levels after each aggressive encounter. Results indicate that female cardinals do not significantly elevate T in response to intrasexual 'intruders' at the nest during incubation. Aggressive responses towards 'intruders' varied among females, yet, individuals exhibiting greater levels of aggression did not demonstrate higher levels of T. These results imply that elevated T might not support female aggression at the nest in this species.

**T13.9 Dhami, Kirandeep,** (Wright State University, Dayton, United States); Peters, Jeffrey (Wright State University, Dayton, OH, United States)

#### THE INFLUENCE OF INTERSPECIFIC HYBRIDIZATION ON THE HETEROGENEITY OF GENETIC DIVERSITY IN GADWALLS AND FALCATED DUCKS

Heterogeneity in genetic diversity is common among loci in many species. This heterogeneity can arise from stochastic variance in introgression of alleles or from selection influencing some loci. The Gadwall (*Anas strepera*) has high heterogeneity in genetic diversity, which failed to fit neutral coalescent models of population history. Both selection and neutral introgression of alleles from the Falcated Duck (*Anas falcata*) were found to be plausible explanations of this heterogeneity. The objective of this study was to assess introgression in non-coding loci to better examine its role in among-locus heterogeneity in genetic diversity. The Gadwalls have two diagnosable populations: one in Eurasia (Old World, OW), where they are sympatric with the Falcated Duck, and one in North America (New World, NW), which was colonized in the late Pleistocene. About 5% of NW Gadwalls have mtDNA haplotypes derived from Falcated Ducks. We sequenced 20 introns for 24 Falcated Ducks to estimate levels of gene flow from Falcated duck into the NW and OW Gadwall populations using coalescent analyses. We found strong evidence of introgression of nuclear alleles into NW Gadwalls, but not OW Gadwalls. We then simulated genetic diversity under this history and an assumption of neutrality and found that introgression was insufficient to explain the observed heterogeneity in genetic diversity. These analyses suggest a prominent role of selection in the among-locus heterogeneity in non-coding DNA.

**T11.7 Diamond, Antony,** (University of New Brunswick, Fredericton, Canada);

#### SEABIRD DIETS REFLECT BOTTOM-UP CHANGES TO QUANTITY AND QUALITY OF A KEYSTONE PREY SPECIES IN THE BAY OF FUNDY

Seabird diets at Machias Seal Island have changed over 18 years of study, particularly in the proportion of the richest component, first-year Atlantic Herring *Clupea harengus*. This is a keystone species in this classically wasp-waisted food-web, with consequences throughout the ecosystem including the commercial fishery whose quantity and quality have also declined. The decline in first-year herring was partly responsible for the loss of the region's largest tern colony (and North America's largest Arctic Tern colony) in 2006. An explanation for this regime shift is developed in terms of changes in oceanography, particularly sea-surface temperature (SST) which has increased sharply since 2000 and is approaching levels last seen in the warm regime of the 1940s-1950s. Development of the spring plankton bloom, which drives the season's productivity, is also susceptible to extreme events such as the

Patriot's Day Storm of April 2007 which halted the spring plankton bloom, slowing growth of herring spawned the previous fall and resulting in seabird diets of larval rather than metamorphosed fish. Data on diets of four focal species (Atlantic Puffin *Fratercula arctica*, Razorbill *Alca torda*, Arctic Tern *Sterna paradisaea* and Common Tern *S. hirundo*) are used to interpret both seabird demographics and changes in the food-web and underlying oceanography, and suggest trends likely to be exacerbated in an era of rapid climate change.

**W13.4 Dibala, Ryan,** (Ball State University, Muncie, United States); Kamal, Islam (Ball State University, Muncie, IN, United States)

#### CONSPECIFIC SOCIAL CUES STRONGLY INFLUENCE MALE CERULEAN WARBLER SETTLEMENT PATTERNS

Examining population age-structure and differential age-specific settlement patterns may be important in identifying and protecting optimal habitats for avian species that are in sharp decline. The Cerulean Warbler (*Setophaga cerulea*) is one species that has become increasingly scarce throughout its range. This species was monitored in Yellowwood and Morgan-Monroe state forests in southern Indiana to address questions pertaining to age-specific male settlement patterns and clustered territoriality. We detected a total of 130 male Cerulean Warblers and demarcated 101 territories across 8 of 9 study sites. Thirty of 96 males (31%) were classified as second year (SY) birds, 66 of 96 (69%) were classified as after second year (ASY) birds, and 5 birds remained of unknown age. Using a nearest neighbor analysis in ArcMap (ArcGIS 10) we determined that 80 of 101 (79.21%) territories located within 5 of 8 study sites were clustered. ASY males were no more likely to cluster than SY males ( $p = 0.258$ ). SY male mean distance to ASY males (0.176 km) was significantly closer than mean distance to other SY males (0.329 km;  $p = 0.001$ ). Similarly, ASY male mean distance to other ASY males (0.123 km) was significantly closer than mean distance to SY males (0.215 km), showing that both age-classes have a clear preference for settling near experienced males ( $p = 0.002$ ). We found no differences in distance to landscape features between the age-classes, supporting social explanations for settlement. These results provide evidence that Cerulean Warbler settlement patterns are strongly influenced by conspecific social cues.

**PS1.5 Dickinson, Matthew,** (College of the Atlantic, Bar Harbor, United States);

#### SPARROW NEST-SITE SELECTION ON GREAT DUCK ISLAND, MAINE: INFLUENCES OF HABITAT AND PREDATION

Savannah sparrows (*Passerculus sandwichensis*), song sparrows (*Melospiza melodia*) and nelson's sharp-tailed sparrows (*Ammodramus nelsoni*) nest on Great Duck Island, Maine USA, in relatively high densities and in close proximity to nesting gulls. As gulls are nest predators it could be predicted that the density of sparrow nests would be inversely correlated with the density of gull nests. Contrary to that assumption and the results of previous studies, a comparison of densities of sparrow nests and gull nests on Great Duck Island revealed a strong spatial correlation between sparrows and gulls. Two hypotheses have been proposed for such predator-prey associations: predator protection and coincidental habitat requirements. Comparisons of sparrow territories, vegetation and invertebrate abundances suggests that sparrows may preference habitat for nest-site selection more than gull proximity.



**PS1.174 Diehl, Robb**, (U.S. Geological Survey, Bozeman, United States);

#### IS THE AIRSPACE A HABITAT?

The earth sciences divide the earth into three non-biological spheres, the lithosphere (land), the hydrosphere (water), and the atmosphere (air). Fauna inhabit all three, and although traditional notions of habitat refer only to how animals occupy the lithosphere and hydrosphere, commonly accepted definitions of habitat do not contain language that excludes the airspace. There are three possible reasons why the airspace has not been considered habitat: 1) most important among them, that the airspace fails to meet the criteria of habitat on biological grounds, 2) humans fail to recognize the airspace as habitat owing to bias and limits to perception, and 3) the concept is excessively esoteric or insufficiently practical or useful. Animals' use of the airspace shares many parallels with that of terrestrial and aquatic habitats. The airspace is home to a variety of movements, foraging, predator-prey interactions, some mating, and so on, and data shows flying animals exhibit strong preference for certain parts of the airspace over others, *sensu* habitat selection. This preference indicates structure of the airspace which, depending on conditions, can resemble the patch-matrix arrangement of habitats typical of many terrestrial landscapes. Anthropocentrically, our concept of habitat may be constrained by our training as biologists and conditioned by our experiences in the field (we know habitat when we see it). Such biases are reinforced by limits of perception imposed by our natural reliance on sight to detect pattern. However, sight is not well suited to detecting structure in the airspace that is often both invisible and highly dynamic.

**PS1.63 Diemer, Kristen M.** (Trent University, Peterborough, Canada);

#### EVALUATING AGRO-ECOSYSTEM MANAGEMENT OPTIONS TO BENEFIT GRASSLAND BIRD REPRODUCTION

Populations of grassland birds, such as the Bobolink (*Dolichonyx oryzivorus*), have declined precipitously in the past half-century, due in part to habitat loss and agricultural intensification. Hay harvests are more frequent and earlier, often overlapping with grassland bird breeding and inducing complete nest failure. Management options that benefit grassland bird reproduction and meet farmer production needs have remained elusive. A recent model by Perlut et al. (2011) illustrated that very early hay harvest (before most breeding began) was a workable solution in Vermont that mitigated the risk of incidental mortality on grassland birds. We seek to evaluate the generality of their strategy by testing it in southern Ontario, and furthering the model by monitoring the response of the birds and their habitat. We established plots that (a) implemented an exceptionally early first harvest followed by a 65 day waiting period in attempt to delay maturation of grasses for the second cut until peak breeding period is over, (b) that acted as control plots under normal management regimes, and (c) plots with first harvest delayed until July 15. We monitored forage quality, invertebrate prey abundance, and breeding success and phenology of Bobolinks. We also examined the effects of vegetation structure on the density and success of breeding Bobolinks through the season. Early results from this ongoing program indicate that first harvest dates should be before June to increase the probability of Bobolinks colonizing during the post-harvest refuge period. Forage quality necessary for most cattle was retained during the peak fledging period, which was in the last week of June on delayed-cut fields. There were no significant differences between the abundance of invertebrate orders important to Bobolink diet between management

strategies, an important result indicating that early and late harvest does not depauperate the Bobolink's prey base.

**F15.1 Dillon, Kristen G.**, (University of Arizona, Arizona Cooperative Fish and Wildlife Research Unit, Tucson, United States); Conway, Courtney J. (U. S. Geological Survey, Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, Moscow, ID, United States)

#### CHANGES IN BREEDING PHENOLOGY AND ELEVATIONAL GRADIENTS IN CLUTCH SIZE OF RED-FACED WARBLERS: EFFECTS OF CLIMATE, NEST PREDATION, AND FOOD.

A better understanding of how breeding phenology and demographic traits vary along elevational gradients can aid efforts to predict the potential impacts of climate change on species persistence. Additionally, understanding the causes of elevational gradients in life history traits may provide new insights into the ecological processes that drive the evolution of life history strategies. We examined variation in breeding phenology and reproductive parameters in red-faced warblers (*Cardellina rubrifrons*) over a 10-year period in southeastern Arizona. May precipitation was negatively associated with breeding date ( $t = -4.9$ ,  $P < 0.001$ ), but annual variation in temperature had no effect on breeding phenology. Nest initiation date also varied among years; red-faced warblers initiated nesting later in the season over the past ten years ( $t = 6.2$ ,  $P < 0.001$ ). These results are opposite to those reported in many other systems, where most birds are now breeding earlier than they once did. We also detected a negative correlation between clutch size and elevation ( $t = -2.7$ ,  $P = 0.006$ ). To uncover the cause of these patterns, we are now testing a suite of correlational and experimental predictions to assess the validity of three mechanistic hypotheses to explain the observed pattern between clutch size and elevation. Preliminary results suggest that variation in predation risk ( $t = -1.4$ ,  $P = 0.091$ ) is most likely responsible for the elevational gradient in clutch size.

**SAT14.11 Docherty, Teegan**, (University of Leeds, Leeds, United Kingdom); Edwards, David (James Cook University, Cairns, Q, Australia); Ansell, Felicity; Hamer, Keith (University of Leeds, Leeds, United Kingdom); Wilcove, David (Canada)

#### THE CONSERVATION VALUE OF DEGRADED HABITATS FOR BIRD COMMUNITIES IN THE LOWLAND RAINFORESTS OF BORNEO

Biodiversity in Southeast Asia is threatened by heavy logging and the conversion of forests to oil palm plantations. The degraded forests that remain after multiple rotations of logging are assumed to be of low conservation priority and are offered little to no protection from conversion to agriculture. This study is a first attempt to measure biodiversity in these heavily degraded habitats. We sought to quantify the conservation value of logged dipterocarp rainforests to bird communities inhabiting lowland Sabah, Malaysian Borneo. We compared species richness and species composition in unlogged, once-logged and twice-logged forests. Remarkably, there were no significant changes in species richness or abundance among logging treatments, however, we did find changes in species composition. Vulnerable species (IUCN Red-list) associated with primary forests declined after the first logging event but did not decline further after a second event. We determined that initial losses of these vulnerable species were attributed to reduced canopy closure and increased density of non-tree understory species. Some forest-dependent species were rare or absent in the twice-logged forest including Bornean endemics, wren-babblers and flycatchers. Although we demonstrate that

unlogged forests are of greatest conservation value, our results indicate that the capacity of degraded habitats to support biodiversity has been unrecognized. Indeed, these heavily logged forests support a large proportion of species found in primary habitat. It is therefore imperative that we protect primary and secondary forests from further degradation and conversion to oil palm.

**T13.11 Dohms, Kimberly**, (University of Lethbridge, Lethbridge, Canada); Burg, Theresa (University of Lethbridge, Lethbridge, AB, Canada)

**TWO CONTINENTS, TWO SPECIES, SIMILAR POPULATION GENETIC STRUCTURE: A PEEK INTO NUTCRACKER (NUCIFRAGA SPP.) PHYLOGEOGRAPHY**

Despite occurring on different continents, *Nucifraga* congeners Clark's (*N. columbiana*; western North America) and Spotted or Eurasian (*N. caryocatactes*; throughout Eurasia) Nutcrackers share many life history characteristics. Both are resident species, strongly associated with higher elevation pine-dominated (*Pinus* spp.) coniferous forests, specializing on pine seeds for which irruptive dispersal occurs in search of large seed crops, noted for long-term seed cache recovery, and found in areas that encompass potential barriers to dispersal and previously-glaciated areas. Little information exists on post-glacial colonization patterns and to gene flow for either species. We investigated these patterns and assessed dispersal barriers using a highly variable genetic marker. We sequenced 925 bp of mitochondrial control region DNA for 41 Clark's Nutcrackers from 11 populations and 62 Spotted Nutcrackers from 12 populations. Clark's Nutcrackers were characterized by reduced genetic diversity relative to Eurasian Nutcrackers. Neither species displayed strong geographic structure suggesting few barriers to dispersal and continued gene flow between populations. Post-glacial colonization patterns based on genetic data were inconclusive. Future work will include species distribution and paleodistribution modeling to elucidate potential locations of suitable habitat for both species during the last glacial maximum (~21 000 yrs ago), and analysis of mitochondrial and nuclear markers of additional Clark's Nutcracker samples from throughout their range in North America.

**PS1.247 Doolittle, Emily**, (Cornish College of the Arts, Seattle, United States);

**A MUSIC THEORETICAL APPROACH TO THE STUDY OF BIRD SONG**

In this poster, I discuss two recent collaborations between musicians and biologists to show how scientific and music theoretical analysis can be used together to gain a deeper understanding of birdsong. Technological tools give precise measurements of frequencies, durations, and timbre, and statistical analysis enables determination of whether apparent patterns occur above chance level. Music theoretical analysis allows for a more nuanced understanding of pitch, rhythmic, and structural relationships. Many aspects of human music theory are dependent on human culture, so are not relevant in the study of birdsong, but others have to do with the physical properties of sound, or with basic biological aspects of sound production and reception, and thus are equally relevant to any species. The song of the hermit thrush (*Catharus guttatus*), widely known for its beauty, has variously been ascribed with following "major and minor keys," "modulations," and "meeting perfectly the requirements of human music." These are all human-music-specific attributions, and thus very unlikely in a birdsong. In recent work with Tecumseh Fitch, Bruno Gingras (University of Vienna), and Dominik Endres (University of Tübingen), we

show that the song is instead made up of pitches related by the harmonic series (a physical rather than a cultural pattern), which underlies much human music as well. Using Bayesian analysis, we show that these overtone relationships occur at significantly above chance level, and are a structural feature of the song. The musician wren (*Cyphorhinus arada*) is also famed for the "musical" quality of its song, but until now its song has not been systematically studied. Together with Henrik Brumm (Max Planck Institute for Ornithology), we show that the musician wren sings "consonant" (perceptually smooth) intervals more often than "dissonant" (perceptually rough) intervals. Though the human concepts of consonance and dissonance are partially cultural, they are based on physical properties of sounds, with pitches related by small integer ratios typically sounding more pleasant, and intervals related by more complicated ratios sounding rougher. The musician wren's selection of intervals mirrors very closely Helmholtz's physically-based predictions of which intervals would be considered consonant by humans.

**PS1.207 Dorman, Wendy**, (Winthrop University, Rock Hill, United States);

**EGG CHARACTERISTICS IN RELATION TO NESTING MICROENVIRONMENT IN CAPTIVE SOUTHERN ROCKHOPPER PENGUINS, EUDYPTES CHRYSOCOME**

Southern Rockhopper Penguins, *Eudyptes chrysocome*, practice a reversed asynchronous brood strategy wherein second eggs are up to 70% larger and hatch a day or more sooner than first eggs. If first eggs are not "throwaway" eggs they may be given some advantage to help them compete with their larger older siblings. I hypothesized that first eggs of rockhopper penguins experience developmental advantages and preferential treatment over second eggs which offset disadvantages associated with reversed hatching asynchrony. Characteristics of the eggs and nesting environments of captive rockhopper penguins were measured from 2010 to 2011 at Riverbanks Zoo in Columbia, SC. The mean laying interval was 4.0±0.6 days. First eggs had significantly smaller masses and greater surface-area-to-volume ratios ( $p < 0.05$ ) than second eggs. The interval between laying and onset of development was equal for all egg types. Change in mass throughout incubation was equal for fertile and infertile eggs, indicating that mass loss patterns are not the result of metabolic processes. First eggs that never had a nestmate lost mass more rapidly after day 4 than first eggs with a nestmate ( $p < 0.05$ ), and experienced higher temperatures, equal to those of second eggs ( $p < 0.50$ ), reflecting a reallocation of resources by the parents. The presence of a second egg was not necessary to elicit this temperature increase. Humidity availability in the nest did not vary by day or egg type. Rockhopper penguins appear to adjust their incubation regime in relation to the expected lay date of their second egg.

**W16.10 Dornak, Laura**, (University of Kansas, Lawrence, United States);

**USE OF ECOLOGICAL NICHE MODELS TO DETERMINE EXTENT OF POTENTIALLY SUITABLE HABITAT FOR HENSLOW'S SPARROWS ACROSS THEIR BREEDING DISTRIBUTION**

Henslow's Sparrow (*Ammodramus henslowii*) is a North American endemic and tallgrass prairie specialist, that breeds across Midwest grasslands. Monumental loss of native prairies (>99%), as a result of human use, have caused documented declines in sparrow populations. Ecological niche models are relatively new, but powerful, tools for identifying potential habitat, and therefore species distributions across landscapes. Two ecological niche modeling methods, GARP and Maxent, were used to relate occurrence points (Breeding Bird Survey) to

environmental data (Enhanced Vegetation Index summaries) using geographic subsets of these points to build models. To improve predictivity, Cropland Data Layers (CDL) data were used to remove all non-grassland habitat from analyses. Model predictions were tested using Ebird data (as independent test data) and area under the curve (AUC) of a modified version of the receiver operating characteristic (ROC) function. Final models from each method were combined to construct a composite model. Year-specific predictions were constructed to show whether amount and distribution of suitable breeding habitat fluctuates. Furthermore, suitably predicted area along BBS routes where Henslow's Sparrows were observed, were compared to the amount of predicted area across the full extent of the breeding distribution. These maps are the first attempt to identify and characterize total amount, distribution, and yearly fluctuation of Henslow's Sparrows' breeding habitat across the full breeding distribution, as well as, assess the ability of the BBS to survey effectively this habitat. These maps, therefore, will be relevant to conservation management decisions.

**PS1.66 Doster, Robert,** (U.S. Fish & Wildlife Service, Sacramento, United States); Weinstein, Anna; Trocki, Linda; Distler, Trish (Audubon California, Emeryville, CA, United States); LeValley, Ron (Mad River Biologists, Inc., Eureka, CA, United States)

#### BLACK OYSTERCATCHERS IN CALIFORNIA: A FIRST LARGE-SCALE SURVEY EFFORT

The Black Oystercatcher is an uncommon (~10,000 individuals), diffusely distributed species entirely dependent on the marine rocky intertidal zone of the eastern North Pacific. The species is poorly understood in California where most information on oystercatcher abundance and distribution was previously gained from surveys of colonial seabirds. In June 2011 we conducted the first targeted survey for the species in California using a tested, standardized, land-based survey protocol designed for citizen scientists and professional biologists. Observers surveyed approximately 17% of the state's suitable habitat, equaling 7% of the total coastline, and 28% of suitable habitat in Channel Islands National Park. Nests were also located and a subset monitored to assess productivity. 1346 oystercatchers were detected during the survey; a number that exceeds previous California estimates and suggests a population three or more times higher than previous estimates. Overall densities of nests and individuals were comparable between the Channel Islands and the mainland. In at least two areas in northern California, nest densities exceeded by at least 3 times those reported from "core" areas of the species' range. 175 oystercatcher nests were located and a smaller subset was monitored until fledging. The average reproductive success at monitored nests was 0.54 young/pair (n = 28) which is a lower rate than previously found in this part of California but still within the range of variability reported for the species. This first statewide breeding season Black Oystercatcher survey in California helps form the basis for future monitoring efforts and guide conservation actions.

**F6.2 Doumas, Lenore,** (Oklahoma State, Coeur d'Alene, United States); Dugas, Matthew (Hendrix College, Conway, AR, United States)

#### THE INTENSITY OF CAROTENOID-BASED NESTLING MOUTH COLORATION IS NEGATIVELY ASSOCIATED WITH ECTOPARASITE DENSITY IN HOUSE SPARROW BROODS

Dependent offspring use a suite of behavioral and morphological traits to attract parental care. In birds, ornamental mouth coloration may be one such trait, and current evidence suggests

that it serves a communication function between parents and offspring. For example, nestling house sparrows (*Passer domesticus*) display yellow mouthparts while begging and previous work has demonstrated a parental preference for chicks with intense yellow flanges. Understanding the evolutionary forces that shape this communication requires understanding the information content of these signals. Previous work has revealed positive relationships between coloration, nestling mass and circulating carotenoid levels within-broods, but has left among-brood variation largely unexplained. Here, we examined the relationship between carotenoid-based flange coloration and the levels of ectoparasite infestation in house sparrow broods. We found a significant negative relationship between mite density and average flange coloration of broods. This result suggests that parasite density may affect among-brood variation in mouth color. More broadly, these results support the hypothesis that offspring signals have evolved under pressure to signal high quality to choosy parents.

**PS1.71 Doyle, F.I.,** (Wildlife Dynamics Consulting, Smithers, Canada); Waterhouse, F. Louise (BC Ministry of Forests, Lands, and Natural Resource Operations, Nanaimo, BC, Canada); Wijdeven, B. (B.C. Ministry of Forests, Lands, and Natural Resource Operations, Queen Charlotte, BC, Canada); Vennesland, R. (Parks Canada Western and Northern Service Centre, Vancouver, BC, Canada); Bergman, Carita (Gwaii Haanas National Park Reserve and Haida Heritage Site, Queen Charlotte City, BC, Canada)

#### USING MULTIPLE APPROACHES TO STUDY THE THREATENED HAIDA GWAII NORTHERN SAW-WHET OWL

Knowledge gaps on the biology of the 'Threatened' Northern Saw-whet Owl, *Aegolius acadicus brooksi*, a subspecies restricted to Haida Gwaii, British Columbia, Canada limits effective science-based planning for recovery. Hence, the Northern Saw-whet Owl Recovery Team has initiated a series of integrated studies to investigate the requirements of this secretive owl, which potentially relocates seasonally between interior breeding and coastal overwintering areas. First, standard call back response transects are being used to determine seasonal shifts in occupancy between interior and coastal areas. Second, radio telemetry is being used to determine home range areas, configuration, and habitat selection. During the 2011 summer, radio telemetry was used to track 4 interior males with PD2 Holohil backpack transmitters. Males used both second and old growth forest. Preliminary analysis indicates multi-nuclear homeranges (190-417ha) that are substantially larger than the previously estimated 80ha core areas. This winter (2012) 5 coastal owls, male and female, have been tracked moving between coastal estuaries and the adjacent forests (up to 1-2 km inland). Individual foraging areas overlap, and roost site selection is variable. Third, vocal recordings of the radio tagged owls are being used to validate their use for individual identification to examine territoriality and site fidelity. Fourth, isotope sectional analysis of owl talons (road killed birds) combined with owl stomach contents (road kills) are being used to determine if there is a seasonal shift in diet (marine to terrestrial). By integrating multiple approaches sufficient information will be obtained to more effectively manage this species.

**PS1.70 Doyle, F.I.,** (Wildlife Dynamics Consulting, Smithers, Canada); Waterhouse, F. Louise (BC Ministry of Forests, Lands, and Natural Resource Operations, Nanaimo, BC, Canada); Wijdeven, B. (B.C. Ministry of Forests, Lands, and Natural

Resource Operations, Queen Charlotte, BC, Canada); Todd, M. (B.C. Ministry of Forests, Lands, and Natural Resource Operations, Nanaimo, BC, Canada); Vennesland, R. (Parks Canada Western and Northern Service Centre, Vancouver, BC, Canada)

#### WHY HAS THE SOOTY GROUSE POPULATION DECLINED ON HAIDA GWAI, BRITISH COLUMBIA, CANADA?

Sooty Grouse (*Dendragapus fuliginosus* group) on Haida Gwaii, British Columbia, Canada are the only mid-sized forest herbivore endemic to the islands. Of management concern is an estimated 7-fold population decline in the last 100 years and its implications for community subsistence hunting and prey supply for the COSEWIC threatened Coastal (A. g. laingi) Goshawk. We are investigating seasonal grouse distribution, dispersal, habitat requirements, and biology to determine potential cause(s) for the decline. We have radio-tagged (using RI-2DM 15g Holohil necklaces) 17 female (n = 10 2010; n = 7, 2011) and 14 male (2011) grouse. In 2010-11, females used a range of forest types in all seasons; winter and breeding home ranges were separated by 1-10km. All adult females returned to their 2010 summer home ranges in 2011. In contrast, although 5 currently tagged males moved similar distances to winter ranges, they are using primarily mature-old growth forests. Seven of the 10 tagged female birds bred in 2011. We located 6 nests of which 4 were off the ground on stumps and logs (one was 3.4 m high). Only 3 females' successfully raised broods; all three extensively foraged along roadsides. By September the three were killed (2 shot, 1 possible predation) and the fate of their dependent young is unknown. Known mortality of tagged grouse was 29% (n = 31) and mostly due to hunting (67%, n = 9). Through this ongoing research our goal is to provide the opportunity for a healthier grouse population, ultimately to the benefit of both hunters and goshawks.

**W9.3 Drake, Anna**, (Simon Fraser University, Burnaby, Canada); Rock, Christine; Quinlan, Sam; Green, David (Simon Fraser University, Burnaby, BC, Canada)

#### ENSO-DRIVEN WESTERLY WINDS DURING SPRING MIGRATION INFLUENCES BREEDING PHENOLOGY, PRODUCTIVITY AND ANNUAL SURVIVAL OF A NEOTROPICAL MIGRANT ON THE WESTERN FLYWAY

Annual variation in the population parameters of neotropical migratory birds has been shown to vary with climate on the breeding grounds, at wintering sites, and during migration. However, climate factors are often correlated across the annual cycle and events in one period may impact processes occurring in subsequent ones. We used an information theoretic approach to evaluate the relative importance of spring conditions on the breeding grounds (mean May temperature), ENSO-related climate conditions (SOI) that predict monsoon and late winter rainfall on wintering grounds, and wind speed on the Pacific flyway during spring migration in determining the breeding phenology, productivity and apparent annual survival of Yellow Warblers in Revelstoke, BC between 2004 and 2011. Mean westerly wind speed during spring migration was the best predictor of male arrival dates and female first-egg dates and consequently influenced annual productivity of Yellow Warblers. Path analysis estimates suggest declines of 0.2 fledglings for older females and 0.5 fledglings for younger females of over the range of wind speeds observed. Mean westerly wind speed during spring migration also explained variation in annual adult survival with declines of approximately 30% over the observed range. Our results support previous

studies that suggest migration costs have a large impact on survival in neotropical migrants. Our findings suggest additional population-level productivity costs associated with climate conditions during this period. Westerlies are significantly correlated to ENSO, with higher wind speeds associated with La Nina conditions in spring. This suggests that ENSO cycles could impose population fluctuations of a similar periodicity.

**S4.3 Drake, Kiel**, (Bird Studies Canada, Saskatoon, Canada); Hedley, Richard (Bird Studies Canada, Saskatoon, Canada); Francis, Charles (Canadian Wildlife Service, Ottawa, Canada); Wilson, Scott (Canadian Wildlife Service, Saskatoon, Canada); Conkin, John; Dudragne, Ryan (Bird Studies Canada, Saskatoon, Canada)

#### USING DIGITAL RECORDINGS TO ESTIMATE OCCUPANCY AND DETECTION OF MARSH BIRDS

Autonomous recording units (ARUs) have the potential to supplement field-based observers in ways that can test some of the assumptions of monitoring programs, and help to design more cost-effective monitoring of secretive marsh birds. We estimated detectability and occupancy for 11 species of secretive wetland-associated birds in Alberta and Saskatchewan, Canada. We set up ARUs to record continuously in the morning and evening for several consecutive days, and had field technicians conduct three to seven 15-minute field surveys at the same locations following the guidelines of the standard North American Marsh Bird Monitoring Protocols. From the recordings, we used skilled birders to analyse multiple 1-minute and 5-minute segments at various times of day using a combination of listening and viewing spectrograms. We used single-season occupancy analysis to (1) compare species-specific estimates of occupancy and detection probabilities derived from field surveys with those derived from analyses of subsets of the ARU acoustic surveys, and (2) to evaluate temporal and seasonal variation in detection probabilities for this suite of species. For some species, occupancy estimates generated from ARUs were greater than those estimated from field surveys, while for others they were comparable. For most species, precision of the estimates (occupancy and detection probability) derived from ARU data was similar to, or higher than, estimates from the field surveys. Detection probability varied by time of day and time of season in different ways for each species suggesting that the optimal sampling period may vary among species. Sampling over multiple periods (as required to estimate detectability and occupancy) and at different times of day can be done more cost-effectively using ARUs than field observers, because the field crews only need to make two visits per season to each site, once to set up and once to retrieve the recorder, and this can be done at any time of day. Further analyses of the intensive samples will allow us to design the optimal strategy for listening to subsets of the recordings to ensure relatively precise estimates of detectability and occupancy.

**SAT16.5 Drever, Mark**, (Environment Canada, Delta, Canada); Hrachowitz, Markus (Delft University of Technology, Delft, The Netherlands); Lemon, Moira (Canadian Wildlife Service, Delta, BC, Canada)

#### HYDROLOGICAL FLOW MODELS CAN INFORM MIGRATION ECOLOGY OF SHOREBIRDS

Estimating length of stay, the number of days a bird can be expected to stay at a site, is critical to understanding the migration ecology of birds as it allows the calculation of population sizes from counts at stopover sites. Moreover,

reductions in length of stay could account for apparent population declines of shorebirds. The problem has an analogue in the hydrological concept of residence time, the amount of time that water spends in a reservoir, which can be calculated as a numerical integration of inflow and outflow rates. We used this approach to estimate mean length of stay of Western Sandpipers and Dunlin based on time series of daily counts at two sites in the Strait of Georgia, British Columbia, 1992-2011. The approach yielded mean residence times during northward (breeding) migration at the Fraser River Delta that ranged between 1.2 and 6.0 days for Western Sandpipers, and 1.1 and 8.9 days for Dunlin, consistent with estimates from radio-telemetry studies. Mean residence times for Western Sandpipers during southward migration at Sidney Island ranged between 1.6 and 7.8 days, and showed a significant decline over time, 1992-2001, again consistent with previous studies with marked birds. These results indicate that hydrological flow models offer reliable means to estimate true population sizes of shorebirds from daily counts. In doing so, the models present an opportunity for testing alternate hypotheses regarding the roles, variously, of behavioral- versus habitat-related mechanisms driving shorebird population sizes.

**PS2.33 Drolet, Bruno**, (Environnement Canada, Québec City, Canada); Rousseau, François (Regroupement QuébecOiseaux, Québec, PQ, Canada); Lepage, Denis (Bird Studies Canada, Port Rowan, ON, Canada)

#### ESTIMATING BIRD'S NESTS CHRONOLOGY TO DESCRIBE THE BREEDING PHENOLOGY OF BIRDS IN CANADA USING THE R PACKAGE RNEST

An accurate description of breeding phenology in birds is essential to assess the likelihood of finding breeding activity in a species at any given time. Typically, breeding phenology is described in terms of duration and start date of the breeding season, which are both affected by climatic and environmental factors. Thus, the timing of breeding activity is often better described in relation to a specific region. Within a breeding season, differences among species and individuals will also lead to variation in breeding intensity throughout the breeding season, which can be evaluated by determining the proportion of active nests on any given date. This proportion can be assessed by backcalculations using raw information collected during visits to nests (e.g., the number or presence of eggs and/or young) and nesting parameters with which can be used to infer the nesting chronology of a set of nests (e.g., laying of the first egg, hatching, departure of young from the nest).

Here, we propose a description of the breeding phenology of birds across Canada based on a new R package called *Rnest*. This package implements a set of algorithm for inferring nesting chronology, and for describing the breeding phenology, of any species or group of species, in any region of the world, using daily nest observations. It aims at estimating, in an automated way, the most likely nesting chronology that an informed ornithologist would estimate using the daily nest observations available. Using *Rnest*, we processed the complete database for Bird Studies Canada's Project NestWatch, which contains more than 680,000 daily nest observations from more than 300,000 nest records for 375 species. Breeding zones for Canada and group of species with similar breeding phenology are presented, and a discussion of the variables that were used to define them.

**SAT1.2 DuBay, Shane\*** (University of New Mexico, Albuquerque, United States); Witt, Christopher (University of New Mexico, Albuquerque, Canada)

#### DIVERSIFICATION BY LOCAL ADAPTATION TO ALTITUDE IN ANDEAN TIT-TYRANTS

Diversification of Andean birds is driven by geographic isolation along the latitudinal axis of the mountain ridge. Subsequent range expansion often leads to parapatric elevational replacement of closely related taxa. Mechanisms for the maintenance of stable, vertically displaced distributions are poorly known, but might include local adaptation to abiotic conditions. We investigated the role of differential adaptation to altitude in maintaining species limits between sister species: the smaller, widespread *Anairetes reguloides* (Pied-crested Tit-tyrant) and the larger, high-elevation *Anairetes nigrocristatus* (Black-crested Tit-tyrant). Mitochondrial DNA indicates that *A. reguloides* diversified northwards below the elevational distribution of *A. nigrocristatus*. We analyzed mitochondrial and nuclear DNA data, morphometric characters, and blood-oxygen carrying capacity across an elevational transect that spans the distributions of both species on the west slope of the Peruvian Andes. Blood-oxygen carrying capacity parameters indicate that *A. reguloides* experiences hypoxic stress at high elevations while *A. nigrocristatus* exhibits no signs of hypoxic stress, suggesting hypoxia resistance due to biochemical adaptation. Principal component analysis of morphometric characters shows that each species has a distinct, non-overlapping phenotype. Intermediate phenotypes were discovered only along a narrow contact zone in an inter-montane valley. Hybridization is apparent in this valley by the presence of individuals with phenotypes that match *A. reguloides* and genotypes that match *A. nigrocristatus*, and vice versa. The parental genotype and phenotype are predicted within the contact zone by elevation rather than proximity to the parental populations. That is, individuals at higher elevations within this valley are more likely to be genotypically and phenotypically similar to *A. nigrocristatus*, the high-elevation specialist. The results suggest that physiological adaptation to abiotic conditions can promote elevational segregation that predominates among Andean birds, and that this pattern can persist despite at least some degree of reproductive inter-compatibility.

**S10.5 Duckworth, Renee**, (University of Arizona, Tucson, United States);

#### ADAPTIVE VARIATION IN BEHAVIOR: EVOLUTIONARY INSIGHTS FROM DEVELOPMENTAL MECHANISMS

Behavior is often assumed to be the most flexible of traits, yet, recent studies show a high repeatability of behavior within individuals even across different functional contexts. What limits behavioral flexibility? One possibility is that inflexibility is adaptive because it enables behavior to be integrated with other traits which are themselves relatively inflexible. Alternatively, inflexibility may be maladaptive if it is caused by pleiotropic effects of genes that limit the ability of behaviors to vary independently. Hormones commonly integrate distinct behaviors either through organizational effects acting during early ontogeny or through activational effects during the adult stage. Activational effects of hormones are expected to regulate flexible phenotypes, whereas, organizational effects set the stage for permanent behavioral differences among individuals. I will discuss the relative importance of these effects and show that hormonal and behavioral variation are often decoupled in adulthood such that behavioral differences could be greatly influenced by early ontogeny maternal effects. I will show that hormone-behavior decoupling in adulthood may be an important prerequisite in the evolution of adaptive personalities and that investigating organizational effects of hormones is necessary for understanding the proximate basis of individual differences.

**T3.5 Duerr, Adam**, (West Virginia University, Morgantown, United States); Miller, Tricia (West Virginia University,

Morgantown, United States); Lanzone, Micheal (Cellular Tracking Technologies, LLC, Somerset, PA, United States); Brandes, Dave (Lafayette College, Easton, PA, United States); Cooper, Jeff (Virginia Department of Game and Inland Fisheries, Fredericksburg, VA, United States); O'Malley, Kieran (West Virginia Department of Natural Resources, Romney, WV, United States); Maisonneuve, Charles (Ministère des Ressources naturelles et de la Faune, Rimouski, PQ, Canada); Tremblay, Junior (Ministère des Ressources naturelles et de la Faune, Quebec City, PQ, Canada); Katzner, Todd (West Virginia University, Morgantown, United States)

#### WEATHER DRIVES MIGRATORY FLIGHT BEHAVIOR OF GOLDEN EAGLES: IMPLICATIONS FOR UNDERSTANDING WIND-WILDLIFE INTERACTIONS AND CLIMATE CHANGE EFFECTS ON MIGRATORY BEHAVIOR

Knowing drivers of migration is important to understanding evolution of migration, migration ecology, and conservation of migratory species. This is especially important in the face of global climate change and anthropogenic mortality risks – for example, associated with wind-energy development – during migration. Endogenous hormone cycles, and thus migratory decisions, are initiated based upon environmental cues such as photoperiod, which operate at annual temporal scales. However, related responses also function at daily time scales but the cues for those behaviors are not well understood. We investigated meteorological parameters associated with daily migratory movements of Golden Eagles in northeastern North America. We outfitted eagles with GPS-GSM transmitters that record GPS-quality locations in 3D at intervals of 30 sec. or 15 min. By comparing migratory movements with weather data (NOAA, NCEP, North American Regional Reanalysis) we show that the meteorological cues that drive migratory decisions differ between spring and fall and for all age classes of birds. During both spring and fall, migratory flights were associated with two distinct patterns. First, daily migration movements occurred in conjunction with high pressure and low to moderate wind speeds. Such conditions may facilitate thermal soaring during early fall and late spring. Second, during late fall and early spring, migratory flights were associated with moderate to high wind speeds and changing atmospheric pressure. In fall, pressure levels increased with northwest winds, while in spring, pressure decreased and wind directions were southeasterly. These conditions appear to facilitate use of orographic lift and correspond to the orientation of the region's main topographic features. Identifying specific weather patterns associated with specific flight behaviors allows evaluation of risk from wind energy. When eagles use slope soaring they are at highest risk of mortality because flight levels overlap with the rotor-swept zone of wind turbines. Thus, efforts to maximize energy output while minimizing risk of mortality, such as feathering rotor blades, can be focused at specific times of detrimental weather and locations where eagles are known to fly. With global climate change, weather patterns in northeastern North America are expected to change. This will alter the trade-offs inherent in migratory decision making for Golden Eagles and impact risk from anthropogenic sources in a changing environment.

**SAT15.5 Duffie, Caroline.** (Louisiana State University, Baton Rouge, United States); Graves, Gary (Smithsonian Institution, Washington, DC, United States); Brumfield, Robb (Louisiana State University, Baton Rouge, United States)

#### HYBRIDIZATION IN ISLAND BIRDS: A CASE STUDY OF THE JAMAICAN ENDEMIC STREAMERTAILS

Streamertail Hummingbirds (*Trochilus polytmus* and *T. scitulus*) are Jamaican endemics that represent one of the few cases of in situ speciation for birds, and thus provide a unique opportunity to study avian evolution within islands. These sexually dichromatic, promiscuous species differ in definitive male bill color, which is red in *T. polytmus*, and black in *T. scitulus*, as well as in bill length and width. A previous study based on phenotype revealed a narrow but stable hybrid zone where their ranges meet along the eastern side of the island. Hybrid forms exhibit intermediate bill colors for both males and females. Given the dispersal ability of these highly volant hummingbirds, the hybrid zone between them is shockingly narrow (~3 km). Maintenance of this narrow width in the face of high parental dispersal indicates that strong barriers to reproduction exist; yet, nothing is known about the forces that prevent them from fusing. We genotyped 172 individuals at 14 microsatellite loci to confirm hybridization and to characterize patterns of introgression across the hybrid zone. Using these multilocus genotypes, we assigned individuals to genetic populations using a Bayesian clustering framework implemented in the program STRUCTURE. We present these results together with cline analysis for the microsatellite loci and phenotypic characters that show interspecific variation. These analyses we implemented in a new software package (HZAR), which functions for fitting genetic, ecological and morphological data from hybrid zones to equilibrium cline models [using the Metropolis-Hasting algorithm in the R platform]. This study provides the first molecular analysis of the *Trochilus* hybrid zone.

**SAT12.6 Dunn, Peter,** (University of Wisconsin-Milwaukee, Milwaukee, United States); Bollmer, Jennifer (University of Wisconsin-Milwaukee, Milwaukee, United States); Freeman-Gallant, Corey (Skidmore College, Saratoga Springs, NY, United States); Whittingham, Linda (University of Wisconsin-Milwaukee, Milwaukee, WI, United States)

#### MHC VARIATION IS RELATED TO A SEXUALLY-SELECTED ORNAMENT, SURVIVAL AND PARASITE RESISTANCE IN COMMON YELLOWTHROATS

Extra-pair mating in birds remains controversial because it is usually not clear which sex initiates the matings, and there is little evidence that offspring gain genes associated with greater survival. In the common yellowthroat (*Geothlypis trichas*), females actively choose extra-pair mates that have a larger black facial mask. Here we test the hypothesis, first proposed by Hamilton and Zuk (1982), that females prefer to mate with more ornamented males because mask size is a signal of their genetically-based resistance to parasites and likelihood of survival. We examined genetic variation at the major histocompatibility complex (MHC), which plays an important role in pathogen recognition. Mask size was positively related to the number of different class II alleles, as predicted if greater variation at the MHC allows for the recognition of a greater variety of pathogens. Furthermore, males with more class II alleles had greater survival (return rate). Resistance to malaria infection was associated with the number of class I alleles, as well as the presence of particular class II alleles, suggesting that some 'good genes' can provide resistance to particular pathogens. Thus, extra-pair mating may provide female warblers with immunity genes that are related to parasite resistance, survival and the expression of a male ornament, consistent with good genes models of sexual selection.

**PS2.243 Dustin, Partridge,** (Fordham University, Suffern, United States);

#### URBAN GREEN ROOFS AS MIGRATORY AND BREEDING BIRD HABITAT

Wildlife face an increasingly urbanized landscape. Urban environments are generally comprised of impermeable surface and often lack suitable stopover and breeding bird habitat. In New York City, for example, 34% of its surface is rooftop, while only 3% is natural green space. However, green roofs may be a sustainable way to provide essential habitat in these otherwise depauperate environments. This study examines if green roofs can be a viable bird conservation tool in urban environments. A green roof is a roof covered by a waterproof membrane and growing medium and planted with vegetation. Green roofs reduce the cooling and heating needs of buildings, minimize stormwater impacts, reduce urban heat island effects, and provide habitat for invertebrate species. However, no study to date has evaluated avian use of multiple green roofs in a highly urbanized area. I am comparing bird and arthropod diversity on green roofs in New York City with nearby non-vegetated roofs. To document the presence of birds, I am using direct observations and deploying autonomous recording units to record bird vocalizations. Preliminary results indicate that during migration up to three times as many species use green roofs compared to traditional non-vegetated roofs and that green roofs host a greater number of individuals. Arthropod prey is up to 11 times more abundant on green roofs than non-green roofs. This is the first study to examine the role of green roofs as stopover habitat for migrating birds. We predict green roofs could play an important role for both migrating and breeding birds in urban environments.

**T14.5 Dwyer, James,** (EDM International, Inc., Fort Collins, United States); **Harness, Richard** (EDM International, Inc., Fort Collins, CO, United States)

#### A LOGISTIC REGRESSION MODEL TO PREDICT AVIAN ELECTROCUTION RISK

Birds are regularly electrocuted on overhead electric systems. Avian electrocutions violate federal and state law, reduce system reliability, and negatively impact public safety. Thus, predicting avian electrocutions and preventing them is a priority for electric utilities. Working with the California Energy Commission and Southern California Edison we used outage data collected from 1981 through 2009 to investigate the feasibility of a logistic regression model predicting avian electrocution. We visited 213 structures where the electrocution of a raptor or corvid had resulted in an outage (incident structures), and 248 randomly selected structures not known to have been involved in an avian electrocution (comparison structures). At each structure we collected data on 35 variables. Of those, 10 independent variables were indicated through univariate analysis ( $P < 0.50$ ) as potentially useful in distinguishing structure types. We then randomly selected 80% of our data to create a logistic regression model and used the remaining data to validate the model. We used AICc and model averaging to select our model and generate parameter estimates. Our model required only 4 variables to distinguish incident structures from comparison structures. The variables were 1) number of jumpers, 2) number of phases, 3) presence of grounding, and 4) presence of unpaved open habitat. The probability of an incident increased 1.0-2.3% with each jumper on a structure, increased 2.0-3.5% with each phase, increased 4.0-13.0% with the addition of pole-top grounding, and increased 4.5-13.7% when open unpaved open habitat was absent. Though the source of our incident data influences our scope of inference and our conclusions regarding habitat, we have demonstrated the value of logistic regression

modeling for predicting structures likely to be involved in an avian electrocution.

**W9.4 Dybala, Kristen,\*** (University of California-Davis and PRBO Conservation Science, Davis, United States);

#### EFFECTS OF WEATHER AND FLEDGE DATE ON SURVIVAL IN JUVENILE SONG SPARROWS VARY BY DEVELOPMENTAL STAGE

Variation in juvenile survival can have significant impacts on population growth rates and viability, yet knowledge of the drivers of variation in juvenile survival, and how they vary by developmental stage, is often lacking. Although the survival of dependent juveniles is often relatively low, their survival may be buffered from the effects of poor environmental conditions by parental care. In contrast, independent juveniles must fend for themselves, and may be particularly sensitive to variation in food availability. In this study, I examined several expected drivers of temporal and seasonal variation in the survival of juvenile Song Sparrows (*Melospiza melodia*). A 30-year mark-recapture data set was used to model the effects of prior winter weather (related to food availability), population density, fledge date, and body mass, on the survival of juveniles from fledging through dependent (weeks 1-3), transitional (weeks 4-5), and independent (weeks 6-12) stages of development. Between 1980 and 2010, juvenile survival varied annually, and a model combining effects of prior winter weather and a declining trend accounted for 73% of the total temporal variation. As expected, prior winter weather had the strongest effect on independent juveniles, who must forage for themselves, but contrary to expectation, fledge date had strong, opposing effects on survival during each stage, indicating that different mechanisms are involved during each stage. Finally, body mass had similar positive effects on survival during all three stages. Juvenile survival has proven challenging to study, but identifying the drivers of variation in juvenile survival is essential to understanding and projecting population responses to environmental change.

**F13.9 Earnst, Susan,** (USGS, Boise, United States); **Dobkin, David** (High Desert Ecological Research Institute, Bend, OR, United States); **Ballard, Jennifer** (Great Basin Bird Observatory, Reno, NV, United States)

#### INCREASES IN AVIAN ABUNDANCE AND CHANGES IN ASPEN WOODLAND VEGETATION DURING 12 YEARS AFTER LIVESTOCK REMOVAL IN THE GREAT BASIN

Riparian and quaking aspen (*Populus tremuloides*) woodlands are centers of avian abundance and diversity in the western United States, but they have been affected adversely by land use practices, particularly livestock grazing. In 1990, cattle were removed from a 112,500 ha national wildlife refuge in southeastern Oregon, and we monitored the vegetation and avian response in years 1-3 (Phase 1) and 10-12 (Phase 2) thereafter on 17 riparian and 9 snowpocket aspen plots. In both phases, riparian and snowpocket aspen produced extensive regeneration of new aspen shoots. By Phase 2, a 64% increase in medium-diameter trees in riparian stands indicated successful recruitment into the overstory, but this pattern was not seen in snowpocket stands, which are relatively dense with smaller trees. By phase 2 in riparian and snowpocket stands, native forb cover had increased statistically significantly by 68% and 57%, respectively, mesic shrub cover had increased significantly by 29% and 58%, and sagebrush cover had decreased significantly by 24% and 31%. Total avian abundance increased significantly by 33% and 39% in riparian and snowpocket aspen, respectively, ground-understory nesters

increased by 133% and 67%, and overstory nesters by 34% and 33%. Similarly, ground-understory foragers increased by 25% and 32%, aerial foragers by 55% and 57%, and overstory foragers by 66% and 43%. We interpret the substantial regeneration of aspen shoots, increased densities of riparian forbs and shrubs, and increased avian abundances as a response to livestock removal and as movement toward recovery of biological integrity.

**PS1.187 Eason, David,** (Southeastern Oklahoma State University, Atoka, United States); Wood, Douglas (Southeastern Oklahoma State University, Durant, OK, United States)  
TREE SWALLOW (*TACHYGINETA BICOLOR*) NEST SUCCESS, SITE FIDELITY, AND SPATIAL MOVEMENT AT RED SLOUGH WMA

The Tree Swallow (*Tachycineta bicolor*) is a Nearctic-Nearctic migrant bird species that historically nests in the northern half of the United States and Canada and winters in the sub-tropics. Tree Swallows expanded their range southward over the last 20 years and now occur in Oklahoma. We monitored Tree Swallow nest boxes and reproductive success at Red Slough WMA in southeastern Oklahoma during 2011. We monitored 57 nest boxes to determine nest success of Tree Swallows. Nest boxes were monitored for use, clutch size, number of eggs hatched/clutch, number of young fledged/nest, and any cause-specific nestling mortality. Adult Tree Swallows were banded, aged, and sexed. Nestlings were also banded and weighed. This allowed for the continued establishment of a banded population of Tree Swallows and study of their site fidelity, population recruitment, inter- and intra-seasonal movement patterns. In 2011, we banded 269 nestlings and 23 adults. Forty-two adults were recaptured from prior years (2009 and 2010). Tree Swallows moved an average of 1.1 km inter-seasonally (range = 0-4.1 km). Only one female moved 118 m intra-seasonally. Tree Swallows attempted 72 nests with a mean clutch size of 5.2 eggs. A total of 375 eggs were laid, of which 72.3% hatched and 94% fledged. Nineteen Tree Swallows (3 M; 16 F) were recruited into the RSWMA population. Our results indicated that nest success and recruitment occurred at Red Slough WMA and was a potential source population of Tree Swallows.

**PS1.98 Edmonds, Samuel,** (Biodiversity Research Institute, Gorham, United States);  
METALS IN FEATHERS OF RUSTY BLACKBIRDS FROM BREEDING AND WINTERING AREAS WITH COMPARISON TO BREEDING CO-INHABITING SONGBIRDS

The Rusty Blackbird (*Euphagus carolinus*) is undergoing a rapid population decline estimated at a loss of greater than 90% since the 1960s. While many reasons have been proposed to explain the dramatic population loss, no consensus exists among researchers. Recent surveys of mercury concentrations suggests that a majority of the Acadian population of the species exceeds published effects levels (blood-Hg 0.94 ppm, feather-Hg 8.26 ppm, Edmonds et al. 2011). We assessed the exposure of this population to other heavy metals [Al, As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Se, and Zn] using feathers non-lethally collected on breeding and wintering grounds to aid in determining if other contaminants may be a factor. Other songbirds captured at the northeastern breeding sites were similarly sampled allowing for comparison to co-inhabiting songbirds. Compared with the other songbirds and with concentrations reported elsewhere, Rusty Blackbirds had elevated concentrations of chromium and manganese. However, due to the lack of available effects thresholds for most metals the potential for impacts to the

population is uncertain. Further research into these heavy metals in birds is recommended

**F5.6 Edworthy, Amanda,** (Australian National University, Canberra, Australia); Martin, Kathy (University of British Columbia, Vancouver, BC, Canada); Wiebe, Karen (University of Saskatchewan, Saskatoon, SK, Canada)

THE DYNAMIC LIVES OF TREE CAVITIES: COMMUNITY-LEVEL USE PATTERNS OF TREE CAVITIES BY CAVITY-NESTING BIRDS

Key resources that are shared by many species within a community can influence its structure and function. Tree cavities are a multi-annual resource that are created either by woodpeckers or decay and are subsequently used by a diverse assemblage of excavators and non-excavators for nesting and roosting (10% of bird species globally). While we know that most excavators select relatively fresh cavities when they reuse a cavity, it is uncertain whether long-lived tree cavities which may have aged and deteriorated continue to be valuable resources. To understand and manage large communities of cavity-nesting birds, it is helpful to examine productivity (cavity use rates) from the perspective of the cavity. We tracked the use and characteristics of more than 1600 individual aspen cavities, 90% formed by 9 excavators and 10% by decay, in interior British Columbia for up to 16 years (1995–2010) to determine patterns in use across the lifespan of a cavity (mean lifespan = 12 years). Most excavators and dominant competitors used relatively fresh cavities; however, secondary cavity nesters including mountain bluebirds and tree swallows used all ages of cavities. We did not determine whether they were forced to use older cavities because of competition, or whether they had no preference. Red squirrels used old cavities more than fresh cavities possibly due to the increase in cavity volume that occurred as a cavity aged. Our results show that useable aspen tree cavities last about 12 years and show age-structured characteristics in the context of community-level reuse patterns with a predictable succession of secondary cavity nesters using them.

**S4.5 Efford, Murray,** (1. Department of Zoology, University of Otago, Dunedin, New Zealand); Dawson, Deanna (USGS Patuxent Wildlife Research Center, Laurel, MD, United States)

ESTIMATING BIRD POPULATION DENSITIES USING MICROPHONE ARRAYS

Sound recording provides a means to estimate the absolute density and habitat distribution of singing birds, but it is necessary to adjust for incomplete detection and availability. Incomplete detection is a function of distance that incorporates the sound amplitude at source, attenuation of sounds between the source and a microphone, and background noise. The detection function may be estimated from field data collected with a microphone array in which individual calls or songs are recorded on multiple microphones. Ancillary information on recorded sound intensity or differential time of arrival may be used to improve precision. We suggest allowing for incomplete availability, the probability that a particular bird does not sing at all during a recording, by estimating the per capita song rate directly from the recordings using models that avoid the need to attribute songs to individual birds.

The combined methods may be applied over large areas using a sampling design in which sounds are recorded at many points spaced across a landscape, and the detection function is estimated with small arrays at a random sample of points.



Spatially explicit capture-recapture modeling of data from a 2011 breeding-season survey of forest songbirds on the ~5200-ha Patuxent Research Refuge in Maryland provided estimates of both the overall density of common species and the variation in density between forest types. We discuss limitations of the methods and their potential for wider application.

**PS2.190 Eggert, Lisa,** (Biodiversity Research Institute, Gorham, United States); Jodice, Patrick (US Geological Survey-SC Cooperative Fish and Wildlife Research Unit, Clemson University, Clemson, SC, United States); Yates, Michael (Biodiversity Research Institute, Gorham, United States); Meatley, Dustin (Biodiversity Research Institute, Gorham, SC, United States); Stenhouse, Iain; Evers, David (Biodiversity Research Institute, Gorham, ME, United States)

**NON-BREEDING SEASON MOVEMENTS AND DISTRIBUTION OF BROWN PELICANS FROM THE SOUTHEASTERN US USING SATELLITE-DERIVED DATA**  
For Brown Pelicans (*Pelecanus occidentalis*) breeding in the US, habitat use, colony fidelity, and threats are relatively well known during the breeding season due to long term colony monitoring and banding studies. Little information regarding these parameters is available, however, for pelicans during the non-breeding season. As part of a pre-assessment study for the Natural Resources Damage Assessment of the Deepwater Horizon oil spill, we deployed satellite transmitters on pelicans captured in Louisiana, Mississippi, and South Carolina (n = 80) in 2010; to date, this is the largest movement dataset for the species. We present satellite-derived movement data to identify key wintering locations of Brown Pelicans in the southeastern US and Latin America and describe the timing and duration of movements to these sites. When possible, we examine habitat use and movements during two consecutive wintering seasons. Understanding habitat selection and threats to pelicans during the non-breeding season is valuable for furthering conservation efforts for the species throughout their annual cycle.

**F14.11 Ehlers, Shannon,** (Institute for Wildlife Studies, San Diego, United States); Bridges, Andrew (Institute for Wildlife Biologist, San Diego, CA, United States); Garcelon, David (Institute for Wildlife Studies, Arcata, CA, United States); Booker, Melissa (United States Navy, San Diego, CA, United States); Docherty, Teegan (University of Leeds, Leeds, United Kingdom)

**QUANTIFYING SURVIVAL AND IDENTIFYING PREDATORS OF THE THREATENED ISLAND-ENDEMIC SAN CLEMENTE SAGE SPARROW**

Predation by invasive mammals has resulted in extinctions of island-endemic species worldwide. Therefore, it is important that managers understand the influence introduced predators have on island species. A population viability analysis conducted in 2007 for the San Clemente Sage Sparrow (*Amphispiza belli clementeae*; federally listed as Threatened) suggested low apparent juvenile survival posed the greatest threat to the subspecies' probability of persistence and recovery. At that point, it was unknown how introduced black rats (*Rattus rattus*), house mice (*Mus musculus*), and feral cats (*Felis domesticus*) affected the population. To better inform the recovery program for this subspecies, we deployed 201 transmitters on independent juvenile and dependent fledgling sage sparrows to provide life-stage-specific estimates of juvenile survival and to identify the causes of juvenile mortality. From 2009–2011, we monitored 177 independent juvenile sage sparrows for 3,440 days and documented 30 mortalities.

Thirteen predations were attributed to invasive mammals, primarily black rats (12). Predation events ascribed to native predators included island foxes (1, *Urocyon littoralis*), American Kestrels (4, *Falco sparverius*), and the endangered San Clemente Loggerhead Shrike (2, *Lanius ludovicianus mearnsi*). Lack of evidence prevented us from identifying the predating species in 10 cases. Known-fate survival estimates were low and differed among years, ranging from 18–38% for the 4-month annual study periods. In 2011, we monitored 24 dependent fledglings for 355 days and documented 12 mortalities, of which 11 were due to predation by rodents. Known-fate modeling resulted in daily survival probabilities of 96.7%, 84.4% and 100% for nestling, inactive fledgling ( 5 days of the nest), respectively. Our findings suggest invasive mammals, particularly black rats, may be a primary limiting factor in population growth. In the spring of 2012, we will continue our radio telemetry study of dependent fledglings and will begin using video cameras to further examine predation at nest sites. Insights gained from this research will allow us to better utilize management options, such as non-native predator control, to improve the recovery probability for the San Clemente Sage Sparrow.

**F10.1 Eichholz, Mike,** (Southern Illinois University Carbondale, Carbondale, United States); Haffele, Ryan (Southern Illinois University Carbondale, Carbondale, United States)

**IS CURRENT NEST SITE SELECTION OF GRASSLAND NESTING BIRDS MALADAPTIVE?**

Nest site selection among open or cup-nesting birds is thought to have evolved as the result of a trade-off between concealment and visibility. Individuals are thought to choose nest sites that are adequately concealed to avoid egg and chick predation yet provide adequate visibility to allow incubating adults to detect approaching predators. Anthropogenic changes, however, have drastically modified landscapes, potentially altering the adaptive significance of nest site selection criteria. We used data from 2,167 nests of upland nesting ducks to test predictions of nest site selectivity and nest success. To determine preferred nest site characteristics, we compared leaf litter height, vegetation density, and vegetation height between nest sites and 497 random locations. Additionally, we compared nest density to nest patch size to see if birds selected nest sites in larger patches. For these nest site characteristics to be adaptive, we predicted leaf litter depth, nest cover density, nest cover height, and patch size to be positively correlated to nest survival. Ducks selected nest sites with greater leaf litter and denser, taller cover compared to random sites, however, vegetation density and height selection varied among species. Consistent with the proposed adaptive significance of nest site characteristics, we found evidence for a positive linear relationship between leaf litter depth, a positive quadratic relationship between vegetation height and survival, and a negative relationship between patch size and survival. In contrast, evidence indicated the relationship between vegetation density and nest survival was negative. Our results indicate some nest site selection characteristics of prairie nesting birds may no longer be adaptive.

**SAT16.1 Elbin, Susan,** (New York City Audubon, New York, United States); Farnsworth, Andrew (Cornell University, Ithaca, United States); Rowden, John (New York City Audubon, New York, United States)

**POWERFUL LIGHT EFFECTS BIRDS MIGRATING OVER NEW YORK CITY ON SEPTEMBER 11**

Visual study of nocturnal migration provides critical insights into behaviors of migrating birds. Coupling observations with

recordings of flight calls provides unique information for species identification. During the past seven years we observed migrating birds in Battery Park, NY, as they encountered powerful ground-based lights, NYC's Tribute in Light Memorial. We counted the number of birds seen in the beams from dusk on September 11 to dawn on September 12 using instantaneous scan sampling. We gathered contemporaneous local climatic data to review any effects of weather on the night's movement. Rain and extensive cloud cover in 2009 resulted in only 12 birds observed; favorable conditions in 2010 resulted in 9,435 birds counted; unfavorable winds and light precipitation in 2011 resulted in light migration, with 330 birds counted. In 2010 and 2011 we positioned an SM2 Song Meter on the roof to record flight calls of migrating birds; this device recorded audio in 16-bit, 24,000 Hz sampling rate from sunset to sunrise. Simultaneous flight call monitoring yielded over 21,000 flight calls of at least 35 species in 2010 and 750 calls of 8 species in 2011. The extent of calling and the number of calls were positively correlated with the lighting periods. Artificial lights may attract migrants under a large range of atmospheric conditions, highlighting the need for additional research on the effects of artificial lighting on migratory birds.

**SAT10.6 Elliott, John**, (Environment Canada, Delta, Canada); Hindmarch, Sofi; Wilson, Laurie (Environment Canada, Delta, BC, Canada); Maisonneuve, France (Environment Canada, Ottawa, ON, Canada)

#### RODENTICIDES: ONGOING PROBLEMS WITH CONTAMINATION AND POISONING OF RAPTORS

Second-generation anticoagulant rodenticides (SGARs) are deployed widely to control rodent pests, but exposure and poisonings occur in non-target species, particularly birds of prey. Most of the widely used SGARs can be considered as PBT-compounds (Persistent Bioaccumulative Toxic), which under legislation in most countries and international agreements such as the Stockholm Convention on Persistent Organic Pollutants would normally demand outright bans or severe restrictions on usage. However, most jurisdictions consider SGARs to be "essential use" compounds due to a lack of effective alternatives. Previous studies, including our own, have reported a high incidence of liver residues of commonly used SGARs in raptors, especially rodent-eating hawk and owl species. A proportion of birds tested also exhibited symptoms of anti-coagulant poisoning. In the present study we widened the scope of sampling to include other hawk and falcon species. Of 130 raptors analyzed in a recent survey of birds collected from 2005 to 2011 from southwestern British Columbia, 94% had detectable liver residues of at least one SGAR compound. Barred and Great Horned Owls had the highest incidence of exposure and the greatest residue concentrations; however, 5 of 5 Peregrine Falcons and 5 of 5 Sharp-shinned hawks tested had residues of at least two SGAR compounds, indicating pervasive contamination of the foodchain of terrestrial birds of prey, at least in areas of greater urbanization or intensive agriculture. The process by which smaller avian prey of falcons and accipters are contaminated is not known. There is also a lack of data on possible chronic effects of sublethal SGAR exposure.

**F15.4 Elliott, Kyle,\*** (University of Manitoba, Winnipeg, Canada);

#### FIXED REPRODUCTIVE INVESTMENT IN A LONG-LIVED BIRD: EVIDENCE FOR AN ENERGY CEILING

Energy expenditure in wild animals can be limited intrinsically by physiological processes that constrain an animal's capacity to use energy or limited extrinsically by energy availability in the environment and/or trade-offs between elevated metabolism and

survival. Such limitations may be particularly important in species that are characterized by very high levels of energy expenditure. To examine the role of an energy ceiling in a species with a high metabolic rate, we compared energy expenditure of thick-billed murres (*Uria lomvia*) with and without 17g handicaps affixed to their backs during a period of peak energy demands (chick-rearing). We also compared energy expenditure of unencumbered birds across years exhibiting contrasting environmental conditions. Handicapped birds increased time spent resting and decreased time spent flying, time spent diving and chick provisioning rates. As the costs of flying and diving increased, the birds adjusted activity budgets such that overall

daily energy expenditure remained unchanged across the two treatments. A meta-analysis comparing responses of breeding animals to handicapping suggests that our results are typical: animals either reduced investment in themselves or in their offspring to remain within the bounds of their energy ceiling. Across species, whether a handicapped individual invested in self-maintenance or its offspring was not explained by life-history, yet older murres did invest more in offspring following handicapping. The energy ceiling likely did not reflect energy availability, as energy expenditure of unhandicapped chick-rearing birds was similar across contrasting foraging conditions. Likewise, the ceiling did not appear to represent a trade-off between metabolism and mortality, as survival was independent of energy expenditure. We concluded that chick-rearing murres are constrained to operate at an intrinsic metabolic ceiling.

**PS1.9 Elliott, Kyle**, (University of Manitoba, Winnipeg, Canada);

#### THYROID HORMONES AS MEDIATORS OF ENERGY ADJUSTMENTS WITHIN AGING CHARADRIIFORM BIRDS

Some studies have suggested a direct linkage between basal metabolic rate (BMR) and daily energy expenditure (DEE) because adjustments that maximize energy intake (exercise organs) increase BMR. One possibility is that intrinsic modulators of BMR, such as thyroid hormones (T3 and T4), may impact both BMR and DEE, allowing animals to modulate energy expenditure across varying conditions such as aging. We tested those ideas in two species of seabirds (kittiwakes and murres) by measuring BMR, DEE and thyroid hormone levels. T3 and T4 were adjusted independently. Free T3 correlated with BMR but not DEE showing that thyroid hormones are unlikely to be involved in linkages between BMR and DEE. T3 (and BMR) increased during stress following capture, as did the strength of the relationship between free and bound T3. In contrast to long-lived birds with low energy costs (petrels), long-lived birds with high energy costs adjusted those costs with progressing age. We suggest that T3 plays a strong role in determining BMR and interactions between BMR and life history but does not play a strong role in determining DEE.

**PS1.78 Elliott-Smith, Elise**, (US Geological Survey, Corvallis, United States); Haig, Susan M. (US Geological Survey, Corvallis, OR, United States)

#### THE 2011 INTERNATIONAL PIPING PLOVER CENSUS: POPULATION STATUS AND DISCOVERY OF AN IMPORTANT WINTERING AREA

The Piping Plover (*Charadrius melodus*) is one of the most imperiled shorebirds in the United States and Canada and is federally listed in both countries. Every 5 years since 1991, the United States Geological Survey (USGS) coordinates an International Piping Plover Census. In 2011, for the fifth time in

20 years, a comprehensive inventory of Piping Plovers was conducted across their winter and breeding range in the U.S., Canada, France (islands near Canada), Mexico, and the Caribbean. The goal of the census is to provide a comprehensive view of abundance, distribution, and effectiveness of recovery efforts. An expanded effort was made in the Bahamas during the 2011 Census, resulting in the discovery of over 1,000 wintering Piping Plovers. This represents 10-25% of the entire species, signifying the Bahamas as the most important wintering region after the Laguna Madre of Texas and identifying it as likely the most important wintering area for the Atlantic Coast breeding population. Preliminary 2011 breeding numbers appear similar to 2006 numbers for some regions and populations, but the US Great Plains and Canadian Prairie numbers were low due to extreme flooding. It is unclear whether this flooding reflects or will precipitate a true decrease in the interior population.

**PS2.95 Ellis, Vincenzo**, (University of Missouri St. Louis, St. Louis, United States); Kunkel, Melanie; Ricklefs, Robert (University of Missouri St. Louis, St. Louis, United States)  
HEALTH AND ITS RELATION TO PATTERNS OF ABUNDANCE IN THE OZARKS OF SOUTHERN MISSOURI

In the summer of 2011 we took blood samples from 485 birds in the Ozarks of southeastern Missouri to test the hypothesis that parasites influence patterns of avian abundance and distribution. Using molecular techniques and light microscopy we screened the blood samples for avian malaria parasites. We quantified haptoglobin, an acute-phase protein that is indicative of inflammation and infection, to assess the overall health of individuals. We also recorded ectoparasite loads, hematocrits, and white blood cell counts to further characterize health. We then looked for relationships between these health variables and the local abundance of birds in the study. We found that haptoglobin levels were significantly higher in birds infected with avian malaria parasites than in birds not infected ( $p = 0.002$ ), confirming the usefulness of haptoglobin as an indicator of infection in wild birds. Furthermore, we found that while prevalence of malaria infections was unrelated to local abundance, average haptoglobin levels were positively related to species abundance (quadratic regression;  $r^2 = 0.25$ ,  $p < 0.001$ ). Contrary to our expectation, locally rare species appear to suffer lower parasite pressure than common species.

**PS1.12 Ellison, Annie**, (Vancouver Island University, Richmond, Canada);  
TESTING PROBLEM SOLVING IN TURKEY VULTURES (CATHARTES AURA) USING THE STRING-PULLING APPROACH

This study examined problem solving in Turkey Vultures (*Cathartes aura*). Three captive vultures were presented with a string-pulling task, which involves drawing a string up to access food. This test has been used to assess cognition in several avian species. A small piece of meat suspended by a string was attached to a perch. Bird A solved the problem without apparent trial and error learning, bird B solved the problem after observing the successful bird, whereas bird C did not solve the string-pulling puzzle. The successful birds showed improvement in the time taken to retrieve the suspended meat (Bird A Mann-Whitney:  $U=82$ ;  $n_A=10$ ,  $n_B=10$ ;  $P < 0.01$ ; Bird B Mann-Whitney:  $U = 90$ ;  $n_A = 10$ ,  $n_B = 10$ ;  $P < 0.0005$ ) suggesting the birds understood the problem and were able to improve their technique. Both vultures solved the problem in a novel way; they appeared to tease the string through their beaks using their tongues, and may have stored the string in their crops until the

meat was in reach. In contrast, ravens, parrots, and finches use a step wise process pulling the string up, tucking it under foot, and reaching down to pull up another length. As scavengers, Turkey Vultures use their beaks for tearing and gulping, but possess large, flat, webbed feet ill suited to pulling or grasping. Thus, the novel string pulling method used by the Turkey Vultures in this study may be an adaptation of a feeding method used by a species under unique evolutionary pressures.

**F13.5 Ellison, Kevin**, (Wildlife Conservation Society, Bozeman, United States); Zack, Steve (Wildlife Conservation Society, Portland, OR, United States)  
GRASSLAND BIRDS AS INDICATORS OF THE ECOLOGICAL RECOVERY OF BISON.

For millennia, bison (genus *Bison*) and fire were the predominant forces that shaped and maintained North American grasslands. Following the loss of these forces and subsequent development and degradation associated with agricultural production, wildlife populations declined precipitously. Grassland birds have declined annually more than any other guild since populations were first measured in the 1960's. Since 1990, 17 grassland restoration efforts have reintroduced plains bison (*Bison bison bison*), for a total of 63 conservation herds. Yet, few managers have experience with bison and attempts at an "Ecological Recovery" require measureable outcomes. Our approach is to identify different grassland bird species as viable "indicators" for bison grazing management, as different bird species respond to different levels of grazing intensity, and presumably did so historically. There seems to be great potential to manage grazers to help restore heterogeneity in grassland habitats essential to Great Plains wildlife. Since 2009, we have used grassland birds (Sprague's pipit *Anthus spragueii*, Baird's sparrow *Ammodramus bairdii*, Chestnut-collared longspur *Calcarius ornatus*, McCown's longspur *Rhynchophanes mccownii*) as indicators of ecological recovery, and grazing management as a tool in grassland bird conservation (also engaging cattle-producers). Through grazing management with partners, we are attempting to re-create the habitat heterogeneity that will allow re-establishment of specific grassland bird species through adaptive management feedback. We also briefly discuss how bison wallowing, prairie dog towns, fire, and native predators are also necessary elements toward a full ecological recovery of portions of the Great Plains with bison.

**S6.8 Ellwood, Elizabeth**, (Boston University, Cambridge, United States); Primack, Richard (Boston University, Boston, United States)  
MIGRATION PHENOLOGY IN THOREAU'S CONCORD OVER 150 YEARS

Indications of climate change are becoming increasingly common in biological systems across North America. One of the most effective ways of evaluating how organisms are affected by rising temperatures is to assess the degree to which phenological events, including the timing of bird migrations, are altered. To this end, we compiled the longest known record of bird arrival dates in North America, spanning the years 1851-2007 and including 22 passerine species. This dataset of arrivals to Concord, Massachusetts was created with the records of American naturalist Henry David Thoreau, those of the well-known ornithologists William Brewster and Ludlow Griscom and the journals of a local enthusiast. When analyzed together, no distinct patterns emerged in arrival dates over time. However, when analyzed separately, three species were found to be arriving significantly earlier, while four species are arriving later. Seven species arrive significantly earlier in response to warmer temperature, and one arrives later in warmer years.

Plants in the same region are advancing flowering times to a much greater degree, setting the stage for potential ecological mismatches. The observations recorded by Thoreau and others have provided a unique opportunity to examine long-term changes in spring arrival dates for a variety of bird species. Nontraditional datasets such as this can be difficult and challenging to work with, but the historical perspective they provide makes them invaluable for climate change research.

**PS2.198 Elmore, Stacey**, (University of Saskatchewan, Saskatoon, Canada); Huyvaert, Kathryn P. (Colorado State University, Fort Collins, CO, United States); Bailey, L.L.; Alisauskas, R.T.; Milhous, J.; Al-Adhami, B.; Jenkins, E.J. (Canada)

#### ESTIMATING TOXOPLASMA GONDII SEROPREVALENCE IN ROSS'S AND LESSER SNOW GESE FROM KARRAK LAKE, NUNAVUT

Ross's and Lesser Snow Geese (*Chen* spp.) are important components of the Karrak Lake ecosystem in the Queen Maud Gulf Bird Sanctuary, Nunavut, Canada. As a seasonally abundant prey source for many arctic carnivores, they might also transmit cyst-forming parasites, such as *Toxoplasma gondii*, to predators. Exposure to the parasite has been documented in serosurveys of several terrestrial arctic wildlife species, including arctic foxes, caribou, and wolverines, but the apparent absence of the usual reservoir host (felids) from the Arctic indicates that another route of transmission is responsible for *T. gondii* persistence in these ecosystems. To investigate the role of migratory geese as potential bridging hosts for *T. gondii* between arctic and subarctic landscapes, we harvested 79 geese upon their arrival at the Karrak Lake breeding colony in May 2011. We analyzed samples of blood collected on filter strips for *T. gondii* antibodies with three different serological assays and compared the performance of these tests. We used detection/nondetection data to estimate the seroprevalence of *T. gondii* both with traditional naïve estimators and also with a site-occupancy modeling approach. Preliminary analyses demonstrate the detection of antibodies in at least 19% (15/79) of the blood samples, thus indicating that Ross's geese and the mid-continent population of lesser snow geese are commonly exposed to *T. gondii* at some point in their lives. These data also suggest that arctic geese are likely to be intermediate hosts of *T. gondii* and are a source of exposure for other wildlife species within the Karrak Lake ecosystem. We will discuss the implications of our findings as they relate to the disease ecology of geese and other arctic avifauna.

**T15.9 Elphick, Chris**, (University of Connecticut, Storrs, United States); Meiman, Susan; Rubega, Margaret (University of Connecticut, Storrs, United States)

#### DOES TIDAL MARSH RESTORATION BENEFIT GLOBALLY VULNERABLE BIRDS?

Tidal marshes are among the most threatened habitats on Earth due to their limited original extent, a long history of human drainage and modification, and the anticipated future effects of sea-level rise. Tidal marshes also provide various services to humans and support several bird species of high conservation interest. Consequently, many millions of dollars have been spent on tidal marsh restoration throughout North America. Southern New England has a long history of tidal marsh restorations, largely focused on the removal of the invasive plant *Phragmites australis*. Working in 18 Connecticut marshes, we examined the bird community in 21 restoration plots and 19 reference plots. Restoration plots were divided into those in marshes where management involved restoring tidal flow and those where direct *Phragmites* control (e.g., cutting, herbicide)

was used. Saltmarsh sparrows – considered globally Vulnerable – had significantly lower abundance and nest densities at sites where tidal flow had been restored than at either reference sites or sites with direct *Phragmites* control. No abundance differences were found for other focal taxa (large wading birds, willets, seaside sparrow). Vegetation variables also differed between sites where tidal flow had been restored and the other two groups, with the former showing characteristics typical of “low marsh”, which is unsuitable for nesting saltmarsh sparrows. We conclude that, although tidal marsh restoration removes *Phragmites* and restores native marsh vegetation, it produces habitat that is unsuitable for saltmarsh sparrows.

**T16.7 Eng, Margaret**, (Simon Fraser University, Burnaby, Canada); Elliott, John (Environment Canada, Delta, BC, Canada); MacDougall-Shackleton, Scott (University of Western Ontario, London, ON, Canada); Letcher, Robert (Environment Canada, Ottawa, ON, Canada); Williams, Tony (Simon Fraser University, Burnaby, BC, Canada)

#### EFFECTS OF EARLY EXPOSURE TO A BROMINATED FLAME RETARDANT ON BEHAVIOUR AND DEVELOPMENT IN BIRDS

Polybrominated diphenyl ethers (PBDEs) are a class of brominated flame retardants that have become ubiquitous in the environment. BDE-99 is one of the most abundant congeners, and is consistently found in avian tissue and egg samples throughout the world. In birds, early life stages are the most sensitive to environmental conditions, and exposure to contaminants during the nestling period may have critical effects at concentrations much lower than those required to affect adults. These effects of exposure may not be evident until reproductive maturity, necessitating long term studies to assess fitness implications. The objective of this study was to determine the long-term effects of early exposure to BDE-99 on behaviour, neuroanatomy, growth, physiology, and reproduction in an integrated avian laboratory and field monitoring system, using the Zebra Finch (*Taeniopygia guttata*) and the European starling (*Sternus vulgaris*) as model passerine species. In both species, we exposed young for the duration of the nesting cycle to environmentally relevant, sublethal levels of BDE99 (0-173.8 ng/g bw/day). Following dosing, we raised young to sexual maturity. In the zebra finches we monitored male mating behaviour, song quality, and female reproductive success. In the starlings we monitored reproductive development and gonadal growth. For both species we measured the neuroanatomy of the song-control system, monitored growth, and took blood samples to assess thyroid hormone homeostasis, oxidative stress, and hematocrit for each treatment group. At our dose levels, early exposure to BDE-99 had significant effects on male mating behaviour and the response of unexposed females to exposed males. There were few effects on neuroanatomy, growth, physiology or reproductive development in either species.

**PS2.206 Engel, Josh**, (Field Museum of Natural History, Chicago, United States); Bates, John (Field Museum of Natural History, Chicago, IL, United States); Fjeldså, Jon (University of Copenhagen Natural History Museum, Copenhagen, Denmark); Kahindo, Charles (Bukavu State University, Bukavu, Dem. Republic of Congo); Kizungo Byamana, Robert (Centre de Recherche en Sciences Naturelles de Lwiro, Bukavu, Dem. Republic of Congo)

#### DEFINING SPECIES AND RANGE LIMITS IN THE BARRED LONG-TAILED CUCKOO COMPLEX (CERCOCOCYX MONTANUS)

Barred Long-tailed Cuckoo (*Cercococcyx montanus*) is a poorly-known East African forest cuckoo comprising two morphologically distinct subspecies, one resident in the Albertine Rift (*montanus*) and one partially migratory in east and southeast Africa (*patulus*). The non-breeding range of *patulus* is not well understood because of the difficulty of detection when they are not singing. Using mitochondrial and nuclear DNA sequences, we show that two specimens mist-netted in relatively low-elevation forest (ca. 1500m) in the Albertine Rift belong to the migratory subspecies (*patulus*) whose closest known breeding area is >800km to the east. We also conclude, based on consistent morphological and genetic differences, that Barred Long-tailed Cuckoo is best treated as two species. With the increased awareness that specific recognition brings—the two are not illustrated separately in any regional field guides—resolving the area of overlap between the taxa will be more feasible.

**PS1.188 Engler, Jan**, (Zoological Research Museum Alexander Koenig Bonn, Bonn, Germany); Secondi, Jean (GECCO - University of Agers, Angers, France); Dawson, Deborah A. (University of Sheffield, Sheffield, United Kingdom); Elle, Ortwin; Hochkirch, Axel (Trier University, Trier, Germany)  
POPULATION GENETICS REVEAL THE ROLE OF LONG DISTANCE DISPERSAL AND ALLELE SURFING IN CONTACT ZONE MOVEMENT IN TWO PARAPATRIC DISTRIBUTED HIPPOLAIS SISTER SPECIES

Disentangling the factors shaping species distributions remains a central goal in biogeography, ecology and evolutionary biology. Recently, a bundle of theoretical studies investigated the consequences of moving range borders on genetic diversity.

On the expanding border, studies predicted (i) the depletion of genetic diversity and the surfing of novel alleles reaching increased dominance when dispersal is low, but (ii) an increase of genetic diversity for higher rates of long distance dispersal. On the receding border, genetic diversity is expected to decrease. However, empirical studies that support or refute these hypotheses are lacking so far. Moving contact zones between parapatric sister species are ideal systems to test these hypotheses as the changes in genetic diversity can be tested simultaneously along the expanding and receding edges of the contact zone.

The two Old World warblers *Hippolais polyglotta* and *H. icterina* form a narrow moving contact zone where interspecific interactions are supposed to be the main factor shaping this zone. Zone shift has been observed for the last 70 years during which *H. polyglotta* expanded northeastwards and *H. icterina* retreated in the same direction. We investigated the population genetic structure of both species along a transect ranging from the core range of *H. polyglotta* across the contact zone and from there far into the range of *H. icterina*. We tested the theoretical predictions of changes in genetic diversity on the range edges of either species as supposed by theoretical work. We discuss their implications in terms of range edge dynamics of avian species.

**PS1.178 English, Philina**, (Simon Fraser University, Elgin, Canada); Nocera, Joseph (Ontario Ministry of Natural Resources and Trent University, Peterborough, ON, Canada); Cadman, Michael (Environment Canada, Burlington, ON, Canada); Mills, Alexander (York University, Toronto, ON, Canada); Heagy, Audrey (Bird Studies Canada, Port Rowan, ON, Canada); Rand, Gregory (Trent University, Peterborough, ON, Canada); Falconer, Myles (Bird Studies Canada, Port Rowan, ON, Canada); Green, David (Simon Fraser University, Burnaby, BC, Canada)

## DETERMINING WINTERING AND STOPOVER LOCATIONS OF ONTARIO'S EASTERN WHIP-POOR-WILLS

Populations of the eastern whip-poor-will (*Caprimulgus vociferus*) appear to be declining across its range. In Ontario, this decline may be associated with habitat loss from agricultural intensification and forest succession. However, declines in populations of many other species of migratory aerial insectivores suggest insect availability throughout the annual cycle may be a factor. Due to their quiet, nocturnal habits during the non-breeding season, little is known about migration and wintering locations of whip-poor-wills and the extent to which populations share risks related to regional conditions. Refinement of light-logging geolocators has enabled the movements of birds the size of whip-poor-wills to be monitored through the use of recorded day length to determine latitude and times of sunrise and sunset to determine longitude. We deployed 46 geolocators on adult males at four locations that encompass most of the species' Ontario range: 10 in southwestern Ontario, 13 in eastern Ontario, 19 in central Ontario, and 5 in northwestern Ontario. We anticipate retrieving 12 – 20 of these tags in 2012, based on historic return and capture rates. An additional 21 adult males were banded but not outfitted with loggers. We will present the first preliminary data on return rates, migration routes, phenology, and wintering locations for this threatened species.

## **S8.3 Enríquez, Paula**, (El Colegio de la Frontera Sur (ECOSUR), San Cristóbal de Las Casas, Chiapas., Mexico); PROGRESSES AND CHALLENGES IN RAPTOR AND OWL RESEARCH IN MEXICO

Raptors and owls are among the less studied birds in Mexico. The country has high species richness, with 56 raptors and 32 owls. Most species (65 species, 74%) are considered in some category of threatened. In recent years, the interest to study them has increased. For instance, there have been records describing aspects of natural history (nest description), distribution (inventories or checklist at state level, new records in delimiting distribution ranges), and fewer studies on biology and ecology such as abundance and density estimation, breeding biology, food habits, habitat association, and migration. Despite of these progresses, none species have been studied in detail in the country. Our knowledge is still limited for understanding the patterns and process in tropical owl and raptor ecology, information useful for establishment of conservation priorities of those species and their environments. The main threat for raptors and owls in Mexico is forest loss and fragmentation, because most of the species are associated to forests, and hunting. Raptors and owls are difficult to study because generally are uncommon, show wide home ranges, and quiet behaviour. Additionally, variation in topography, weather, and exuberant vegetation in tropical areas increases the complexity to study them. The challenges to increase our knowledge must be to establish long-term studies in populations and communities, for determining population trends, consider distribution spatial analysis models including habitat selection, movements studies (home range and migration), and start with autonomous vocal recording stations.

**PS1.210 Erickson, Amy**, \* (NA, NA, United States); McNew, Lance; Sandercock, Brett (Kansas State University, Manhattan, KS, United States)

## DEMOGRAPHIC RESPONSES OF GRASSLAND SONGBIRDS TO A PATCH-BURN GRAZING MANAGEMENT IN THE FLINT HILLS

The tallgrass prairie of the central Great Plains is one of the most threatened ecological communities in North America. Loss of native grasslands and intensification of agricultural practices on remaining grasslands are thought to be leading factors in the decline of many grassland vertebrates. Grassland songbirds evolved under a shifting mosaic of habitat types created by the interaction of fire and bison grazing, but much of the Flint Hills is now managed to create a homogenized landscape that is evenly grazed by cattle. A patch-burn grazing management aims to restore heterogeneity on rangelands without impacting cattle productivity and landowner revenue. The purpose of this two-year field study was to determine if grassland songbird species richness, species abundance, nesting density, and nesting success differed between patch-burned sites and traditionally managed sites. Three patch-burned pastures and four traditionally managed pastures in Chase County, Kansas were used in this study. During breeding season (May-August), birds were surveyed along 300-meter transects and nests were located and monitored. Vegetative structural heterogeneity was higher on patch-burn sites. Number of species observed at patch-burn sites was 1.6–2.4 times higher than on traditionally managed sites, and total number of birds observed was higher at patch-burn sites. A similar number of nests were found on each management type, with Dickcissel nests having a higher survival probability on patch-burned sites (0.255) than on traditionally managed sites (0.215). Thus, a patch-burn management may be an effective conservation strategy for grassland songbirds. Information on cattle productivity will be obtained from landowners. If cattle productivity is similar between traditional management and patch-burning, landowners may be more likely to switch to a patch-burn management system.

**SAT11.3 ESCALANTE, PATRICIA**, (INSTITUTO DE BIOLOGÍA, UNAM, MEXICO, Mexico); Gurrola, Marco (Instituto de Biología UNAM, Mexico, DF, Canada); Thonathiu, Sanabria (Instituto de Biología UNAM, Mexico, DF, Mexico)  
DNA BARCODING EFFORTS FOR THE BIRD FAUNA OF MEXICO

The Barcode of Life project proposes to build a digital library of a standardized DNA fragment for identification purposes. Building this library is an opportunity to test species limits and to identify taxonomic problems. In the course of the last two years we have used part of the national collection in Mexico (CNAV-IBUNAM), with additional field expeditions to supplement this collection in order to contribute to this effort. Focusing on resident species is the main interest, of which Mexico holds about 878 recognized species. To date we have obtained 1,278 barcodes of 344 species. Of the surveyed species, so far only in 200 species we are able to compare different populations within their know range. Our results indicate that in 25% of these comparisons, genetic distances with this marker give more that 2.2% genetic differences, ranging from 2.2 to 9.71% in some cases. Forty one cases will be presented, many of these clearly indicate allopatric populations that have been separated for a long time, and with verification with other characters can easily be given species status. But in other cases, individuals with high genetic distances might be indicative of other phenomena, such as intratropical migration. Clearly this approach is helping to identify problems in our classification at the species level. As other authors have considered, the current application of the biological species concepts provides an underestimation of avian diversity, and once again molecular data in conjunction with morphological and acoustical information can help elucidate more natural species limits.

**PS1.259 ESCALANTE, PATRICIA**, (INSTITUTO DE BIOLOGÍA, UNAM, MEXICO, Mexico); Lopez-Flores, Luis Fernando (Instituto de Biología UNAM, Mexico DF, Mexico)  
MITOCHONDRIAL PHYLOGEOGRAPHY OF THE WHITE-BELLIED WREN (*UROPSILA LEUCOGASTRA*)

The White-bellied Wren is a little known species inhabitant of tropical dry forests, cuasi endemic to Mexico. We surveyed populations in the field and put together a sample of 30 individuals from different parts of their range for 9 localities. Using a 692 bp fragment of CO1 mitochondrial gene we found a highly fragmented population structure in which three allopatric groups of populations are separated by up to 5.38% genetic distance. Using other algorithms such as maximum parsimony, maximum likelihood, or Bayesian, the same pattern of separation exists. We found 9 haplotypes, 2 exclusive of the Pacific coast populations, 3 for the Gulf of Mexico lowlands, and 4 for the Yucatan Peninsula. In total, the haplotypes showed 43 different mutations of which 40 were informative. A morphological review was also performed for the same populations; differences in coloration between the Pacific and the rest of populations were detected. Four meristic variables were also compared, bill, tarsus, tail and wing length. For tarsus and tail, significant differences were obtained between the Yucatan Peninsula populations and the rest. The amount of separation suggests that these groups have been separated at least from the end of the Pliocene and might be recognized as three different species. The White bellied Wren has currently a patchy distribution and very little natural habitat is left for the Pacific and the Gulf of Mexico populations. The Yucatan Peninsula populations are more common and more habitat remains.

**PS2.192 Escalante-Vargas, Melquicedec**, (Universidad Juárez Autónoma de Tabasco, Villahermosa, Tabasco, Mexico); Trejo-Pérez, Juana Lourdes (Universidad Juárez Autónoma de Tabasco, Villahermosa, Tabasco, Canada)

TRIBAL ETHNIC PERCEPTION IN THE MANAGEMENT OF CATHARTIDS (AVES: CATHARTIDAE) AND OTHER WILD BIRDS IN A RURAL ZONE OF THE CHONTALPA REGION, TABASCO, MEXICO.

Tabasco has the special feature that some of its rural communities dedicate their activities to subsistence hunting, since many years ago. In this manner, wild birds are used as food or pets. They are also valuable for many other uses. Nowadays, hunting for religious cults is still practiced, but it is always associated to popular believes. Although, in Tabasco are many ethnic groups that manage their backyard avifauna, the use is different depending the region. There is a lack of papers referring to ethnozoological approach, which could allow to recover the knowledge this groups have about their avifauna and how they use it. The purpose of this paper is to describe the role cathartids and other wild birds held in captivity have in Ranchería Huapacal 2nd Section, Jalpa de Mendez Municipality. This site has 1750 inhabitants and 291 families. Opened questions (94) were applied during March and April of 2011. The species identification was made by taking some photographs and using field guides. We obtained 14 species and 169 specimens of wild birds. We found four specimens of *Coragyps atratus* in three of the polled homes. The more frequent species was *Aratinga nana* (39%). The local perception about these vultures is that these birds absorb the diseases, and because of their presence, other backyard animals will reproduce successfully. In the study area birds are not subject to commerce, people uses them to get an extra income within the

community. These trade activities are made by only children and young boys.

**W17.4 Esler, Dan**, (Simon Fraser University, Delta, Canada); Dickson, Rian; Brodhead, Kathy; Kirk, Molly; Lewis, Tyler (Centre for Wildlife Ecology, Burnaby, BC, Canada); Ward, David; Hupp, Jerry; Schmutz, Joel (Alaska Science Center - USGS, Anchorage, AK, United States); Boyd, Sean (Wildlife and Landscapes Branch, Delta, BC, Canada); VanStratt, Corey; Uher-Koch, Brian (Centre for Wildlife Ecology, Burnaby, BC, Canada)

#### WINTER SITE SELECTION BY SURF SCOTERS REFLECTS CONTINENTAL-SCALE TRADE-OFFS

Surf scoters exhibit differential migration to wintering sites; i.e., sex and age classes are differentially distributed by latitude, with proportions of adult males higher at northern wintering areas and proportions of females and juveniles higher at southern sites. We conducted a Pacific-wide study to evaluate factors related to observed patterns, from Baja California, Mexico, through the range core in coastal British Columbia, to southeast Alaska. We measured foraging effort, body mass variation, and survival of all age and sex classes. Foraging conditions were best in Alaska and declined with decreasing latitude, based on measures of foraging effort of radio-marked individuals. On average, scoters in Mexico foraged more than twice as much as those in Alaska, and foraging activity in Mexico extended into nocturnal periods, which was rarely observed in British Columbia or Alaska. Conversely, average survival was lowest in Alaska and increased with decreasing latitude, suggesting that individuals trade-off foraging conditions against survival probability when choosing wintering sites. However, the nature of that trade-off varied by age and sex class. Foraging effort by juvenile females in Alaska was considerably higher than average. Also, survival variation by latitude was driven largely by juvenile cohorts, as adult male survival was similar across sites. We also found evidence that body mass influenced survival, and speculate that choice of wintering sites at a continental scale reflects trade-offs among site-specific and individual conditions that co-vary with age and sex class, leading to observed differential migration.

**W14.8 Espino, Judith**, (Universidad Michoacana de San Nicolas de H, Morelia, Mexico); Cuevas, Eduardo (Universidad Michoacana de San Nicolas de Hidalgo, Morelia, Mexico)

#### HUMMINGBIRD POLLEN DEPOSITION AND FRUIT PRODUCTION IN TWO SALVIA SPECIES (SAGES) THAT DIFFER IN THE STAMINAL LEVER MECHANISM.

Pollinator effectiveness is related to plant reproductive success and can be estimated by pollen deposition on stigmas of flowers. In most *Salvia* species pollen is transferred through "the lever mechanism" in which the lever, a modified stamen, is moved towards the stigma upon pollinator visitation. Interestingly, in some bird-pollinated species this mechanism has become inactive. We compare pollen deposition and fruit production in *Salvia fulgens* that has an active lever, and *S. elegans* that has an inactive lever. Video recordings were used to identify the pollinators of each species. Pollen deposition on stigmas during five days, fruit set and total fruit production per plant were estimated for each species. The main pollinator of *S. fulgens* was the hummingbird *Eugenes fulgens*. *S. elegans* was pollinated by four hummingbird species. On average *S. elegans* flowers received significantly more pollen grains ( $91.5 \pm 6.7$ ) than *S. fulgens* flowers ( $61.5 \pm 6.7$ ). *S. elegans* received more pollen grains from the third day onwards, while in *S. fulgens* no significant differences in pollen deposition were detected among

days. The fruit-set of both species did not differ (*S. fulgens* = 0.20, *S. elegans* = 0.34,  $P = 0.1487$ ), however, total fruit production was significantly higher in *S. elegans* than in *S. fulgens* ( $244.18 \pm 63.04$  and  $23.53 \pm 3.4$ , respectively). These results suggest that the inactivation of the lever mechanism in bird-pollinated sages may confer an advantage in terms of reproductive success, although other factors may contribute to the reproductive differences found.

**W4.3 Essak, Martha**, (University of British Columbia, Vancouver, Canada); Reid, Jane (University of Aberdeen, Aberdeen, United Kingdom); Arcese, Peter (University of British Columbia, Vancouver, BC, Canada)

#### CONSISTENT DIRECTIONAL SELECTION ON BREEDING DATE IN SONG SPARROWS

Since climate change can alter selection pressures, it is important to know how small populations experience and respond to these pressures. Previous studies of natural populations have shown that linear selection fluctuates in strength and direction over time. However, a recent meta-analysis has found selection in temporally replicated studies to be consistent. We investigated directional selection on breeding date in an insular population of Song Sparrows (*Melospiza melodia*) over 36 years of continuous monitoring. We used two methods to determine magnitude and direction of annual selection co-efficients: the linear regression method originally proposed by Lande and Arnold, and a generalized linear mixed model that controlled statistically for female identity and year effects. We found consistent fecundity selection for early breeding through annual measures of banded, independent and recruited offspring. We also found a consistent lack of viability selection on breeding date based on over-winter adult survival. The absence of a trade-off between survival and reproduction could be explained by differences in territory quality and individual nutrition. Further research using statistical models that incorporate pedigree structure will attempt to separate the effects of genes and the environment, investigate patterns underlying selection and determine if there is significant heritability or evolutionary change for breeding date.

**F15.10 Evenson, Joseph**, (Washington Department of Fish & Wildlife, Lakewood, United States); Esler, Daniel (Simon Fraser University, Delta, BC, Canada); Boyd, Sean (Environment Canada, Delta, BC, Canada); David, Nysewander; Murphie, Bryan; Cyra, Thomas (Washington Department of Fish & Wildlife, Lakewood, WA, United States); Kraege, Don (Washington Department of Fish & Wildlife, Olympia, WA, United States); Takekawa, John; De La Cruz, Susan (United States Geological Survey, Vallejo, CA, United States); Ward, David (United States Geological Survey, Anchorage, AK, United States)

#### SURF SCOTER (*MELANITTA PERSPICILLATA*) WINTER PHENOLOGY AND INTER-ANNUAL SITE PHILOPATRY TO WINTERING AREAS ALONG THE PACIFIC COAST

Satellite transmitters were implanted into after-third-year age class surf scoters (*Melanitta perspicillata*) from five wintering populations along the Pacific Coast of North America and tracked during six consecutive winters, 2004-2010. Winter phenology was examined for 64 surf scoters transmitted during consecutive winters from five capture regions: South East Alaska ( $n=4$ ); Strait of Georgia, British Columbia ( $n=9$ ); Puget Sound, Washington ( $n=35$ ); San Francisco Bay, California ( $n=13$ ); and Baja California, Mexico ( $n=3$ ). Inter-annual philopatry to wintering sites was examined for 50 of these

transmitted scoters: South East Alaska (n=4); Strait of Georgia, B.C. (n=7); Puget Sound, WA (n=29); San Francisco Bay, CA (n=7); and Baja California, Mexico (n=3). Individual home ranges were compared across years and sorted by capture region. Length of stay at, timing of departure from, and timing of arrival to wintering areas varied by capture region, and was influenced by latitude and sex. Surf scoters wintering in southern latitudes generally departed wintering areas earlier and returned to wintering areas later than those from northern wintering areas. Mean length of stay at wintering areas ranged from 7.4 months in South East Alaska to 4.7 months in San Francisco Bay. The majority of surf scoters showed a high level of site loyalty to wintering areas (92% having overlapping winter home ranges between years). High inter-annual site philopatry to, and prolonged lengths of stay at wintering areas has important management implications for this species.

**T16.3 Evers, David**, (Biodiversity Research Institute, Gorham, United States); Jackson, Allyson; Adams, Evan; Lane, Oksana; Edmonds, Sam (Biodiversity Research Institute, Gorham, ME, United States)

#### ASSESSING MERCURY IN SONGBIRDS: A NEW CONCERN FOR BIRD CONSERVATION

Mercury is a pollutant that is cause for conservation concern at local, regional, and global scales. While areas of high contamination may occur near mercury-emitting sources, long-distance atmospheric transport poses the greatest threat to the health of bird populations. Although great strides have been made to reduce North American sources of mercury anthropogenically released into the air and water, high levels of mercury persist within multiple foodwebs and across many habitat types. While past investigations have emphasized assessments of mercury exposure and effects in avian piscivores, here we evaluate mercury impacts on terrestrial avian invertivores. We demonstrate that mercury concentrations in avian invertivores, such as songbirds, regularly cause reproductive harm, creating a major paradigm shift in ecotoxicological research, assessment, monitoring, management, and policy. For example, current environmental mercury loads have the ability to significantly reduce reproductive success in several songbird species of conservation concern in the northeastern U.S., including the saltmarsh sparrow and rusty blackbird. Standardized monitoring of environmental mercury loads is needed to measure how changes in mercury emissions are related to new U.S. EPA regulations; we suggest the use of songbirds as key indicators for assessing short and long-term changes in response to new national mercury regulations.

**PS1.231 Fairhurst, Graham**, (University of Saskatchewan, Aiken, United States); Treen, Gillian (University of Saskatchewan, Saskatoon, SK, Canada); Clark, Robert (Environment Canada, Saskatoon, SK, Canada); Bortolotti, Gary (University of Saskatchewan, Saskatoon, SK, Canada)

#### POST-BREEDING FEATHER CORTICOSTERONE FROM TREE SWALLOWS (TACHYCINETA BICOLOR) PREDICTS SUBSEQUENT SWITCHING BETWEEN TWO TYPES OF NEST BOXES

The decision to switch nesting sites between years may be influenced by reproductive success the previous year. Measures of the energy-regulating hormone corticosterone (CORT) from feathers grown post-breeding may quantify physiology relevant to reproductive performance and subsequent choice of nesting site. We investigated this idea in a Saskatchewan population of Tree Swallows (*Tachycineta bicolor*) breeding in two types of nest boxes. In 2008, swallows were offered for the first time

thicker-walled “aspen” boxes constructed from rounds of *Populus tremuloides* trunks, as well as “plywood” boxes constructed from 1-cm-thick plywood. These nest box types were offered again in 2009. Feather CORT from a sample of individuals breeding in 2009 (feathers grown post-breeding 2008) was significantly lower in birds breeding in aspen boxes than it was in birds breeding in plywood boxes. To determine how previous reproductive performance influenced feather CORT, we analyzed a subsample of these birds that had also bred in the study area in 2008. Feather CORT did not differ between box types in 2008. However, females that ultimately switched box type the following year had significantly lower feather CORT, bred later, and were less productive in 2008. We interpret our results as suggesting that CORT from feathers grown post-breeding may quantify an individual’s cumulative energetic expense of raising young, and less successful individuals subsequently changed box type to improve their future success. Feather CORT may therefore be a useful indicator of past reproductive performance and shed light on subsequent reproductive decisions.

**PS2.84 Falxa, Gary**, (U.S. Fish and Wildlife Service, Arcata, United States); Raphael, Martin (U.S. Forest Service, PNW Research Station, Olympia, WA, United States); Dugger, Katie (Oregon Cooperative Fish and Wildlife Research Unit, Corvallis, OR, United States); Galleher, Beth (U.S. Forest Service, PNW Research Station, Olympia, WA, United States); Lynch, Deanna (U.S. Fish and Wildlife Service, Lacey, WA, United States); Miller, Sherri (U.S. Forest Service, PSW Research Station, Arcata, CA, United States); Nelson, S. Kim (Oregon Cooperative Fish and Wildlife Research Unit, Corvallis, OR, United States); Young, Richard (U.S. Fish and Wildlife Service, Portland, OR, United States)

#### STATUS AND TREND OF NESTING HABITAT FOR THE MARBLED MURRELET IN THE U.S. PACIFIC NORTHWEST

The Marbled Murrelet (*Brachyramphus marmoratus*) is a small alcid that forages in nearshore marine waters and flies inland to nest on limbs of large conifer trees in old forests. Loss of coastal old-growth forest led to the species being listed as Threatened in the USA in Washington, Oregon and California. The Northwest Forest Plan is an ecosystem management plan for federal forest lands in the U.S. Pacific Northwest, affecting 10,000 hectares of federally managed forests in western Washington and Oregon, and northwest California. One of the Plan’s goals is to stabilize and increase murrelet populations by maintaining and, over the long-term, increasing nesting habitat. To help evaluate the Plan’s effectiveness in achieving this goal, we monitored changes in nesting habitat since its 1994 start. We used maximum entropy (Maxent) modeling to compute habitat suitability scores at the pixel scale by comparing conditions at 342 occupied murrelet sites with average conditions over all available forested lands. Conditions were represented by a suite of vegetation (from Gradient Nearest Neighbor analysis) and physiographic attributes. We estimated that 1.5 million hectares of higher suitability nesting habitat were present over all lands in the murrelet’s range in Washington, Oregon, and California at the plan’s start (1994/96 baseline), including 1.0 million hectares on federal lands. Most (89%) of baseline habitat on federal lands occurred within reserved areas. A substantial amount (36%) of baseline habitat occurred on nonfederal lands. Over all lands, we observed a net loss of about 7% of higher suitability potential nesting habitat from 1994/96 to 2006/07. If we focus on losses and ignore gains, we estimated a loss of 13% of the higher suitability habitat present at baseline, over this



period. Fire has been the major cause of loss of nesting habitat on federal lands since the Plan was implemented; timber harvest was the primary cause of loss on nonfederal lands. We also found that murrelet population size was strongly and positively correlated with amount of nesting habitat, suggesting that conservation of remaining nesting habitat and restoration of currently unsuitable habitat is key to murrelet recovery.

**W13.9 Farmer, Chris**, (American Bird Conservancy, Hawaii Volcanoes National Park, United States); Plentovich, Sheldon (USFWS, Honolulu, HI, United States); Kohley, Robby; Rutt, Cameron (American Bird Conservancy, Hawaii Volcanoes National Park, HI, United States); Freifeld, Holly (USFWS, Portland, OR, United States); Wallace, George (American Bird Conservancy, The Plains, VA, United States)

#### TRANSLOCATION OF MILLERBIRDS FROM NIHOA TO LAYSAN

The global population of Millerbirds (*Acrocephalus familiaris*) was estimated at approximately 775 individuals in 2011, and has historically fluctuated between 30–800 birds. The species is thus at high risk of extinction due to demographic and environmental stochasticity, and translocation to another of the Northwestern Hawaiian Islands has been recommended for over 30 years as an important recovery action to reduce these risks. Therefore, we translocated 24 Millerbirds from Nihoa to Laysan Island, over 1000 km by sea, in September 2011. We sexed birds based on wing and tail measurements, and intended to move 12 males and 12 females. Subsequent behavior on Laysan has validated these determinations for 21 birds, for a release cohort of 13 males and 11 females. All 24 birds survived the transport and release periods, and at least 88% (21/24) of the birds were surviving on Laysan as of March 2012. The birds have displayed two bouts of reproductive activity, one beginning October 2011 and another beginning February 2012. Ten nests from at least eight females were discovered in Fall 2011. Eggs were laid in three nests, five were abandoned, and the fate of two was indeterminate. One clutch hatched two nestlings, which died before fledging, but the eggs of the other two clutches were removed, and most likely depredated. As of 29 February 2012, five pairs of Millerbirds have been observed carrying nesting material, and one nest is nearly complete. Each of the surviving birds has been detected a mean of 15.9 times (range 7–24), with a mean gap of 10.3 days between resightings (range 6.3–20.6 days); whereas the most recent detection of a putatively deceased bird was 15 November 2011. The birds' territories and movements on Laysan (1023 ha) are much greater than is known from Nihoa (63 ha). Several Millerbirds were detected 500–2400 m away from the release sites, indicating the birds have traversed the available habitats on Laysan. The translocation and high survival rate of Millerbirds are encouraging, but multiple successful breeding seasons will be required to achieve the objective of establishing a self-sustaining population of Millerbirds on Laysan. Our results with a small (18 g), insectivorous passerine indicate that translocation can be successfully employed worldwide to protect, conserve, and restore a diverse range of avian species under extremely challenging logistical conditions.

**PS2.98 Farmer, Robert**, (Dalhousie University, Halifax, Canada); Leonard, Marty (Dalhousie University, Halifax, Canada); Mills Flemming, Joanna; Anderson, Sean (Dalhousie University, Halifax, NS, Canada)

#### HEARING LOSS AND OBSERVER SENESENCE IN LONG-TERM BIRD SURVEY DATA

Long-term survey data collected by skilled volunteers are used in broad-scale avian population assessments. Data from the

North American Breeding Bird Survey (BBS) includes sequences of observations from individual volunteers spanning several decades. Age-related changes in observer ability with time (e.g. hearing loss) might negatively bias inferred population trends. Using independent accounts from the BBS and the Atlas of the Breeding Birds of Ontario, we showed declines in detection consistent with such observer senescence effects. We also found evidence that some existing population trend estimates (based upon BBS data) may be influenced by this bias. This research demonstrates how greater controls for observer age in long-term datasets and models are crucial for accurately inferring real patterns of population change.

**F16.4 Farrell, Shannon**, (Texas A&M Institute of Renewable Natural Resources, College Station, United States); Collier, Bret (Texas A&M Institute of Renewable Natural Resources, College Station, United States); Morrison, Michael (Texas A&M Department of Wildlife and Fisheries Sciences, College Station, United States); Wilkins, Neal (Texas A&M Institute of Renewable Natural Resources, College Station, United States)

#### DEVELOPING HIGH-RESOLUTION, FINE-SCALE, OCCUPANCY MODELS FOR ENDANGERED SONGBIRDS USING LIDAR

Numerous studies have investigated habitat-occurrence relationships for the federally endangered golden-cheeked warbler (*Setophaga chrysoparia*) and black-capped vireo (*Vireo atricapilla*), most relying on ground-based or broad-scale remotely-sensed metrics, such as patch size. Habitat use can be influenced by vegetation height, structure, and other small-scale habitat conditions that until recently could only be assessed on the ground or at coarse resolutions, and conservation actions are often applied at local scales. Recent developments in remote sensing technology including LIDAR can provide a useful tool for modeling species occurrence. We developed a fine-scale, spatially-explicit occurrence model for warblers and vireos on Fort Hood military installation in central Texas using LIDAR and other remotely-sensed data for canopy height, ecosite, slope, woody canopy cover, and woody vegetation species composition metrics. We conducted repeated-visit, double-observer point count surveys at 453 sample points in 2011. We used LIDAR data to estimate canopy height and to correct canopy cover estimates by excluding woody cover <1m tall. We used a single-season occupancy model to estimate point occupancy and detection probabilities. Best-fit models for both species included canopy height. When compared to models without canopy height and models using traditional, uncorrected canopy cover estimates, models including LIDAR-derived metrics performed best. We generated a 100-m-radius hexagonal grid surface for the prediction area, and within each hexagonal cell we calculated predicted probability of occupancy, creating a resource selection probability surface for occurrence for warblers and vireos. Precise, high-resolution prediction of species occurrence is an essential tool for current challenges in conservation and management.

**PS1.48 Feria, Teresa**, (The University of Texas-PanAmerican, Edinburg, United States); Brush, Timothy (The University of Texas-PanAmerican, Edinburg, TX, United States)

#### FUTURE DISTRIBUTION OF TURDUS GRAYI IN 2050

Species are modifying their distribution due to global warming. Since it is likely that global warming will accelerate in the next decades, forecasting of species' future distributions is encouraged. Recent field work showed that *Turdus grayi* has established populations in south Texas, an area several hundred kilometers north of their original distribution. To assess if this

species would potentially move to other areas in the north of the USA, we use a maximum entropy approach to model its future (2050) potential distribution under the A1b IPCC scenario, by correlating geographic distribution with 19 climatic variables. We used two general circulatory models: CSIRO and CCCMA. Distributional data was divided into 70% and 30% to train and test the models, respectively, with 100 replicates. Model performance was evaluated using the Area Under the Curve in an ROC plot. We obtained an average map and AUC value from the 100 replicates. Contribution of variables was assessed with a jackknife test. Our final models had  $AUC > 0.9$  indicating a very good performance. Min temperature of coldest month and temperature annual range were the variables that showed major influence in limiting the distribution of *T. grayi*. Future distribution maps show suitable habitat in northern parts of the species current distribution, mainly in Texas with some shifts on its original distribution in Mexico and Central America. Short-term work should include monitoring modifications in altitudinal range and nesting success to determine population viability in different areas of its range.

**PS2.85 Ferrer, Yarelys**, (National Enterprise for the Flora and Fauna Protection (ENPFF), La Paz, Mexico); Denis, Dennis (University of Havana, La Paz, Mexico); Chavez, Felipe (Gulf Coast Bird Observatory, Lake Jackson, United States); Penichet, Claudia (University of Havana, La Paz, Mexico)

#### ASSESSMENT OF HISTORICAL CHANGES OF THE QUALITY AND EXPANSION HABITAT OF GRUS CANADENSIS NESIOTES (AVES: GRUIDAE) IN THE CUBAN CIEGO DE AVILA NORTHERN REGION PROVINCE

To quantify the reduction of habitats is a vital step to prioritize the conservation measures for threatened species like *Grus canadensis nesiotes*, which is restricted to some redoubts of grasslands in Cuba. In this work we assess the historical changes of the quality and expansion habitat of cranes in the Cuban central region through satellite images LandSat (1986, 2002, 2010) that were resized to the study area and resampling to 30 m spatial resolution. We used image bands to obtain indexes: NDVI, greenness, wetness and we realized supervised classifications using 35 training areas (grassland, woodlands and water bodies' zones). The classification precision was verified using a confusion matrix and Kappa index, with 200 random points verified in field. With the classified maps we calculated area, perimeter and area/perimeter rate of grassland and woodland fragments for all years. The grassland quality among years was analyzed through the mean value of NDVI, obtained from 35 training areas with 20 pixels each one. We obtained 94-96.5% precision in the supervised classification and 0.9 -0.95 of Kappa index. The temporal variations of the fragment metrics didn't show significant statistic changes between years ( $p > 0.05$ ), with mean values of the grassland fragments between 0.6 -1.3 km<sup>2</sup>. The grassland quality was significantly superior in 2010 (Kruskal-Wallis:  $H(2, N=138) = 37.4, p = 0$ ). These results can be related to protection and habitat management activities, which have been effective for the extension of grassland for the cranes' survival.

**PS2.131 Ferrer, Yarelys**, (National Enterprise for the Flora and Fauna Protection, La Paz, Mexico); Rodriguez, Ricardo (CIBNOR, La Paz, Mexico); Chavez, Felipe (Golf Observatory, Houston, TX, United States)

#### FACTORS INFLUENCING THE DISTRIBUTION AND ABUNDANCE OF RAPTORS (FALCONIFORMES) AT THE

#### GRAN HUMEDAL DEL NORTE DE CIEGO DE AVILA REGION, CUBA

Human activity modifies habitats and then the way a species use an array of habitats. Raptors are considered good indicators of habitat quality but a controversy on what causes a species be benefited/affected by human activity, without a clear relationship with their Neartic/Neotropical origin. Specialist species in temperate and continental zones are more affected by human activities than generalists, but a lack of information exists for tropical islands. We expect that negative effects by human activities are more intense and frequent over specialists than in generalist species, and that a different degree of human activity may modify accordingly their abundance and distribution. Our hypothesis is that raptors diversity and species richness will be greater in areas without human activity than in those modified and fragmented areas. In insular conditions, human activities may modify the species-area relationship, opposite to the island biogeography assumptions. Our aim is to evaluate the relationships between environmental and human-related variables and the presence, abundance and nest distribution of raptors in the Cuban central region. Ten diurnal raptor species will be studied, recording their presence/absence and abundance in 100 points and six transects, during 2012-2013. Habitat around active nests will be characterized at three spatial levels and compared with random points. Environmental variables include vegetal cover, patch area, distance to human activity and others. The relationship between habitat use-availability will be evaluated through a selection index. Probabilistic models will be developed using GLMM and MaxEnt algorithms, fitting environmental and human variables that determine their distribution and abundance.

**PS1.41 Ferretti, Valentina**, (Villanova University, Villanova, United States); Bains, Ashveen; Lee, Rachel; Curry, Robert (Villanova University, Villanova, PA, United States)

#### HISTORICAL VARIATION IN HATCHING SUCCESS IN A MOVING HYBRID ZONE OF CAROLINA AND BLACK-CAPPED CHICKADEES (POECILE CAROLINENSIS AND P. ATRICAPILLUS)

Studies of hybridization in the wild can address some fundamental questions in ecology and evolutionary biology such as mechanisms of reproductive isolation, and the disruption of local adaptations, among others. Moving hybrid zones, although rare, can provide a temporal window in which to study the dynamics of inter-specific mating and its fitness consequences. Populations impacted by moving hybrid zones will likely suffer changes in fitness over time depending on the position of the interbreeding zone. Here, we study temporal variation in hatching success in the leading and trailing ends of a moving hybrid zone of Carolina and black-capped chickadees (*Poecile carolinensis* and *P. atricapillus*). From 2000 to 2011 we monitored nesting activity and hatching success in artificial nests in two study sites located 40 miles apart: Hawk Mountain Sanctuary (HM) and Nolde Forest (NF, both in Berks County, Pennsylvania). At the start of our study NF was located well within the chickadee contact zone, while HM was located north of the leading edge supporting a pure Black-capped chickadee population. Towards the end of our study, however, the leading edge of the contact zone had reached HM, with NF now closer to the trailing edge. We found no differences in hatching success across years within sites; yet, when individual years were used in paired comparisons (i.e., comparisons between the two first and two last years of study), hatching success at HM showed a significant decline, while experiencing a significant increase at NF. Moreover, we found hatching success during the last two years to be significantly higher in NF. Our results provide partial

evidence for a hybrid disadvantage. It remains to be tested whether they are a result of an effect of Haldane's rule in the hybridizing populations.

**PS1.268 Fidorra, Jason**, (University of Florida, Gainesville, United States); Frederick, Peter (University of Florida, Gainesville, FL, United States); Meyer, Ken (Avian Research and Conservation Institute, Gainesville, FL, United States); Evers, David (BioDiversity Research Institute, Gorham, ME, United States)

#### HABITAT SELECTION AND THE IMPORTANCE OF HUMAN-CONSTRUCTED WETLANDS FOR TWO POPULATIONS OF GREAT EGRETS IN THE SOUTHEASTERN USA.

With the widespread loss and alteration of wetland habitats worldwide, there is increased interest in the ability of human-constructed habitats to fill the ecological roles provided by wetlands, such as providing habitat for wetland species. Man-made wetlands take many forms, the most abundant in the U.S. being agricultural impoundments and excavated ponds. Determining if these constructed wetlands are selected or avoided is the first step towards understanding their value as habitat.

We conducted a use-availability study to determine foraging site selection of satellite tagged great egrets (*Ardea alba*) in Louisiana and South Carolina, USA. We followed daily movements of 30 egrets over a 9 month period in 2010-2011. We used the FWS National Wetland Inventory for wetland classification and updated this with recent aerial photos from our study areas. Wetlands categorized as impounded, diked, or excavated formed our "constructed" category. We analyzed habitat use at two scales: selection of the home range from within the coastal region and selection of wetlands within each home range. Compositional analysis was used to rank habitat use and compare selection between habitat types. We did not find significant selection of constructed wetlands over non-constructed habitats in SC ( $p=0.331$ ) or LA ( $p=0.942$ ) at the home range level. Within home ranges, we found selection for constructed wetlands in SC ( $p<0.001$ ) but not in LA ( $p=0.798$ ). Selection was strongest for constructed ponds in SC, which were selected over all other habitat types ( $p<0.001$ ). The different patterns observed between LA and SC suggest a difference in the relative functional quality between constructed and non-constructed wetlands in these locations.

Agricultural wetlands generally did not occur within the home ranges of our satellite tagged birds. Therefore, we conducted flight surveys over the agricultural region of south-central LA within 30km of active great egret colonies. Agricultural impoundments were used 4.0 times more than expected given their availability, and were selected over unimpounded marsh ( $p<0.001$ ). Crawfish aquaculture ponds were selected most strongly late in the breeding season when ponds were being drawn down ( $S=9.9$ ). Agricultural wetlands therefore provided attractive foraging opportunities for local egret populations at times of the highest food demand. Further study is needed to relate fitness of egrets to their use of these constructed wetland habitats.

**F16.9 Fierro, Karolina**, (University of Montana, Missoula, United States);

#### ENVIRONMENTAL FACTORS AFFECTING THE DISTRIBUTION OF TERRITORIES IN FOUR GROUND-NESTING BIRDS OVER TIME

Understanding the relative importance of environmental factors in the distribution of species, and how those factors influence

habitat selection will allow us to predict some potential ecological consequences of global climate change. Ideally, species select higher suitability habitats where the average success rate of adults is higher than in other habitats. High vegetation density provides coexisting species with more food availability, less predation risk, and more options to minimize competition with similar species by partitioning vertical and horizontal layers. Therefore, a high quality habitat may consist of high vegetation density and low density of competitors in a given area. Under this theoretical framework, I examined how changes in vegetation density and abundance of individuals have affected territory selection of four coexisting, ground-nesting species of birds over time. To address this question, I analyzed the distribution of territories of Virginia's Warbler (*Vermivora virginiae*), Red-faced Warbler (*Cardellina rubrifrons*), Orange-crowned Warbler (*Vermivora celata*) and Dark-eyed Junco (*Junco hyemalis*) on the Mogollon Rim in Arizona from 1993 to 2010. Based on some results from a climate change study in the same area, I predicted that if vegetation density and abundance of individuals decrease at the same rate, then the number of overlapped territories will be constant. Alternatively, if vegetation density and abundance of individuals decrease at different rates, then the number of overlapped territories will depend upon the relative influence of vegetation density or abundance. We found that Dark-eyed Junco have responded to changes in vegetation density in the opposite direction of Virginia, Red-faced and Orange-crowned Warblers; therefore, the distribution of the territories and percentage of overlap were also different among species. Whereas Junco has increased in density and has preferences for open areas, warblers have declined with reduced of mean deciduous stem density. The results of this study contribute to our understanding of how biotic factors such as vegetation density and abundance of competitors are mediating the habitat selection in birds over a large scale of time and furthermore, how the distribution of species has been affected under challenges of climate change.

**S1.5 Fink, Daniel**, (Lab of Ornithology, Cornell University, Ithaca, United States); Hochachka, Wesley (Cornell Lab of Ornithology, Ithaca, NY, United States); Rosenberg, Kenneth; Kelling, Steve (Lab of Ornithology, Cornell University, Ithaca, NY, United States)

#### THE CHALLENGES OF USING CONTINENTAL-SCALE DATA TO AID LOCAL DECISION-MAKING

Effective management of bird species across their ranges requires knowledge of where the species are living; their distributions and habitat associations. Often, detailed data documenting a species' distribution and niche will not be available for the entire region of interest, particularly for widely distributed species or for species that have not been the subjects of intensive study in the past. In these cases, we must use broad-scale survey data in order to interpolate a species' distribution and identify its habitat associations. In this presentation, we describe the novel use of broad-scale observational data for the purpose of inferring jurisdictional responsibilities for management of birds in the contiguous United States. We use this example to illustrate challenges to interpolating birds' distributions and deriving inferences from these interpolations, including challenges of: (1) accounting for and describing variation in a species' habitat associations through time and space (statistical non-stationarity), (2) handling a need to define discrete range boundaries in the face of models that will extrapolate non-zero probabilities of distribution well outside the actual range of a species, and (3) validating the accuracy and describing the precision of interpolations. To meet these challenges for specific applications requires clearly articulated

inferential objectives. While the details of our study stem from our single research objective and we made use of only one data set (eBird checklist data), insights from the processes that we used have wider applicability in creating models of species' niches and distributions.

**T12.7 Fisher, Ryan,** (University of Alberta, Edmonton, Canada); Wellicome, Troy (Environment Canada, Canadian Wildlife Service, Edmonton, AB, Canada); Bayne, Erin (University of Alberta, Edmonton, AB, Canada)

#### EXTREME WEATHER EVENTS INFLUENCE REPRODUCTIVE OUTPUT OF BURROWING OWLS IN CANADA

Climate change scenarios predict an increase in the number of extreme weather events in North America, potentially having adverse consequences on reproductive success of many birds. Due to human-alteration of the grassland landscape, birds are also confronted with a landscape that is presumably composed of patches of varying quality. Since 2003 we have monitored over 900 nesting attempts of the endangered Burrowing Owl in the mixed-grass ecoregion of Canada. Using a subset of monitored nests, we examined variation in daily nest survival of Burrowing owls in native (n=621) and tame pastures (n=82) and roadside ditches (n=51), in response to precipitation, temperature, and soil texture. The largest source of nest failure was due to burrow flooding (32% of failures) and maximum one-day precipitation between nest visits had the largest negative effect on daily nest survival. Daily nest survival did not differ amongst habitat types; however, there was some indication that nests in tame pastures succumbed to flooding at a lower one-day precipitation threshold compared to nests in native pastures and roadsides. Using video cameras to monitor nests (N=27), we also documented significantly lower vertebrate-prey delivery rates during periods of cold temperatures (a 1°C increase in temperature increased prey delivery rates by 1.07 times). We are currently examining how reduced prey delivery in response to extended periods of inclement weather may influence nestling mortality. Increases in the frequency of extreme weather events under various climate change scenarios could be just as influential on Burrowing Owl reproductive output as changes in average conditions.

**PS2.141 Fitterer, Jessica,** (University of Victoria, Victoria, Canada); Nelson, Trisalyn (University of Victoria, Victoria, BC, Canada); Coops, Nicholas (University of British Columbia, Victoria, BC, Canada); Wulder, Michael (Canadian Forest Service, Victoria, BC, Canada); Mahony, Nancy (Environment Canada, Delta, BC, Canada)

#### PREDICTING AVIAN SPECIES RICHNESS USING LANDSCAPE-SCALE INDICES IN BRITISH COLUMBIA, CANADA

British Columbia contains approximately 353 bird species, 31 of which are listed on Canada's Species at Risk Public Registry as either threatened (10), endangered (9), or of special concern (12). The British Columbia Breeding Bird Atlas together with recent mapping of provincial indirect indicators of biodiversity offers a unique opportunity to study the drivers of avian diversity over regional extents. The goal of this research is to quantify the power of landscape indices representing vegetation productivity, ambient energy, and habitat heterogeneity to predict avian species richness. Productivity, captured by the Moderate Resolution Imaging Spectroradiometer as the fraction of absorbed photosynthetically active radiation is transformed into breeding season vegetation indices to characterize resource availability, habitat composition, and seasonality. Ambient

energy is represented by integrated annual and seasonal data sets derived from MODIS land surface temperature and topographically adjusted climate indices such as the climate moisture deficit and reference evaporation. Habitat heterogeneity is expressed as topographic coefficient of variation, and measures of land cover heterogeneity. The relationship between landscape indicators and avian species richness is investigated using regression tree analysis. Results display that species richness responds to increased levels of ambient energy and productivity with avian species favouring lower altitudes. Overall, our results highlight the advantages of monitoring landscape characteristics as indicators of vertebrate population status and expand upon the research which examines the significance of food resources (productivity), thermoregulatory needs (ambient energy) and niche habitat (heterogeneity) on vertebrate habitat selection.

**PS1.196 Fitzgerald, Trina,** (, , Canada); Van Stam, Elisabeth (Bird Studies Canada, NA, Canada); Nocera, Joe (Trent University, Peterborough, ON, Canada); Badzinski, Debbie (Bird Studies Canada, Port Rowan, ON, Canada)

#### HABITAT LOSS IS NOT A PRIMARY FACTOR LIMITING NORTHERN CHIMNEY SWIFT POPULATIONS

Populations of aerially-foraging insectivorous birds in North America have been significantly declining for several decades. Habitat loss has been hypothesized to be a leading cause for these declines. Chimney Swifts (*Chaetura pelagica*) are a model insectivore with which to test this hypothesis because their habitat use and availability can be monitored easily and accurately. To examine whether habitat is a limiting factor for swift populations, we inventoried chimneys (n=660) in selected communities, across Ontario, that were used or unused by swifts. A logistic regression model revealed that swifts preferentially used chimneys with a greater length exposed above roofline ( $z = 2.53, p = 0.01$ ) and greater inside area ( $z = 5.68, p = 1.32 \cdot 10^{-8}$ ), that were not associated with residential buildings ( $z = -8.488, p = < 2 \cdot 10^{-16}$ ). The average chimney used by swifts extended 2.9 m above the roofline and had an internal area of 9500 cm<sup>2</sup>. The regression model represents the range of conditions that swifts will tolerate in their habitat use and we used this to build a linear discriminant function (ldf) that had an I-index of 94% (a measure of prediction success). Among 1392 open chimneys, the ldf classified 424 of them as suitable but only 7.3% of those chimneys were occupied; no chimney classified as unsuitable was occupied by swifts. This level of habitat loss is unlikely to be limiting swift populations because >90% of suitable sites were unoccupied, indicating that swifts are not experiencing competition from habitat saturation. Our results suggest that chimney swift populations are being limited primarily by processes other than habitat loss.

**PS2.108 Flahr, Leanne,** (University of Saskatchewan, Saskatoon, Canada); Morrissey, Christy (Department of Biology/Dept. of Biology/School of Environment and Sustainability, Saskatoon, SK, Canada)

#### PHYSIOLOGICAL AND FUNCTIONAL EFFECTS OF AROCLOR 1254 ON AVIAN COGNITION AND MIGRATORY BEHAVIOUR

The onset of migratory restlessness, orientation and navigation during avian migration are directly under neurological and hormonal control. For birds exposed to endocrine disrupting chemicals, neurological changes could lead to effects on learning, cognition and migratory behaviour. We are investigating the potential of Aroclor 1254, a PCB mixture, as a thyroid hormone disruptor in European starlings (*Sturnus*

vulgaris ) and red-winged blackbirds ( *Anglailus phoeniceus* ). Birds were orally administered 0, 0.35 or 0.70 $\mu$ g Aroclor 1254/g-bw. Body mass, along with tarsus, wing-chord and bill-lengths were measured over the period of nestling development. Blood was taken to measure thyroid function. A subset of nestlings were sacrificed, and liver samples collected for contaminant and biochemical analyses. The remaining birds were taken into captivity and exposed to two photoperiod shifts to simulate autumn and spring migrations. Birds were observed for migratory restlessness. Furcular fat, moult scores and body mass measures were taken biweekly. Serial blood samples were taken during these shifts to measure thyroid function. Emlen funnel trials were used to assess migratory orientation. There were no overt signs of toxicity; however, contaminant, biomarker and thyroid hormone analyses are ongoing. Migration was only induced in captive starlings; however, dose group effects were indistinct. This study is attempting to link alterations in avian behaviour to contaminant-specific mechanisms. Subtle alterations in thyroid hormones could give rise to larger-scale effects, including changes in cognition and migratory behaviour, which could explain observed global declines in migratory species.

**PS1.95 Fletcher, Dawn**, (Great Basin Bird Observatory, Reno, United States); Leist, Amy (Great Basin Bird Observatory, Reno, NV, United States)

#### TESTING ASSUMPTIONS OF AN AVIAN DOUBLE-SAMPLING AREA SEARCH METHOD ON RIPARIAN BIRDS OF THE LOWER COLORADO RIVER

The Lower Colorado River (LCR) Riparian Bird Survey Project, part of the LCR Multi-Species Conservation Program, has been assessing the demography of riparian birds occurring along the LCR since 2007. For data collection we used a double-sampling area search method, which allowed us to estimate population density and long-term population trends for riparian birds. Using this method, we surveyed a set of plots rapidly (twice during breeding season) and then surveyed a subset of those plots intensively (8 times during the breeding season). We compared territory numbers from rapid and intensive plots to obtain a detection ratio, which was used to calculate population size estimates in the program Double Sampling. Beginning in 2011, we surveyed a third plot type (enhanced-intensive plots) 16 times during the field season, in effort to test the assumption that double-sampling provides unbiased estimates of bird population densities. We then compared the enhanced intensive data to the standard intensive area search data collected on the same plots to calculate species-specific estimates of the error rates associated with standard intensive area searches. We calculated the ratio of the average number of territories determined by the intensive surveyor compared to the average number of territories determined by the enhanced intensive surveyor. Here we present our preliminary results.

**T7.3 Fokidis, H. Bobby**, (University of British Columbia, Vancouver, Canada); Prior, Nora; Soma, Kiran (University of British Columbia, Vancouver, BC, Canada)

#### FOOD RESTRICTION INDUCES SOCIAL INSTABILITY AND RAPID CHANGES IN CIRCULATING STEROIDS IN MALE ZEBRA FINCHES (*TAENIOPYGIA GUTTATA*)

Food availability is one of the most important environmental factors driving avian life-histories. When food restricted, all birds engage in aggression to acquire and/or defend food resources, and yet the biological basis of this highly conserved behavior is largely unknown. We investigated how access to food alters social instability in groups of adult male zebra

finches and whether steroid hormones may mediate this type of aggressive behavior. Zebra finches were food restricted for 6 hrs and then behavior was scored around exposure to a point source feeder (accessible by one bird at a time). We also measured non-feeder related social interactions and circulating steroid levels. Food restriction significantly decreased body mass and increased aggressive displacement behaviors directed at accessing the feeder. Food restriction also increased the occurrence of non-feeder-related aggression, suggesting lowered social stability. Circulating levels of corticosterone and dehydroepiandrosterone (DHEA, an androgen precursor) increased with food restriction, whereas circulating testosterone levels declined. Surprisingly, these hormonal changes were reversed within minutes of feeding, suggesting that these steroids may have rapid effects within the brain to regulate this type of aggression. This study demonstrates that food availability may have profound impacts on social stability and aggression, and suggests a potential role for steroids in mediating the effects of food availability on social behavior. These findings have important implications for the evolution of territoriality and the role of food availability in shaping avian behavior.

**S6.3 Fontaine, Joseph**, (U.S. Geological Survey-Nebraska Cooperative Fish and Wildlife Research Unit, Lincoln, United States); Stutzman, Ryan (University of Nebraska, Lincoln, United States)

#### THE INTERPLAY OF CLIMATE AND LAND-USE CHANGE: IMPLICATIONS FOR A LONG DISTANCE MIGRANT

Due to the extraordinary constraints inherent in migration and the reliance on predictable interconnections between multiple habitats, migratory populations may be particularly vulnerable to changing environmental conditions. With climate change expected to alter precipitation, evapotranspiration, and temperatures, local habitats are likely to undergo changes in phenology, productivity, and ecosystem function that may have important implications for migratory birds. Moreover, changes in climate will also affect land-use practices by shifting crop distribution and management. During the spring migration period of 2010 and 2011, we set out to assess the interrelationship of shorebird migratory phenology and local resource phenology with the goal of understanding the potential impacts of predicted changes in climate and land-use on shorebird populations. By incorporating empirical data on migratory shorebird habitat preferences and suitability with downscaled climate models and projected changes in regional agricultural practices we were able to develop a series of predictive models that outline scenarios of habitat suitability for migrating shorebirds in Prairie Pothole Region of North America.

**PS2.223 Forrester, Timothy**, (Simon Fraser University, Burnaby, Canada); Bishop, Christine; McKibbin, Rene (Environment Canada, Delta, BC, Canada); Green, David (Simon Fraser University, New Westminster, BC, Canada)

#### TEMPORAL VARIATION IN THE DEMOGRAPHY OF RIPARIAN BIRDS IN THE OKANAGAN VALLEY

Loss of riparian habitat as a result of residential, industrial and agricultural development and river canalization has resulted in extensive riparian habitat loss in the Okanagan since the 1950's. We used data from point counts conducted in 2001 to 2003 to examine if distribution and abundance of five riparian songbird species varied with local vegetation variables and/or larger landscape variables within, 1, 5, 10, and 20km of point count

stations. We then used point count data from the same locations in 2012 to examine how recent changes in local or landscape features influence songbird distribution and abundance. Point counts were conducted at 90 locations within five study areas in the Southern Okanagan Valley of B.C. Focal species were the SARA red-listed yellow-breasted chat, yellow warbler, willow flycatcher, gray catbird, and song sparrow. We discuss the importance of changes in local and larger scale land use for populations of riparian dependent songbirds.

**T7.2 Forsman, Anna,** (Cornell University, Ithaca, United States);

#### EXPERIMENTALLY INCREASED BACTERIAL LOAD IN TREE SWALLOW NESTS INFLUENCES EGG DEFENSES AND IMMUNE-BASED MATERNAL EFFECTS, BUT NOT AS EXPECTED

Birds encounter a variety of bacteria in their environment on a daily basis. The vast majority of these organisms likely exert minimal direct effects on avian fitness, while others may exert negative pathogenic effects or conversely, positive probiotic effects. Regardless of pathogenicity, the antigenic properties of many bacteria likely contribute to variation in immune status among individual birds at any given time. Some of this variation may in turn be inherited from mother to offspring through the deposition of protective immune compounds into eggs. Neonates may be especially sensitive to environmental bacteria during the first weeks of life, before the immune system is fully developed and the gut microbiota established. And thus, variation in female exposure to bacteria prior to egg-laying may result in indirect fitness consequences through maternal effects on early offspring immune phenotype. In this study, I manipulated bacterial load in tree swallow nests during nest-building and egg-laying to explore bacterial effects on female investment in egg defenses and on offspring growth and immune status. Contrary to my predictions, eggs collected from nestboxes with added bacteria contained lower concentrations of yolk antibodies than eggs from control nests. These patterns, observed for total yolk antibodies, were also reflected in nestling plasma samples, with differences becoming amplified with nestling age. I will integrate these results with new data on measures of immune function in both adults and nestlings to better understand possible probiotic effects of environmental bacteria.

**PS1.235 Foster, Kenneth,** (Owl Moon Environmental Inc., Calgary, Canada); Godwin, Christine (University of Calgary, Calgary, AB, Canada); Pyle, Peter (Institute for Bird Populations, Point Reyes Station, CA, United States)

#### MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP IN THE ALBERTA OIL SANDS REGION

MAPS (Monitoring Avian Productivity and Survivorship) is a continent-wide bird-banding program dedicated to the understanding of bird demographics. These data are currently lacking in the boreal forest, the breeding grounds for a large number of migrant species. In 2011, six MAPS stations were established in the oil sands region of NE Alberta, with the objective of demonstrating the utility of the MAPS protocol in providing data that (1) advance understanding of avian population dynamics and diversity in habitats that are reclaimed and subject to disturbances associated with industrial activities; (2) provide estimates of population vital rates for bird species nesting in the boreal forest; and (3) provide a platform for other researchers for complementary projects. Six MAPS stations were established: three in natural undisturbed areas, two in reclaimed areas, and one in a semi-natural area (reservoir

shoreline). The abundance of birds processed in 2011 was high (1,605 new bandings). The capture rate at natural habitat stations ranged from 432-885 birds per 600 net-hr. Capture rate was high at one reclaimed station (730 per 600 net-hr), low at the other reclaimed station (140), and high at the semi-natural station (806). The mean apparent productivity (HY:AHY) in natural habitat stations was 0.91 (SE 0.24). Productivity at one reclaimed station was higher, while the other was much lower. Diversity of birds captured at the six stations ranged from 19-37 spp., increasing to 39-52 spp. when including species observations, and was much higher than was measured by conventional point count techniques (8-12 spp.). In 2012, 18 new MAPS stations will be established in natural and disturbed habitat regimes. One of the ultimate goals of the project is to help guide habitat reclamation efforts to maximize the maintenance of healthy landbird populations. In a parallel program in 2011, blood samples from TEWA and CHSP captured at each station were taken and analysed for metal concentrations to examine potential toxicity from exposure to metals originating from oil sands processing facilities. Data from both years of MAPS in the oil sands region will be presented. Funding in 2011 from Syncrude Canada Ltd. and Hammerstone Corporation, and support from an additional eight oil sands partners for the 2012 program, is gratefully acknowledged.

#### **S3.1 Fox, Tony,** (Aarhus University, Rønde, Denmark); INVESTIGATING EFFECTS OF OFFSHORE WIND FACILITIES ON BIRDS: THE DANISH EXPERIENCE

The first full-scale commercial offshore wind farms were constructed in Danish marine waters in the early 2000s, although others have been elsewhere in Europe since then. Potential adverse effects on birds ensured considerable effort was invested to assess avian interactions with such structures constructed at sea. The methods used concentrated on the measurement of (i) avian flight avoidance and (ii) feeding/resting avoidance/displacement responses post construction, as well as (iii) prediction and subsequent measurement of collision rates with turbines. The results of these studies from Denmark will be reviewed and consideration given to the lessons learned in Europe then and since, as well as the contemporary problems still needing to be addressed. These include the deployment of remote sensing technology and the thorny question of how to assess cumulative effects from multiple stressors, including multiple offshore wind farms, on long distance migratory species. The modeling approaches needed to determine the energy expenditure of avoidance responses and their relative "costs" to population dynamics in relation to, for instance, collision mortality will also be considered. We also use historical data on avoidance responses of flying birds to show how these data can enlighten geometric design and turbine arrangement patterns to minimize effects on birds.

#### **S4.1 Francis, Charles,** (Canadian Wildlife Service, Environment Canada, Ottawa, Canada); Farnsworth, Andrew (Cornell Laboratory of Ornithology, Ithaca, NY, United States) OPPORTUNITIES AND CHALLENGES FOR INTEGRATING ACOUSTIC TECHNOLOGIES INTO BIRD MONITORING PROGRAMS

Many current bird-monitoring programs rely on acoustic detections of birds. For example, on breeding season point counts, up to 95% of species detections by skilled observers are based on audio detections. During nocturnal migration, many species can be identified based on their flight calls. As a result, there is considerable potential to use acoustic monitoring technologies such as digital recorders and weatherproof

microphones to develop new and improved bird monitoring programs. In this talk, we set the stage for the more in-depth presentations on individual topics in the rest of the symposium by presenting an overview of the diverse ways that acoustic technologies can be and are being used to enhance bird monitoring programs as well as technical and analytical challenges that still need to be overcome. Uses of acoustic technologies range from complementing and supplementing traditional field observation techniques to sampling in ways that would not be possible without these technologies. Digital recordings made concurrently with field observations can help document unusual species and allow later interpretation of recordings by birders skilled at audio identifications. Deploying recorders unattended for extended time periods, including in remote or difficult to access areas, allows repeated sampling at different times of day and over multiple dates to enhance detection rates and estimate occupancy rates, activity patterns or numbers of birds. Microphone arrays can be used to estimate population density and population size or the heights of migrating birds. Technical challenges include dealing with variation in detection rates with equipment type or habitat and reducing the effects of environmental noise such as wind or rain. The biggest remaining challenge is analysing the huge volumes of data that can be collected by recorders. Various computer algorithms are being developed to detect and process recordings, but most have not yet reached the stage where they perform as well as manual interpretation of recordings. Overcoming these challenges will open the way for more cost effective bird population monitoring providing more reliable information on distribution, status and trends of each bird species. These, in turn, will enhance bird conservation, through improved prioritization, guidance and evaluation of management activities.

**W13.2 Francis, Clinton**, (National Evolutionary Synthesis Center, Durham, United States); Kleist, Nathan (University of Colorado, Boulder, CO, United States); Ortega, Catherine (Fort Lewis College, Durango, CO, United States); Cruz, Alexander (University of Colorado, Boulder, CO, United States)

#### ANTHROPOGENIC NOISE ALTERS KEY ECOLOGICAL SERVICES PROVIDED BY BIRDS

Many vertebrate populations are in decline as a result of human-induced environmental change, raising concerns that the services they provide through mutualisms, such as seed dispersal and pollination, may be compromised, triggering further losses of biodiversity. One novel, yet widespread environmental change that has only recently been recognized as a threat to birds and other vertebrates is noise pollution. However, species do not respond uniformly to human-induced environmental changes, including noise, prompting the need to understand how mutualistic species that depend on vertebrates that serve as mobile links may be impacted indirectly by these novel acoustic conditions. Herein, we isolated noise pollution from confounding stimuli common to human-altered landscapes. Using observations, vegetation surveys and pollen transfer and seed removal experiments we studied how effects of noise pollution can reverberate through communities and influence flower pollination, seed predation and dispersal, and seedling recruitment. Black-chinned Hummingbirds (*Archilochus alexandri*), the main pollinator of *Ipomopsis aggregata* in our study area, visited artificial flowers in noisy areas five times more often than flowers in quiet areas, resulting in more movement of fluorescent powder, a proxy for pollen, among plants and patches. In contrast, noise altered the animal community that preys upon and disperses piñon pine (*Pinus edulis*) seeds. *Peromyscus* mice, which are primarily seed predators, were more common removing and consuming seeds

in noisy relative to quiet areas and Western Scrub-jays (*Aphelocoma californica*), which are important piñon seed dispersers, only removed seeds on quiet sites. Consistent with the observed distribution of these seed predators and dispersers, recruitment of piñon seedlings was four times higher in quiet relative to noisy areas. Despite evidence that some ecological services, such as pollination, may benefit indirectly due to noise, declines in recruitment of a dominant species like piñon pine may have dramatic long-term effects on ecosystem structure and diversity. Given the continued expansion of noise pollution, there is a need to determine how other functionally unique species respond to novel acoustic environments so that we may begin to understand the trajectory of many populations and communities exposed to our industrial rumble.

**S2.1 Fraser, Kevin**, (York University, Toronto, Canada); Stutchbury, Bridget (Department of Biology, York University, Toronto, ON, Canada)

#### CONSTRAINED MIGRATION SCHEDULES IN A TRANS-HEMISPHERIC MIGRANT SONGBIRD

Behavioural inflexibility in onset of migration may limit a species' ability to adjust migration timing in response to climate change, and has been implicated in severe population declines of migratory songbirds. It is hypothesized that phenotypic variation in avian migration schedules is reduced in long-distance migrants due to strong stabilizing selection, leading to environmental canalization of migratory traits. Until recently, it has not been possible to track small birds to test the degree to which en route migration schedules are endogenously controlled or flexible to environmental conditions. We tracked a trans-hemispheric migratory aerial insectivore (purple martin, *Progne subis*) from four populations across the North American breeding range with different migration routes. We show that, despite one-way journeys exceeding 6000 km and variable migration timing and routes, departure date predicted most of the variation in arrival date for both autumn and spring migration. Surprisingly, autumn departure dates also predicted arrival back to the breeding site the next year, despite a 5-month winter season in Brazil. Autumn migration pace, flight speed and ratio of flying to stopover days was similar between populations. Autumn migration featured an unexpectedly rapid (450 km/d) initial migration covering 2000 km or more, followed by prolonged stopovers before birds resumed their journey to South America. Our results suggest that en route migration strategy may be far more constrained in songbirds than previously realized, and may explain population declines in some species such as this aerial insectivore.

**T16.6 Frederick, Peter**, (University of Florida, Gainesville, United States); Jayasena, Nilmini (University of Peradeniya, Peradeniya, Sri Lanka); Campbell, Ashley (Florida Atlantic University, Boca Raton, FL., United States); Borkhataria, Rena (University of Florida, Belle Glade, FL, United States)

#### DOES MERCURY EXPOSURE AFFECT AVIAN SURVIVAL?

Mercury (Hg), particularly in its methylated form (MeHg), is a global contaminant increasingly found in high concentrations in carnivorous birds of many guilds. Known for measurable effects on developmental, endocrine, reproductive, behavioral and immunological systems, mercury exposure has often been hypothesized to affect survival. Here, we report on survival of White Ibises (*Eudocimus albus*) during exposure to 4 levels of dietary MeHg in captivity and later as depurated free-ranging animals. Ibises were chronically exposed in captivity to dietary MeHg in groups at 0 (control), 0.05 (Low), 0.1 (Medium) and

0.3(High) ppm MeHg ww for 43 months. No differences in annualized survival among captive groups were seen within age classes. Survival of all ages taken together was significantly lower for Control birds than for Low or Medium dosed birds, but was not different from High birds. While this might be evidence of a hormetic effect, none of the captive results support the prediction that MeHg impairs survival. Using a mark-recapture analysis we found no effects of dose group or of MeHg exposure on survival or resight probabilities during the first 99 days post-release to the wild. The latter results suggest that there is no lasting, post-depuration effect of even high MeHg exposure (0.3 ppm ww dietary) on survival. Together with the existing literature, we find no evidence of a relationship between MeHg exposure and survival of wild birds. However, the results of many survival studies have been confounded by seasonal depuration through molt, variation in exposure rates over time, and protection of young birds via rapidly growing feathers. We suggest future studies concentrate on evaluating survival effects during nonmolting periods in species for which methylmercury exposure is relatively constant.

**PS2.221 Freed, Leonard**, (University of Hawaii at Manoa, Kailua, United States); Cann, Rebecca (University of Hawaii at Manoa, Kailua, United States)

#### CHANGES IN TIMING, DURATION, AND SYMMETRY OF MOLT OF HAWAIIAN FOREST BIRDS FROM COMPETITION WITH AN INTRODUCED BIRD

Molt is a life history stage in birds that is energetically expensive and may change as a result of food limitation. That food limitation for Hawaiian forest birds, at Hakalau Forest National Wildlife Refuge, resulted from increased numbers of the introduced Japanese white-eye (*Zosterops japonicus*), beginning in 2000, which competes with all native birds. Before the increase, molt occurred primarily from June to October, after breeding. However, with food limitation, both young and adults of all native species took longer to complete their molt, finishing in months November to March which had previously been rarely or never used. In addition, adult birds initiated their molt one to two months earlier than June. These changes included primary flight feathers as well as body feathers. We documented increased prevalence of suspended molt of primary feathers. In addition, beginning in August 2002, most species had asymmetric molt of primary feathers. With the exception of asymmetric molt, the changes in molt represent a reduction of daily energy expenditure on molt, a short-term response to food limitation confirmed by experimental studies. However, survival decreased steadily between 2000 and 2004, with no difference between birds with normal and extended molt. Variation among study sites in prevalence of molt was related to changes in density of white-eyes. Now, native birds can neither breed successfully nor molt efficiently, with lower survival from both. Control of white-eyes in key areas is necessary to prevent further declines and perhaps extinction of Hawaiian birds.

**T11.3 Freeman, Benjamin**, (Cornell University, Ithaca, United States);

#### INTERSPECIFIC COMPETITION EXPLAINS BIMODAL DISTRIBUTION OF A NEW GUINEAN SONGBIRD ALONG AN ELEVATIONAL GRADIENT

I show that the Blue-gray Robin (*Peneothello cyanus*) occupies a bimodal abundance distribution along an elevational gradient in New Guinea, and consider three hypotheses to explain this unusual distribution. 1) Ecological divergence, where the two abundance peaks represent distinct, ecologically divergent populations, 2) "Elevation is an inappropriate proxy," where the underlying environmental variables that affect the focal species'

abundance distribution are not linearly related to elevation; and 3) Interspecific competition, where competition with a superior competitor shifts the focal species' unimodal fundamental niche to a bimodal realized niche. Morphometric analyses failed to support ecological differentiation among Blue-gray Robins, while a comparison of abundance distributions of co-distributed montane species provided weak support for the "Elevation is an inappropriate proxy" hypothesis. In contrast, the interspecific competition hypothesis was strongly supported. Blue-gray Robin abundance was inversely correlated to the abundance of the larger, confamilial Ashy Robin (*Heteromyias albispecularis*). Ashy Robins responded with high interspecific aggression towards Blue-gray Robin playback trials, while Blue-gray Robins did not respond to Ashy Robin playback trials, perhaps because a Blue-gray Robin would be unable to evict the putatively competitively-superior Ashy Robin. This is the first experimental evidence that asymmetric interspecific competition can maintain a bimodal abundance distribution. Many montane species in New Guinea and other tropical regions have restricted elevational distributions, and interspecific competition may be more important in limiting these distributions than has previously been appreciated.

**T11.6 Frei, Barbara**, (McGill University, Ste-Anne-de-Bellevue, Canada); Nocera, Joe (Trent University, Peterborough, ON, Canada); Fyles, Jim (McGill University, Ste-Anne-de-Bellevue, PQ, Canada)

#### RED-HEADED WOODPECKERS EXHIBIT NON-IDEAL HABITAT SELECTION IN A HUMAN-MODIFIED LANDSCAPE

The Red-headed Woodpecker (*Melanerpes erythrocephalus*) is a cavity nesting species that was once common but whose populations are now declining, resulting in it being listed as threatened in Canada and several states in the U.S. Few studies have examined the species' choice of breeding habitat characteristics, and no study has investigated the influence of these characteristics on the species' nest success. As the species now inhabits a strongly human-modified landscape (e.g., agroforestry areas), we predict that Red-headed Woodpecker's habitat choice may not necessarily be correlated with realized nest success, resulting in non-ideal habitat selection. In 2010-2011, we monitored 60 Red-headed Woodpecker nests in southern Ontario to describe breeding habitat use at multiple spatial scales and estimate nest success. Habitat features were quantified at nest tree, nest patch, territory, and landscape scales at breeding and random locations. We quantified nest success and used a logistic exposure model to relate it to habitat features, temporal and climatic covariates, and competitor presence. Red-headed Woodpeckers selected unique breeding habitat features on multiple scales (e.g., dead limb length), which often were uncorrelated with or directly opposed to nest success. We found that nest initiation date, minimum daily temperature, and the presence of interspecific nest cavity competitors have a strong influence on nest survival, which was lower for earlier nesters and those with European Starlings (*Sturnus vulgaris*) in the vicinity. As a weak primary excavator requiring decadent wood, Red-headed Woodpeckers may face habitat limitation contributing to the species' declines. Our findings suggest temporal and competition limitations as well, where later nesting woodpeckers may benefit from reduced starling harassment, and higher insect food abundance due to warmer temperatures.

**W17.8 Frey, Sarah**, (Oregon State University, Corvallis, United States); Nicholas, Rodenhouse (Wellesley College, Wellesley, MA, United States); Scott, Sillett (Smithsonian Conservation Biology Institute, Washington, DC, United States); Richard, Holmes (Dartmouth College, Hanover, NH, United States);



Matthew, Betts (Oregon State University, Corvallis, United States)

**UPS AND DOWNS: LONG-TERM SONGBIRD POPULATION TRENDS ACROSS AN ELEVATIONAL GRADIENT IN THE HUBBARD BROOK EXPERIMENTAL FOREST, NH**

Consistent, long-term ecological data is relatively rare, yet critical for examining population trends over time. These datasets are particularly important for investigating species' responses to long-term perturbations such as climate change. For instance, species are predicted to shift up-slope in relation to a warming climate. We examined the long-term (1999-2011) population trends of common songbird species within the Hubbard Brook Experimental Forest, New Hampshire. This is a mountainous, forested landscape that spans an 821-m elevation gradient and has been relatively undisturbed over the course of this study. We used point count data on singing males collected three times each year throughout the breeding season at 371 sites across the 3160-ha watershed. Using dynamic occupancy models, we calculated year-dependent settlement and vacancy rates to derive trends in occupancy probability, that accounted for imperfect detection. We then tested for distributional shifts across the elevational gradient over time. Six of 16 species showed significant linear declines in valley-wide occupancy over this period ( $p < 0.05$ ). Rates of decline ranged from 0.9-3.5% per year. These declines appeared to cut across species traits such as migratory strategy and vegetation association. Two species showed slight, but non-significant, population increases, 13 tended to be decreasing, and one species showed little change in occupancy. We found some evidence for elevational range shifts, but interestingly, these shifts were both upwards and downwards in elevation, indicating that perhaps climate may not be the key factor in driving changes in distributions.

**PS1.197 Friesen, Megan,** (University of California Davis, Davis, United States); Prada, Paola; Nevitt, Gabrielle (University of California Davis, Davis, CA, United States)

**CLOSE RELATIVES WITH DIFFERENT ODORS: A COMPARISON OF FEATHER ODOR SIGNATURES BETWEEN TRICOLORED (AGELAIUS TRICOLOR) AND RED-WINGED (AGELAIUS PHOENICEUS) BLACKBIRDS**

The differences in breeding strategies between the Tricolored Blackbird (*Agelaius tricolor*) and the Red-winged Blackbird (*Agelaius phoeniceus*) have become iconic studies in ecology. Tricolored Blackbirds form the largest colonies of any extant passerine and are also noted to have a strong, musky odor to the human nose, while Red-winged Blackbirds exhibit territorial behavior throughout the breeding season and emit no apparent odor. The close evolutionary relationship, and extreme differences in mating systems make these Icterids ideal study species for evaluating and comparing chemical cues in passerines. Additionally, the gaps in information regarding chemical ecology and species specific odor signatures in passerines make this study critical in advancing the field of avian sensory ecology. Feathers from around the preen gland region of both species were collected for the analysis of volatile organic compounds (VOC) associated with odors using stir-bar sorptive extraction coupled with gas chromatography mass spectrometry. More than 160 compounds were associated with Tricolored Blackbirds (including ketones, aldehydes, hydrocarbons, terpenes, hydrocarbons, acids, and others), while the Red-wing Blackbird odor profile contained considerably less. Results suggest that there is indeed a difference in odor signature between the two species. Currently, data is being investigated to understand the link between the generated odors

and the life history of both species, including prey acquisition and the differences in breeding strategies.

**PS1.105 Friesen, Vicki,** (Queen's University, Kingston, Canada); Chown, Erin (Queen's University, Kingston, ON, Canada); Deane, Petra (Cornell University, Ithaca, NY, United States); Bolton, Mark (The Royal Society for the Protection of Birds, Sandy, Bedfordshire, United Kingdom); Birt, Tim (Queen's University, Kingston, ON, Canada)

**HOW DO SYMPATRIC SEASONAL POPULATIONS OF BAND-RUMPED STORM-PETRELS ARISE? TESTING MECHANISMS OF EVOLUTION**

Storm-petrels (*Oceanodroma* spp.) include multiple examples of sympatric seasonal populations or sister species that breed within the same archipelago at different times of year. Previous studies indicated that seasonal populations arose independently within each archipelago, however the mechanisms by which they evolved are unclear. The annual cycle of storm-petrels is tightly scheduled between reproduction and molting, providing little opportunity to shift the timing of breeding by 4 to 8 months. We are testing the hypothesis that races arose through "isolation by time" (IBT; Hendry & Day 2005, *Mol. Ecol.* 14:901). According to the IBT model, if timing of reproduction is heritable, gene flow may be restricted between individuals that breed at different times of year. This may result in genetic divergence of seasonal populations, and may enable adaptation to different seasons ("adaptation by time"). Accordingly, results from analyses of neutral genetic variation (mitochondrial control region sequences and microsatellite length variation) in band-rumped storm-petrels indicate that gene flow between seasonal populations is restricted within most archipelagos. Variation in neutral molecular markers also suggests that seasonal shifts involved large numbers of birds, arguing against a founder effect. Previous analyses of stable isotopes revealed differences in diet between seasonal populations in at least one archipelago, suggesting differences in selective pressures. We are currently testing for adaptation by time by investigating whether morphological shifts (e.g. differences in wing length) are similar (i.e. convergent) for seasonal populations from different archipelagos. We are also analyzing whether variation in the clock gene, which has been associated with differences in breeding time in other species, correlates with breeding season.

**PS2.180 Fristoe, Trevor,** (University of New Mexico, Albuquerque, United States);

**ENERGY USE BY MIGRANTS IN NORTH AMERICAN BREEDING BIRD COMMUNITIES**

On the order of 5 billion birds comprising more than 700,000 tonnes of biomass migrate across North America every year in order to exploit seasonal resource pulses at high latitudes during breeding. Yet, little is known about the metabolic role of these migrants in temperate and arctic breeding bird communities. Using data from the North American Breeding Bird Survey and scaling relationships for field metabolic rate as a function of body size and taxonomic group, I estimated energy use by migrant and resident breeding birds in communities across North America. Results suggest the relative contribution of migratory species to avian community metabolism increases with latitude and seasonality, ranging from below 1% in the subtropics to more than 70% at many taiga and arctic tundra habitats. With increasingly milder winters predicted under continuing climate change, future shifts in breeding community composition may occur as resources available for residents increase relative to the summer excess used by breeding migrants.

**PS1.224 Fronstin, Raime**, (Simon Fraser University, Burnaby, Canada); Tony, Williams (Simon Fraser University, Burnaby, BC, Canada); Stephanie, Doucet (University of Windsor, Windsor, ON, Canada)

#### EGGSHELL COLOUR, BILIVERDIN AND SEXUAL SIGNALING IN THE EUROPEAN STARLING (*STURNUS VULGARIS*): A PHYSIOLOGICAL PERSPECTIVE

The functions of, and mechanisms underlying variation in eggshell colour remains very poorly understood in birds. It has been proposed that blue-green egg colouration might function as a sexually-selected, condition-dependent signal of female quality, which males might use to determine their level of post-hatching parental investment. Biliverdin, derived from heme by heme-oxygenase and deposited by the eggshell gland, is the pigment responsible for blue-green colouration. Whether variation in eggshell pigmentation is limited by the availability of heme or biliverdin in circulation or by the activity of heme-oxygenase in the eggshell gland is unknown. We took an experimental approach to investigate both the functional and mechanistic components of variation in blue-green eggshell pigmentation in the European starling (*Sturnus vulgaris*). We experimentally manipulated hematocrit and hemoglobin, and therefore heme and biliverdin availability, in free-living female European starlings during egg-laying. We measured hemoglobin, hematocrit and plasma biliverdin, in relation to our treatment and compared this to variation in eggshell colour, maternal quality, parental provisioning of offspring, and brood success. If variation in eggshell biliverdin is derived from limited heme resources in circulation, we expected females with experimentally increased RBC degradation to exhibit a corresponding increase in eggshell colouration. However, if variation in eggshell pigmentation is due to limited heme-oxygenase activity in the eggshell gland, we expected to see no difference in eggshell colour between treatment groups. Our treatment successfully increased total hemoglobin levels and while eggshell colour increased across clutches, there was no difference between treatment and control groups. However, in contrast to the control group, within the treatment group, post-treatment eggshell colour was negatively correlated with post-treatment hematocrit and plasma hemoglobin and positively correlated with egg mass. Our results yield mixed support for the sexual selection hypothesis and suggest the underlying mechanism of variation in eggshell colour is limited by heme-oxygenase activity within the eggshell gland.

**T9.3 Frye, Graham G.,\*** (Boise State University, Boise, United States); Forbey, Jennifer S. (Boise State University, Boise, ID, United States); Connelly, John W. (Idaho Department of Fish and Game, Blackfoot, ID, United States)

#### EFFECTS OF SAGEBRUSH CHEMICAL COMPOSITION ON DIET SELECTION AND HABITAT USE BY AN AVIAN HERBIVORE, THE GREATER SAGE-GROUSE

The defensive and nutritional chemistry of plants constrains the diet of herbivores. The Greater Sage-Grouse (*Centrocercus urophasianus*) is an avian herbivore with a specialized diet of sagebrush (*Artemisia* spp.), a taxon with high concentrations of defensive compounds. We hypothesized that sage-grouse behaviorally regulate the intake of nutrients and defensive compounds via selective foraging. Specifically, we predicted that plants consumed by sage-grouse have lower concentrations of defensive chemicals and higher concentrations of nutrients. We also hypothesized that a selective foraging strategy would influence habitat use on multiple spatial scales. We located foraging sites of radio-marked sage-grouse and collected samples of browsed and unbrowsed plants. We also collected

sagebrush samples at randomized locations throughout the study area. We quantified concentrations of defensive compounds (monoterpenes, phenolics) and nutrients (calcium, phosphorus, crude protein), and modeled the log odds of patch-use and plant-use as functions of sagebrush chemical composition. Sage-grouse used black sagebrush (*A. nova*) habitat more, and Wyoming sagebrush (*A. tridentata wyomingensis*) habitat less, than expected on the basis of availability (Fisher's exact test,  $P < 0.0001$ , odds ratio = 27.8). Black sagebrush had lower total monoterpene concentrations ( $\bar{x} = 626.71$  AUC/mg  $\pm$  20.6 SE) than Wyoming sagebrush ( $\bar{x} = 827.52$  AUC/mg  $\pm$  35.05 SE). Within black sagebrush habitat, the odds of patch-use increased with crude protein concentration (odds ratio = 1.65, 95% CI = 1.15-2.49). Within used patches, the odds of plant-use increased with crude protein concentration (odds ratio = 2.14, 95% CI = 1.02-4.50) and decreased with concentrations of two monoterpenes: alpha-pinene (odds ratio = 0.76, 95% CI = 0.54-1.07) and 1,8-cineole (odds ratio = 0.79, 95% CI = 0.64-0.96). Our results highlight the importance of sagebrush chemistry in sage-grouse diet and habitat use decisions on multiple spatial scales, and suggest that sagebrush chemistry should be considered in conservation and management efforts.

**T14.12 Furfey, Brehan**, (Arkansas State University, Jonesboro, United States); Pierce, Aaron (Nicholls State University, Thibodaux, LA, United States); Bednarz, James (Arkansas State University, Jonesboro, AR, United States)

#### NESTING AND FORAGING ECOLOGY OF BLACK SKIMMERS (*RYNCHOPS NIGER*) IN COASTAL LOUISIANA FOLLOWING THE BP OIL SPILL

We monitored the reproductive and foraging ecology of Black Skimmers (*Rynchops niger*) on the Isles Dernieres Barrier Refuge (IDBR) in coastal Louisiana from May–August 2011 and tracked their response related to the BP oil spill. Similar to many coastal birds, there is a paucity of information on the effects of oiling events on skimmer reproductive and foraging ecology. The IDBR represents an ecologically sensitive area that is historically important habitat for wintering and breeding waterbirds, and is currently threatened by habitat loss, disturbance, and climate change. In 2011, skimmers began nesting at five sites on and adjacent to the refuge, but we documented successful nesting at only two sites, West and East Raccoon islands. Of the nests monitored ( $n = 62$ ), 53.2% of nests hatched young successfully, while 46.8% of the nests failed due to abandonment, predation, or flooding. The daily nest survival rate was 0.973, and the overall mean nesting success was 29.80% (95% Confidence intervals = 12.50–47.10%). Based on transect counts, we estimated 0.13 fledglings produced per nest on West Raccoon Island and an estimated 0.083 chicks produced per nest on East Raccoon Island. Compared to data collected before and during the oil spill in 2009 and 2010, Black Skimmer reproductive success seemed to have recovered to some degree in 2011, but data on fledgling survival suggest that the population in the IDBR is currently in decline. Also, we captured 39 skimmers, 20 of which were equipped with radio transmitters. Most of the 203 radio locations were within 800 m of the nesting colonies. The maximum distance traveled by any bird from the breeding colony was 11.97 km. Of these, 26 locations (10%) were documented at night when skimmers were actively foraging. The mean home-range size was 50.00 ha (range = 10.62–243.78 ha;  $n = 11$ ). Our results on breeding success and habitat utilization are crucial for determining priority sites to protect and manage for the conservation of Black Skimmers in the coastal Louisiana ecosystem. With the rapid rate of land loss in coastal Louisiana, additional management efforts are needed to improve the quality

and quantity of breeding and foraging habitat available for Black Skimmers to stop declining population trends.

**PS1.96 Gahbauer, Marcel**, (Stantec, Calgary, Canada); Pomeroy, Andrea (Stantec, Burnaby, BC, Canada)

#### ASSESSING AVIAN MORTALITY RATES DUE TO POWER LINE COLLISIONS

Collisions with artificial structures are recognized as a major source of mortality for birds, with several previous reviews identifying power lines as one of the top causes of such mortalities. Increasing demand for electricity is driving the construction of new power lines in North America and elsewhere in the world. Project proponents are expected to estimate the effects of power lines on avian mortality and their consequences for bird populations, but are limited by critical gaps in the existing literature. While studies of power line collisions have been conducted around the world, most reviews overwhelmingly focus on a minority of references that reported unusually high collision rates or report estimates that range over more than an order of magnitude. In an effort to better estimate typical collision rates and understand how they vary relative to a number of factors, we assessed over 20 primary studies on power line collisions, plus several major reviews of avian mortality rates. We found that survey design and interpretation have been inconsistent, and several sources of bias commonly had a substantial influence on results. Annual estimates of mortality ranged from zero to several hundred per kilometre, but were generally low and only rarely exceeded 20 per kilometre. The greatest mortality rates were reported in areas with a high density of wetlands supporting large concentrations of waterbirds, but little research has been done in upland habitats. Collision rates have been shown to vary by species and by season, although there too effort has been biased, in favour of collision-prone species and periods of peak abundance. Despite well-documented concerns about collisions, studies have generally given little attention to evaluating the design and placement of power lines with respect to avian mortality risk. Improving our understanding of the factors influencing bird collisions with power lines should help guide more effective siting and mitigation of future and existing power lines. As priorities for research, we recommend 1) standardized comparison of collision rates in various habitats, 2) assessment of the relationship between collision risk and height of power lines, 3) evaluation of the incremental collision risk associated with parallel power lines, and 4) study of the relationship between collision risk and proximity of power lines to key habitat features.

**F13.4 Galla, Stephanie**, (University of North Texas, Denton, United States); Johnson, Jeff A. (University of North Texas, Denton, TX, United States)

#### EXPLORING THE EVOLUTIONARY DISTINCTIVENESS OF THE CRITICALLY ENDANGERED ATTWATER'S PRAIRIE-CHICKEN USING COALESCENT MULTI-LOCUS ANALYSES

Our ability to diagnose evolutionary relationships among taxa has important implications in conservation. However, in recently divergent groups with large ancestral population sizes molecular phylogenies often result in polyphyletic patterns due to incomplete lineage sorting and the presence of ancestral polymorphisms. North American prairie grouse (*Tympanuchus* spp.), for example represent a diverse group of birds, yet their evolutionary history remains elusive. This uncertainty is of concern because managers are considering plans to breed the critically endangered Attwater's Prairie-chicken (*T. cupido attwateri*) with its conspecific the Greater Prairie-chicken (*T. c.*

*pinnatus*) to increase genetic diversity and improve fitness. Recent work based on mtDNA suggests that the Attwater's Prairie-chicken is as divergent with its conspecific than with other *Tympanuchus* grouse (i.e. Sharp-tailed Grouse, *T. phasianellus*, and Lesser Prairie-chicken, *T. pallidicinctus*). Therefore, before implementing a breeding program using the Greater Prairie-chicken, more work is warranted to determine if additional loci show similar patterns to those obtained with mtDNA. Eleven nuclear loci (6 autosomal, 5 z-linked) were identified from an initial screening of 138 loci for further phylogenetic analysis and were amplified over 105 individuals representing extant *Tympanuchus* species and subspecies. Based on preliminary analyses, coalescent extended Bayesian skyline plots (EBSP) agree with previous analyses based on mtDNA that prairie grouse populations experienced a demographic expansion in effective population size starting approximately 20,000-10,000 ybp following the last glacial maximum. The overall degree of expansion differed among species and subspecies, with the Attwater's Prairie-chicken possessing minimal if no increase while its conspecific, the Greater Prairie-chicken increasing at a much higher rate. We are currently generating results from an Isolation with Migration model (IM) to investigate the timing of divergence and gene flow patterns among *Tympanuchus* taxa. By utilizing sequences from multiple loci within this genus, we are able to address uncertainty associated with stochastic lineage sorting and provide a more robust survey exploring the recent demographic history of this species complex. These results will prove valuable in the conservation of prairie grouse and allow managers to evaluate current conservation management plans for Attwater's recovery.

**F8.2 Gammie, Kevyn**, (University of Windsor, Windsor, Canada); Doucet, Stephanie (University of Windsor, Windsor, ON, Canada)

#### SEXY DADS AND CRYPTIC MOMS: IRIDESCENCE, SEXUAL DIMORPHISM, AND MATING SYSTEMS IN THE GALLIFORMES

Iridescent colouration produces some of the most extravagant visual displays found in nature, but its mechanisms of production and evolutionary patterns remain poorly understood. The objective of our research is to characterize the evolution of iridescent colouration and feather nanostructure in the order Galliformes, and to investigate the possible influence of sexual selection in driving divergence in iridescent plumage. The Galliformes, the order of birds including quails, pheasants, and turkeys, exhibit dramatic variation in both the degree of iridescent plumage and the extent of sexual dimorphism. If iridescent colours have evolved by sexual selection in this group, then the proliferation and diversification of these colours should be associated with reproductive strategies that promote plumage dimorphism between cryptic females and ornamented males. We compiled a phylogeny of 70 galliform species from several recent molecular phylogenies. We used museum specimens to quantify sexual dichromatism using reflectance spectrometry, as well as through visual assessments of overall dichromatism and dichromatism in iridescent colouration for 15 different body regions. We collected life history information including mating system, parental care, and physical measurements from published species accounts. Our preliminary findings suggest that both overall sexual dichromatism and sexual dichromatism in iridescence become more prominent as mating systems become more polygynous and male contribution to parental care decreases. Interestingly, only overall sexual dichromatism was related to sexual size dimorphism, suggesting that sexual dichromatism in iridescence often occurs independently of dimorphism in body size. Combined with our

studies of barbule nanostructure in this group, it may be possible to not only identify the pressures that influence the gain and losses of dichromatism, but also whether sexual selection is acting on iridescent colouration itself or the traits it accentuates such as elaborate trains or eyespots.

**PS1.246 Gañán, Natalia,** (Laboratorio de Conducta Animal. Instituto de Ecología. UNAM., Mexico D.F., Mexico); Argáez, Víctor (Laboratorio de Conducta Animal. Instituto de Ecología. UNAM., Mexico D.F., Mexico); Nadia, Neri (Laboratorio de Conducta Animal. Instituto de Ecología. UNAM., Mexico D.F., Canada); Lifshitz, Natalia (Laboratorio de Conducta Animal. Instituto de Ecología. UNAM., Mexico D.F., Mexico); Torres, Roxana (Laboratorio de Conducta Animal. Instituto de Ecología. UNAM., Mexico D.F., Canada)

#### IS SKIN COLOUR A SEXUAL SIGNAL IN THE BROWN BOOBY (*SULA LEUCOGASTER*) ?

Many animal species display extravagant traits such as the striking coloration of feathers and skin found in some birds. These traits are considered to be signals used by females to evaluate male quality and adjust their reproductive investment accordingly. Brown booby (*Sula leucogaster*) males display during courtship green-blue coloration on the facial unfeathered skin and on the feet. We investigated the potential role of male's skin coloration as a sexual signal. We predicted that females paired with colorful males (1) will display higher courtship and copulation rates and (2) will lay larger and more colorful eggs than females paired with duller males. Males with greater gular UV reflectance ( $R_{max}$ ) spent more time in the territory. Male skin colour influenced female courtship and copulation behavior: female mean courtship rate was positively related to gular  $R_{max}$  and UV and green chromas of male feet and mean copulation rate was positively related to male gular green chroma and facial  $R_{max}$ . Also, males with greater gular UV and green chromas had a larger probability to establish a clutch. Furthermore, there were positive relationships between male facial and gular UV reflectance and green chroma and egg volume and colour, respectively. Our data suggest that skin coloration of brown booby males is a sexual signal that influences female behavior and investment in the egg.

**PS2.219 GARCÍA CARRASCO, MONICA,** (ESCUELA NACIONAL DE CIENCIAS BIOLÓGICAS, IPN, México D.F, Mexico); LOPEZ ISLAS, MARIA EUGENIA (Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional, MEXICO CITY, Canada); LÓPEZ LÓPEZ, EUGENIA (Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional, MEXICO D.F., Mexico)

#### COMPARISON OF THE CONDITION FACTOR, HEPATOSOMATIC AND GONADOSOMATIC INDEXES IN COOT POPULATIONS OF *FULICA AMERICANA* IN TWO RAMSAR WETLANDS: TECOCOMULCO LAKE AND LACUSTRINE SYSTEM OF XOCHIMILCO, MEXICO.

The coot, *Fulica americana* is an aquatic bird without sexual dimorphism, abundant in North America, of hunting importance as well as for food. In Mexico, there is a resident population and each year thousands of individuals arrive during the winter migration, both in inland and coastal wetlands. We analyzed various somatic indexes of *F. americana* from Tecocomulco Lake, and Xochimilco, both water bodies are included in the list of Ramsar wetlands of international importance. The study was conducted during four periods in an annual cycle. There were differences between the two study sites populations by sex ratio, body mass, gonadosomatic and hepatosomatic indexes. In

Tecocomulco, coots reached a higher weight and condition factor and reproduction started in May, while in Xochimilco it was until July. Population of *F. americana* at Tecocomulco is much greater than that of Xochimilco. These differences may be attributed to differences in conditions prevailing at each study site. Tecocomulco is a rural environment with agricultural and hunting activities with areas of recreation and tourism. However, Xochimilco is an urban lake supplied by treated urban wastewater, it is also influenced by agricultural activities, tourism, and is heavily impacted by urban settlements. Wetlands of international importance included in the Ramsar Convention have a key role as a harbor for waterfowl, as well as providing environmental services such as biodiversity reservoirs, water treatment and groundwater remediation. Therefore, it is necessary to assess and monitor their conditions to improve conservation and management strategies.

**PS1.217 García, Gabriela,** (UNAM, Saltillo, Coahuila, Mexico); Zamudio, Luz; Hernández, Blanca (UNAM, Mexico City, Mexico)

#### A REVIEW OF THE GREEN-FRONTED HUMMINGBIRD *AMAZILIA VIRIDIFRONS* (AVES: TROCHILIDAE) USING MITOCHONDRIAL AND NUCLEAR GENES.

The taxonomy of the Green-fronted hummingbird *Amazilia viridifrons* has been ambiguous and changing. Sometimes it has been considered conspecific with the Violet-crowned hummingbird (*A. violiceps*), sometimes as a separate species, and more recently has been suggested that *A. viridifrons* -sensu the American Ornithologists' Union- is composed of several independent taxa. Here, we provide a hypothesis regarding species limits and phylogeny of the Green-fronted hummingbird complex using DNA sequences from mitochondrial (ND2, ND3) and nuclear genes (AK1). Our results suggest that *A. viridifrons* and *A. violiceps* are separate, sister species. Previous morphological analyses and our molecular data also show that the Cinnamon-sided hummingbird *A. wagneri* may constitute a separate species, though further analyses are needed to confirm this. *A. v. villadai* (Oaxaca) was not supported as a different taxon; instead, it shared haplotypes with *A. viridifrons* from Guerrero, suggesting that they belong to the same species. In addition, we found unsuspected relationships of this complex with other *Amazilia* species, suggesting that a thorough analysis of the phylogeny of the species assigned to this genus is still needed.

**PS1.248 García, Natalia C.,** (Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires, Argentina); Barreira, Ana S.; Kopuchian, Cecilia; Tubaro, Pablo L. (Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires, Argentina)

#### INTRA AND INTER-SPECIFIC VOCAL VARIATION IN THREE SPECIES OF GROSBEAKS (PASSERIFORMES: CARDINALINI) AND ITS RELATIONSHIP WITH BODY MASS.

The negative relationship between song frequencies and body size, first described for birds by Wallschläger in 1980, is well supported by several studies considering a large number of species, but contradicting results were obtained at the intraspecific level. Variation in temporal song traits, on the other side, has been related to the effect of the habitat acoustics on song communication. However, the rate at which notes are produced could also be related to morphological traits that usually correlate with body size, such as bill length or depth. Here, we compared the vocalizations of *Cyanoloxia glaucocerulea*, *Cyanocompsa brissonii* and *Cyanocompsa*

cyanoides. *Cyanoloxia glaucocaerulea* and *Cyanocompsa brissonii* are sister species, and *Cyanocompsa cyanoides* is the sister species of this clade. Both *Cyanocompsa* species are divided into several subspecies, so they provide a good model to describe the variation in song traits in relation to body mass in closely related groups. We analyzed the songs of *C. glaucocaerulea*, the four subspecies of *C. cyanoides* and four out of the five subspecies of *C. brissonii* using the program Raven version 1.3. We measured frequency and time-related variables, and we collected weight data from specimens stored at different museums and also from bibliography. We evaluated the correlation between each song variable and the mean weight of each group. We found significant differences between and within species in both frequency and time-related variables, as well as in body mass. When comparing all the groups together we found that emphasized frequency shows a clear negative correlation with body mass. Note rate and internote interval length also significantly correlated with body mass, the heavier species having lower note rate and longer internote intervals. Even though the differences are small, our results suggest that the negative correlation between frequency and body size stands when comparing closely related groups, at least for the emphasized frequency. The correlation of note rate and internote interval length with body mass that we found suggests that body size could also influence the temporal structure of song, as it was previously found in birds with trilled sequences in their songs, at both the intra and interspecific levels.

**PS1.208 Garcia, Rony**, (Wildlife Conservation Society, Bronx, United States); McNab, Roan Balas; Ponce, Gabriela; Cordova, Marcial; Merida, Melvin (Canada)

#### STATUS OF THE WILD SCARLET MACAW POPULATION IN GUATEMALA

The Maya Biosphere Reserve is an extremely important breeding site for *Ara macao cyanoptera*, a highly threatened subspecies of the iconic scarlet macaw. Poaching and habitat loss, largely driven by intentional forest fires, cattle ranching, and the expansion of human settlements, have reduced the total population of *A. m. cyanoptera* to less than 1000 individuals distributed across southern Mexico, Belize, Guatemala, Honduras, and Nicaragua. An estimated population of 300 individuals remains within the Maya Biosphere Reserve of Guatemala. Until recently, the aforementioned threats were rapidly pushing this iconic species towards extinction in Guatemala.

Since 2002 we have been monitoring scarlet macaw nesting success by using an Index of Fledging Success (IFS), defined as follows: the number of successful fledglings obtained in a nesting season, divided by the number of nests monitored. At the beginning of each nesting season all known nests were reviewed several times; active nests were visited periodically to register the number of nests, chicks, and successful fledglings incorporated to the population.

During the last decade of monitoring and conservation we have registered a total of 146 fledglings that flew from the nests. The current trend indicates that survival probability of the scarlet macaw population in Guatemala is improving due to increased nesting success in the wild population, as a consequence of management and protection activities that CONAP (Guatemala Park Service) and partners have been executing in the last few years.

**S10.10 Garcia, Victoria**, (Virginia Tech, Blacksburg, United States); Walters, Jeffrey (Virginia Tech, Blacksburg, VA, United States)

#### WHAT FACTORS CONTRIBUTE MOST TO LIFETIME FITNESS IN RED-COCKADED WOODPECKERS?

Understanding the relative contributions of different genetic and environmental factors to an individual's lifetime fitness is a central goal in ecology and conservation. Additionally, knowing the amount of variance in lifetime fitness explained by different components is critical to understanding the evolution of life history strategies. In this study, we used an existing 30-year (1980-2010) dataset comprised of 2 different study sites in North Carolina, USA to calculate both lifetime reproductive success (LRS; total number of fledglings produced) and population projection matrix-based individual fitness ( $\lambda$  ind ; incorporates total fledglings and age at first reproduction) in endangered cooperatively breeding Red-cockaded Woodpeckers (*Picoides borealis*). The two measures are collectively referred to as lifetime fitness. Only individuals who were monitored for their entire lives were included in the study, and males and females were analyzed separately. We examined both factors that vary annually (e.g., clutch size) and factors that are only measured once in an individual's life (e.g., dominance rank within and individual's brood), and calculated the relative contributions of different environmental and life history traits to lifetime fitness using AICc and structural equation modeling. Most individuals had a lifetime fitness of 0, and most of the genetic contribution to future generations was made by relatively few individuals. Lifetime fitness was influenced by factors present when an individual hatched, such as the number of helpers present in the hatch territory (for males only) and cohort. Components such as lifespan strongly influenced lifetime fitness, as expected. Some traits that vary annually, such as number of helpers at the nest and the age of an individual's mate, affected the lifetime fitness of one sex but not the other.

**PS1.263 Garcia, William**, (Belize Foundation for Research and Environmental Education, Punta Gorda, Toledo District, Belize, Belize); Pop, Liberato (Belize Foundation for Research and Environmental Education, Punta Gorda, Toledo District, Belize, Canada); Rotenberg, James (Department of Environmental Studies, University of North Carolina Wilmington, Wilmington, NC, United States); Marlin, Jacob (Belize Foundation for Research and Environmental Education, Punta Gorda, Toledo District, Belize, Canada)

#### MONITORING JUVENILE HARPY EAGLE BEHAVIORS IN BELIZE: FROM NESTLING, FLEDGLING, ADOPTED BIRD, AND BEYOND

We monitored the behaviors of a juvenile Harpy Eagle (*Harpia harpyja*) in the Maya Mountains of Belize for six months. We discovered the active nest along with one nestling and parents in November 2010. This was the first nest of a Harpy Eagle documented in Belize. We made over 600 hrs of focal observations during the 6-months, January through June. We used focal animal observation with an all-occurrences sampling rule that provided a complete record of the juvenile eagle's behaviors. From these data we were able to calculate frequency and/or the rate of all occurrences of specific behaviors. In April 2011, we captured the juvenile and placed a satellite transmitter to track its movements after it fledged the nest. Soon after, the parents abandoned the fledgling, and we "adopted" the juvenile, feeding it for 28 days. We found a distinct progression in the young bird's behaviors, changing from spending most of its time in the nest sleeping, resting and eating to standing, exercising its wings, jumping, and then branching to nearby trees. After fledgling and during the "adoption" period, the juvenile spent most of its time on the ground or on low branches no higher than

3 meters. During the final post-adoption period, we tracked the bird at distances that ranged from 100-2000 meters from the nest. We conclude with the most up-to-date information on the nest, parents and juvenile, as well as a summary of conservation needs for the critically endangered Harpy Eagle in Belize.

**T15.7 Garcia-Perez, Belen,** (University of Saskatchewan, Saskatoon, Canada); Hobson, Keith A. (Environment Canada, Saskatoon, SK, Canada)

#### DIFFERENTIAL PATTERNS OF DECLINE IN BARN SWALLOW (*HIRUNDO RUSTICA*) BREEDING IN NORTH AMERICA: POTENTIAL EFFECTS OF STRESSORS ON BREEDING AND WINTERING GROUNDS

Breeding populations of Barn Swallow (*Hirundo rustica*) have declined during the last two decades in Canada and northern United States but are stable or increasing in southern United States; however, causes of this pattern are unknown. We tested whether factors on breeding or wintering grounds could have differentially affected population trends of Barn Swallows in North America. We established patterns of migratory connectivity among ten northern and three southern breeding populations using stable isotope ( $\delta^2\text{H}$ ,  $\delta^{15}\text{N}$ ,  $\delta^{13}\text{C}$ ) measurements of feathers and isoscapes derived for South America. We also examined corticosterone (CORT) levels in feathers from three increasing and four decreasing populations. Long-term reproductive success data was compared against weather variables in Manitoba and Washington State where populations are decreasing. We found wintering areas of southern stable populations different from northern decreasing populations. However, we established patterns of migratory connectivity weakly relate to breeding latitude and found no difference in CORT levels in feathers grown across the wintering grounds (mean  $\pm$  SD, northern populations =  $4.68 \pm 1.37$  pgmm<sup>-1</sup>, southern populations =  $4.51 \pm 0.96$  pgmm<sup>-1</sup>). At northern breeding grounds, a negative correlation was found between duration of cold ( $\leq 11^\circ\text{C}$ ) temperature episodes and reproductive success. Together, our evidence suggests that while the use of different wintering grounds may be a factor, conditions on the breeding grounds associated with the frequency of adverse weather events is a more likely cause of differential population trajectories seen for Barn Swallows in North America.

**S2.7 Gardali, Thomas,** (PRBO Conservation Science, Petaluma, United States); Seavy, Nathaniel; Humple, Diana (PRBO Conservation Science, Petaluma, CA, United States); Cormier, Renee (PRBO Conservation Science, Petaluma, United States)

#### MIGRATORY CONNECTIONS OF THE GOLDEN-CROWNED SPARROW AND SWAINSON'S THRUSH: GEOGRAPHY AND STRENGTH

We used light-level geolocators to describe the migratory geography of two passerines tagged at the Palomarin Field Station in coastal California. Golden-crowned Sparrows (*Zonotrichia atricapilla*) winter at Palomarin and were tracked north to their breeding grounds while Swainson's Thrushes (*Catharus ustulatus*) breed at Palomarin and were tracked south to their wintering grounds. We tagged 33 Golden-crowned Sparrows in the winter of 2009-10; eleven were recaptured in the subsequent winter but only four retained their tags. We tagged 35 Swainson's Thrushes in the summer of 2010 and recaptured eleven the following summer, all with tags. We used Bayesian state-space models to estimate the most likely breeding and wintering locations. Golden-crowned Sparrows migrated along the coast and bred on the coast of the Gulf of Alaska;

locations spanned approximately 1200 kilometers, and none of the individuals bred in the same location. Preliminary analyses suggest that Swainson's Thrushes migrated along the coast and then moved inland to avoid the desert and followed the Sierra Madre Occidental Mountains until settling in western Mexico, but shading complicated the analysis. We evaluated tag effects for Golden-crowned Sparrows by comparing weight at initial capture with subsequent capture before migration and found no significant difference between tagged and control birds; we also compared return rates and weights between tagged and control birds and found no differences. We recommend that researchers evaluate the potential for tag effects and additional means or materials be developed to attached the tags. Additionally, we propose that there is a need to develop quantitative measures of migratory connectivity.

**W7.4 Gardiner, Rachel,** (SFU, Sacramento, United States); Lank, David (Simon Fraser University, Burnaby, BC, Canada)

#### DIFFERENCES IN MORPHOLOGY INFLUENCE THE STOPOVER ECOLOGY OF TWO CALIDRID SANDPIPERS ON SOUTHWARD MIGRATION

Migratory birds adjust their refueling rates at stopover sites based on habitat characteristics and physiological state. Sandpipers travelling through the Strait of Georgia often use the same stopover sites on southward migration. However, within a site, species appear to take advantage of different habitats. We investigated differences in foraging habitat, diet, and fattening rate between Least (*Calidris minutilla*) and Western (*C. mauri*) sandpipers. Least sandpipers are smaller than Western sandpipers, are believed to make shorter hops on migration, and previous work has shown that they have faster escape performance. Least sandpipers disproportionately used vegetated habitat relative to availability, and  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values indicate that Least sandpipers feed more terrestrially and/or forage at a lower trophic level than Western sandpipers. Female Least sandpipers had the most terrestrial diet, and have a faster escape speed than males which may allow them to forage primarily in the marsh environment. The disproportionately long culmen of female Western sandpipers allows them to access larger prey items in the substrate, which may favour their acquisition of marine invertebrates. Detailed endpoint analysis is necessary in order to determine if the lower isotope values measured in Least sandpipers stem from marsh, inland, or biofilm sources, although they are likely a combination of the three. Fattening rate was significantly higher in Least than Western sandpipers, but did not differ with respect to covariates in either species. We interpret patterns of variation in stopover ecology as species-specific prioritization of danger management, feeding conditions, and migratory route.

**S11.4 Garvin, Mary,** (Oberlin College, Oberlin, OH, United States); Whelan, Rebecca (Oberlin College, Oberlin, OH, United States); Schoech, Stephan (University of Memphis, Memphis, Tennessee, United States)

#### VOLATILE COMPONENTS OF UROPYGIAL GLAND SECRETIONS AND COMMUNITY LEVEL INTERACTIONS IN DISEASE TRANSMISSION.

Chemical cues are an often overlooked aspect of the landscape and community ecology of disease transmission. Avian chemical cues are poorly understood, yet may be an important influence on the interactions of birds with arthropod vectors of disease. If such cues protect birds from environmental factors that can decrease fitness, then they are traits on which natural selection may act. Like-wise, natural selection may also act on the sensory mechanisms of the arthropods that receive the signal

and the resultant behavioral or physiological responses. We are exploring this relatively new area of avian biology with two projects that aim to determine if the volatile components of avian uropygial gland secretions influence interactions between birds and the blood-feeding arthropods that act as vectors of infectious agents. We have identified key differences in the volatile components of uropygial gland secretions among passerine species that may explain their relative involvement in two infectious disease cycles. In northern Ohio, we are comparing the secretions of American robins, house sparrows, and European starlings which serve as reservoir hosts for West Nile virus. In south-central Florida, we are comparing the secretions of Blue Jays with those of Florida scrub-jays two species that appear to vary in prevalence of both arthropod-borne viral infections and blood parasites. If the identified volatile compounds influence the species of bird on which arthropod vectors feed, then these compounds are important mechanisms that likely play a key role in the co-evolutionary arms race between birds and arthropod vectors of disease.

**PS2.53 Gates, River,** (U.S. Fish and Wildlife Service, Anchorage, United States); Brown, Stephen (Manomet Center for Conservation Sciences, Manomet, United States); Lanctot, Richard (U.S. Fisheries and Wildlife Service, Anchorage, AK, United States); Sandercock, Brett (Kansas State University, Manhattan, KS, United States)

#### THE ARCTIC SHOREBIRD DEMOGRAPHICS NETWORK: UNDERSTANDING CAUSES OF SHOREBIRD DECLINES

Factors limiting populations of Arctic nesting shorebird populations are poorly understood amid population declines in North America. In 2010, we formed the Arctic Shorebird Demographics Network (ASDN, Network), an international collaborative effort by governmental wildlife agencies, non-profit conservation organizations, and academic institution aimed at gathering critical demographic information on a suite of focal species to identify mechanisms behind shorebird declines on the breeding grounds. Our study sites include ten sites across the North American Arctic including Nome, Barrow, Cape Krusenstern, Ikpikpuk, Canning and Colville Rivers in Alaska and Mackenzie Delta, Churchill, Bylot Island and East Bay in Canada. We will present results from the first two years of this five year project (2010 – 2011) and make focal species comparisons across sites for Semipalmated and Western Sandpipers, Dunlin and Red-neck and Red Phalaropes. In 2010 and 2011, we located over 1,000 nests/year of 20 shorebird species, and banded over 1,200 adult shorebirds/year of 16 species. To better understand the influence of ecological factors on demographic patterns, we examined environmental variables including alternative prey availability, predator counts, invertebrate abundance and biomass, snowmelt phenology, and daily weather conditions.

**T14.11 Gaudet, Carolyn,** (University of Regina, Regina, Canada); Brigham, R. Mark (University of Regina, Regina, SK, Canada); Davis, Stephen K. (Environment Canada, Regina, SK, Canada)

#### GRASSLAND SONGBIRDS ARE INFLUENCED BY NATURAL GAS DEVELOPMENT IN SOUTH-WESTERN SASKATCHEWAN

Natural gas development is currently expanding in south-western Saskatchewan meaning the quality and quantity of the remaining suitable grassland habitat may be threatened. Several prairie species, many of which are avian species of conservation concern, depend on native prairie for their habitat. Currently, the effects of natural gas development on grassland birds are poorly

understood. Recent research in Saskatchewan and Alberta suggests that abundance of certain grassland bird species increases with distance from natural gas development but results are often species specific and vary across the species' range. The objective is to determine the degree to which natural gas development influences density and reproductive success of grassland songbirds in Saskatchewan.

We found and monitored 392 nests of 7 species of grassland songbirds. I examined the effect of distance to natural gas disturbance (well, compressor station and linear disturbances) for all 7 species. Nest survival of many species increased near compressor stations whereas the effect of distance to gas well on nest survival varied according to species. The degree to which linear disturbances influence nest survival also varied by species. Plot disturbance (% of plot area disturbed) had a significant effect on density on 4 of the 7 grassland bird species.

**PS1.177 Gautreaux, Jill,** (University of Southern Mississippi, Hattiesburg, United States); Moore, Frank (University of Southern Mississippi, Hattiesburg, United States); Buler, Jeffrey (University of Delaware, Newark, DE, United States)

#### EXAMINATION OF SPRING STOPOVER OF MIGRATORY LANDBIRDS IN AN URBAN COASTAL LANDSCAPE: A MULTI-SCALED APPROACH.

Urbanization negatively impacts ecological communities and may have serious consequences for migratory birds near geographic barriers and associated coastal landscapes. Anthropogenic pressures coupled with natural disturbances result in rapid loss and fragmentation of sensitive coastal ecosystems, creating tension between importance of coastal landscapes for economic development and their value for migrants. Evidence suggests that availability of high quality stopover habitat may limit bird populations and that migrant-habitat relations are dependent upon a complex interplay of intrinsic (e.g., energetic condition) and extrinsic (e.g., weather) factors, yet response of birds to stopover habitat alteration is poorly understood. A multi-scale investigation of migrant response to human-induced coastal change is essential. We measured behavioral and physiological responses of landbirds stopping over in urban landscapes along the Mississippi coast presumably after crossing the Gulf of Mexico during spring migration. Fuel stores of migrant are dramatically depleted following trans-Gulf flight, and replenishing depleted fuel stores is critical for continued migration. We quantified migrant fuel deposition rates (FDR) based on circulating triglyceride and  $\beta$ -hydroxy-butyrate levels from bird blood samples and the densities of birds and arthropods based on daily bird transect surveys and weekly arthropod surveys within four forest patches (two  $\leq 1$  ha; two  $\geq 160$  ha) during two spring migration seasons. We compared multiple factors affecting site differences in FDR and resource competition (measured as migrant to arthropod ratio). Results suggest differences in both migrant and arthropod densities across forest patches indicating varying microhabitat conditions at stopover sites embedded within urban matrix. We also analyzed weather surveillance radar data to determine bird distribution and abundance across the study area for a landscape-scale spatiotemporal view of migration. Radar data reveal high densities of spring migrants in close proximity to the coastline irrespective of habitat quality.

**SAT17.1 Gawlik, Dale E.,** (Florida Atlantic University, Boca Raton, United States); Kingsford, Richard T. (University of New South Wales, Sydney, N, Australia)

#### HYDROLOGIC VARIABILITY AS A GLOBAL DRIVER OF COLONIAL WATERBIRD NESTING

One of society's most pressing issues is to meet the growing demand for freshwater without causing irreversible degradation to wetland ecosystems. Two serious impacts to wetlands stem from reduced water flows and shifts in the timing and magnitude of flood pulses. Waterbirds have emerged as a group of indicator species that respond strongly to hydrologic manipulations. The ubiquitous nature of waterbirds and their biological similarities as a group led us to investigate the patterns of bird responses to hydrologic variability. We compared waterbird responses to water level fluctuations with a meta-analysis and two case studies; one in the Everglades in North America and the other in desert rivers in the Murray-Darling Basin in Australia. For storks, variability in nest numbers tended to be higher for wetland obligates than for species that commonly forage in uplands. When hydrologic conditions were good, nest numbers (all species pooled) were higher in the Murray-Darling than in the Everglades. Birds in the Murray-Darling had a longer interval between years with good nesting, and in both systems that interval increased after flood regimes were altered. Birds in both ecosystems exhibited differences in the timing of nest initiation, which likely corresponded to foraging preferences and food availability. One key difference was that in the Murray-Darling birds nested during rising and peak water levels. Desert rivers have long inter-flood intervals so the density of terrestrial prey can increase during dry periods and then become available to birds on the rising water edge. Thus, food availability is high with rising water and again when aquatic prey concentrate in drying pools. In the Everglades there is no pulse of availability with rising water and nesting is not initiated until water levels drop and aquatic prey are concentrated into pools. Although birds in different regions exhibited differences in the magnitude and timing of nesting, we hypothesize that these differences were a consistent response to food availability driven by hydrologic fluctuations.

**PS2.188 Geary, Brock**, (Texas State University, San Marcos, United States); Green, M. Clay (Texas State University - San Marcos, San Marcos, TX, United States); Ballard, Bart; Reed, Daniel (Cesar Kleberg Wildlife Research Institute, Texas A&M University - Kingsville, Kingsville, TX, United States); Howe, William (U.S. Fish & Wildlife Service, Region 2, Migratory Bird Office, Albuquerque, NM, United States)

**EFFECTS OF TROPICAL CYCLONES AND SEVERE WEATHER ON JUVENILE REDDISH EGRET DISPERSAL BEHAVIOR, 2010-2012**

Analyses of dispersal information gathered for a population or species can potentially provide insight into their response to severe weather events. Tropical depressions, tropical storms and hurricanes are not uncommon in the Gulf of Mexico, and four tropical systems passed over our study site during two years of observation of juvenile reddish egret (*Egretta rufescens*) movements. Twenty-five birds were captured and tagged with satellite transmitters in the summer of 2010, and several have continued to provide location data up to the present day. Hurricanes and other tropical systems have been shown to affect waterbird nesting and movement, as well as direct effects on breeding and foraging habitat. Here we present the effects of tropical cyclones and other severe weather events, such as prolonged periods of cold or lack of rain, on these egrets from summer 2010 to the present. The resilience of our study cohort to these four storms, some of which passed through the Gulf before our entire cohort was capable of flight, are of great conservation interest. Waterbirds are considered by some to be bioindicator species whose presence can be used to gauge ecosystem health. Significant negative effects on waterbirds due

to these storms or inclement weather periods could be indicative of sudden and severe habitat degradation. This would encourage greater emphasis on the protection of the Gulf coast ecosystem due to the frequency of these storms and expected increase in frequency and strength under many climate change scenarios.

**PS2.81 Geleynse, Daniel**, (Trent University, Ayr, Canada); Nol, Erica (Trent University, Peterborough, ON, Canada); Burke, Dawn (Ontario Ministry of Natural Resources, London, ON, Canada)

**BROWN CREEPER'S HABITAT SELECTIVITY BETWEEN LOGGED AND UNLOGGED HARDWOOD FORESTS OF ALGONQUIN PROVINCIAL PARK, ON**

The maintenance of functioning ecosystems and biodiversity occurs by conserving pristine habitats mostly confined to protected spaces. Some parks also allow multiple uses, including logging. Algonquin Provincial Park is a 7653 square kilometer park in central Ontario that allows logging through 78% of its forested lands. As an indicator of old-growth forest condition, the Brown Creeper has not previously been studied in Ontario. We examined the effect of singletree selection and group-selection logging on Brown Creeper density, nest success, and foraging trees. As Brown Creepers nest in the bark of large, decaying trees, we hypothesized that Brown Creeper density, timing of nesting, and nest survival would be affected negatively by both forms of silviculture, because of the standard practice of removing large, decaying trees as part of providing safe conditions for loggers. We also predicted that creepers in logged stands would have both different nesting and foraging characteristics than in uncut forests. We found no significant differences in any demographic characteristics among treatments. We also found no significant differences in the bark cover or size of trees that were used by creepers among treatments. However, stands with either form of logging contained significantly lower densities of brown creepers than unlogged stands. This is likely due to the limited number of preferred nesting and foraging Balsam Fir trees in the logged stands. Further research is needed to determine the association between Balsam Fir and the Brown Creeper.

**F16.10 Germain, Ryan**, (University of British Columbia, Vancouver, Canada); Crombie, Merle; Arcese, Peter (University of British Columbia, Vancouver, Canada)

**HABITAT PREFERENCE AND NESTING SUCCESS UNDER EXOTIC PLANT INVASION IN ISLAND SONG SPARROWS**

The conversion of native plant communities by exotic, invasive species is recognized as a major threat to conservation. While exotic plant invasions can disrupt community structure, eroding native biodiversity and reducing habitat quality for birds, our understanding of how birds may use exotic plants as a replacement for native species is unclear. We investigated the breeding habitat preference of song sparrows (*Melospiza melodia*) over 18 years of monitoring in a small island population where the plant community has undergone substantial invasion by exotic shrubs. We asked how female preference for nesting sites varied over the study period, and how nesting in exotic vs. native shrubs may influence nesting success. We found that declines in the island-wide cover of native shrubs historically preferred by song sparrows as nesting substrate co-occurred with an increase in the cover of *Rubus armeniacus*, an exotic invasive shrub. Habitats where the cover of *R. armeniacus* increased were associated with an increase in the density of song sparrow nests, and the adoption of *R. armeniacus* as a commonly used nest substrate. Both *R.*



armeniacus and its less-abundant native congener, *R. ursinus*, were the most preferred nesting substrates per total area of cover, and returned the highest proportional nesting success (fledging at least one offspring) of all shrubs on the island. Although the removal of exotic invasives is often essential to restore native plant and animal communities, our results indicate that some exotics provide novel feeding and nesting opportunities, and may act as reliable substitutes for the native shrubs they replace.

**F15.9 Ghalambor, Cameron.** (Colorado State University, Fort Collins, United States); Sofaer, Helen; Yoon, Jongmin (Colorado State University, Fort Collins, CO, United States); Morrison, Scott (The Nature Conservancy, San Francisco, CA, United States); Sillett, T Scott (Smithsonian Conservation Biology Institute, Washington DC, DC, United States)

#### RESOLVING THE CONTRASTING INFLUENCES OF LIFE HISTORIES AND BREEDING DENSITY ON AVIAN REPRODUCTIVE STRATEGIES

Variation along the slow-fast life history continuum is predicted to shape parental investment strategies through differential changes in the costs and benefits of investing in offspring versus self-maintenance. Alternatively, parents should also alter patterns of parental investment in response to breeding density and other aspects of the social environment. Partitioning variation due to these alternative perspectives requires comparative studies of populations that differ in their life histories and breeding environment. Here we compare populations of the orange-crowned warbler (*Oreothlypis celata*) that differ with respect to their life histories and breeding density. We find that differences between populations in nestling growth rate and brooding attentiveness are consistent with predictions from life histories, but local breeding density better predicts variation in testosterone levels, territorial aggression, and per nestling feeding rates. These results suggest that despite the expectation that physiological, behavioral, and other life history traits should predictably covary along a dominant axis of variation, there is the potential for these traits to be decoupled depending on the local environment. We argue that more population comparative studies are needed across diverse environments to better understand the combinations of traits that are compatible and potentially locally adapted

**PS1.77 Gill, Chris.** (Coastal Conservation, Tappen, Canada); Bergman, Carita (Gwaii Haanas National Park Reserve and Haida Heritage Site, Queen Charlotte City, BC, Canada); Boyce, Jennifer (NOAA Restoration Center, Long Beach, CA, United States); Gruman, Christine; Halpin, Luke (School of Resource & Environmental Management, Simon Fraser University, Burnaby, BC, Canada); Howald, Gregg (Island Conservation, Kelowna, BC, Canada); Wein, Laurie (Gwaii Haanas National Park Reserve and Haida Heritage Site, Queen Charlotte City, BC, Canada)

#### NIGHT BIRDS RETURNING: A COLLABORATIVE EFFORT TO RESTORE SEABIRD NESTING HABITAT IN GWAII HAANAS NATIONAL PARK RESERVE AND HAIDA HERITAGE SITE

Gwaii Haanas National Park Reserve and Haida Heritage Site, cooperatively managed by the Haida Nation and the Government of Canada (Parks Canada), has identified introduced species as the primary threat to the ecological integrity of the park reserve. Management of invasive species, including invasive rats, is an agency priority. In 2009, in an effort to restore 10 seabird nesting islands (~800 ha), a 5-year,

2-phase project to eradicate two species of rats was initiated. Islands were selected based on their historic seabird nesting values, with an objective to restore nesting habitat for Ancient Murrelets (translated as “night birds” from the Haida language, *Synthliboramphus antiquus*, a COSEWIC listed species) and two species of storm-petrels (*Oceanodroma furcata* and *O. Leucorhoa*). This project is comprised of three components: pre- and post- eradication monitoring (of both key ecosystem indicators and impacts to nontarget species), Phase 1 eradication (~100 ha using bait stations), and Phase 2 eradication (750 ha using bait broadcast techniques). The project is a collaborative effort among Gwaii Haanas, Coastal Conservation, Island Conservation, Simon Fraser University, and the Luckenbach Trustee Council. We present here a summary of pre-eradication monitoring, and the Phase 1 eradication that were completed in 2011. Modified eradication techniques and mitigative measures reduced non-target species risk while still achieving the desired result. Invasive species eradication is a powerful conservation tool that can be used to restore island ecosystems both across lands managed Parks Canada Agency, and in other high value conservation areas in Canada.

**T10.2 Gill, Sharon.** (Western Michigan University, Kalamazoo, United States); Schewe, Katherine; Uppliger, Katherine (Western Michigan University, Kalamazoo, MI, United States)

#### EVOLUTION AND LIFE-HISTORY CORRELATES OF LONG-TERM MONOGAMY IN NORTH AMERICAN PASSERINES

The predominant mating system among birds is social monogamy. The expression of this mating system is highly variable, however, ranging from species in which social monogamy occurs with high levels of extra-pair paternity to those in which partners remain together for multiple breeding seasons, sometimes for life. Long-term monogamy (LTM), defined as socially monogamous partnerships that persist for multiple breeding seasons, has been estimated to occur in more than 20% of bird families. Its expression in some families is well known, such as the long-lived albatrosses, but perhaps both unexpected and unappreciated, LTM has also been recorded in the generally shorter-lived passerines. Very little is known about LTM in passerines, but one hypothesis poses that a combination of resource monopolization by both sexes, low resource availability and fitness benefits may favor the evolution of LTM in passerine birds. To test this hypothesis, we examined the relationship between LTM in passerines and other aspects of their life history, compiling data from the Birds of North America (BNA) series and through additional literature searches. Because data from long-term studies of banded pairs are scanty, we operationally defined LTM as occurring when pairs were observed together for more than one breeding season, and recorded whether partnerships were continuous throughout the year or seasonal during breeding only. For each species, we scored additional life-history characteristics: migration (migratory or sedentary), territoriality (year-round, seasonal, or non-territorial), song (male-only or both sexes), and plumage (dimorphic or monomorphic). LTM was detected in more than 20 passerine families and in species exhibiting both continuous and seasonal partnerships. The most important correlate of LTM appears to be migratory behavior, with LTM found primarily among resident species and only rarely among migratory birds. We will perform a comparative analysis of these data and discuss whether life-history characteristics, particularly those associated with resource defense, are associated with the evolution of long-term monogamy in passerines.

**PS1.186 Girault, Cécile.** (Groupe de recherche en écologie comportementale et animale, Université du Québec à Montréal, MONTREAL, Canada); Giroux, Jean-François (Groupe de recherche en écologie comportementale et animale, Université du Québec à Montréal, MONTREAL, PQ, Canada); Gauthier, Gilles (Centre d'études nordiques et département de biologie, Université Laval, Québec, PQ, Canada)

#### POST-BREEDING MOVEMENTS AND HABITAT USE BY RING-BILLED GULLS: A DIVERSITY OF STRATEGIES

Although it is recognized that many larid species can undertake post-breeding dispersion, little is known about the importance of this behavior and the characteristics of these movements. More than 70,000 pairs of Ring-billed gulls (*Larus delawarensis*) nest on islands in the St-Lawrence River near Montreal, Quebec. As part of a larger study on the ecology and management of this species, we wanted to determine whether the birds breeding in the area remained nearby in late summer and fall. More specifically, our objectives were to estimate the proportion of birds that dispersed, to locate the post-breeding sites, and to characterize the habitat used by gulls for feeding during the day and for roosting at night. We fitted 22 breeding adults with solar-powered Argos-GPS PTT (25 g) that recorded 2 locations ( $\pm 5$  m) per day (noon and midnight). Data were transmitted by satellites once a week. Each location was assigned a habitat type based on Google Earth maps and we used multivariate approach to define preferential habitat use. We characterized three different strategies of post-breeding dispersal once the juveniles had achieved independence. Some birds remained in the Montreal region until they undertook a rapid migration to their wintering grounds. Others dispersed shortly after breeding to stop-over sites located along the route to their wintering area. Finally, a third group dispersed to areas that represented a detour where they stayed for several weeks before reaching their wintering site. The gulls utilized agricultural lands, intertidal shores, landfills and shipment centers during the day and roosted on lakes and buildings' flat roofs. Some birds tracked for more than one season showed high repeatability in both the routes used and the stop-over sites, whereas others showed great flexibility using different sites and habitats in successive years. Ring-billed gulls are very opportunistic in their feeding behavior and appear to be also opportunistic in their strategy during the post-breeding period.

**F2.4 Giroux, Jean-François.** (Université du Québec à Montréal, Montréal, Canada); Pannetier Lebeuf, Anik; Pilotte, Catherine; Beaumont, Matthieu; Doiron, Madeleine (Université du Québec à Montréal, Montréal, PQ, Canada); Reed, Eric T. (Canadian Wildlife Service, Gatineau, PQ, Canada); Rodrigue, Jean (Canadian Wildlife Service, Québec, PQ, Canada)

#### WHAT IS LIMITING TEMPERATE BREEDING CANADA GEESE?

We are following the establishment of a breeding population of Canada geese (*Branta canadensis maxima*) in southern Quebec since 1992. The number of pairs nesting on the Varennes islands located in the St-Lawrence River near Montreal increased from 3 to 243 in 20 years. The annual growth rate peaked in 2001-2002 with a lambda of 1.43 and declined thereafter to reach 1.28 in 2011. Concomitantly, nearby islands are starting to be used by geese for nesting. Neither clutch size ( $5.4 \pm 0.4$ ) nor nesting success ( $80 \pm 14\%$ ) changed over the years although nest inundation may be important in years with high water levels. As expected, natal philopatry was higher for females than males and the median distance between the natal and the first nests was shorter for females (395 m) than for males (1047 m). Globally, the distance between successive nests for individual pairs was

very short (median=41 m). Using mixed live recapture and dead recovery capture-mark-recapture analyses, we found that females had a slightly lower survival rate than males. Juvenile survival varied among years between 0.73 (95 % CI 0.43-0.90) and 0.90 (0.74-0.96) and was higher than for adults (0.56 [0.44-0.67] to 0.76 [0.68-0.82] and yearlings (0.54 [0.45-0.63] to 0.73 [0.64-0.81]). A negative relationship between hatch date and juvenile survival was observed but there was no significant effect of body condition and gosling age at banding. In addition to a short migration, the predominant use of areas that are not open to hunting by family groups in fall could explain the high survival of juveniles. The use of rural habitats where susceptibility to hunting is higher, combined with the behaviour of moult migration could explain the lower survival rates of adults not accompanied by young and yearlings. Although, space may become limited on the Varennes islands, the abundance of other nesting islands in the St-Lawrence River coupled with high reproductive output and high survival rates should maintain the population growth of Canada geese in southern Quebec.

**W14.11 Goldberg, Joshua.** (University of Montana, Missoula, United States); Martin, Thomas (Montana Cooperative Wildlife Research Unit, Missoula, MT, United States)

#### SPATIAL PATTERNS DURING THE FLEDGLING PERIOD: PARENTAL FORAGING AND PROVISIONING STRATEGIES RELATIVE TO FLEDGLING DISPERSION

During the fledgling life-stage, young birds have left the nest but remain dependent on parents for food. The need to provision dispersed offspring presents a unique challenge to parents and may influence foraging strategies. Fledgling provisioning and parent foraging strategies may have important consequences for breeding bird ecology, life-history evolution and population demography, but remain poorly understood. I examined the parental foraging strategies and care behaviors of red-faced warblers (*Cardelina rubrifrons*) and dark-eyed juncos (*Junco hyemalis*) in northern Arizona with respect to resource depletion in patches, as fledglings aged and used increasing mobility to change dispersion. I used radio telemetry to locate parents and recorded behavior and location information approximately every 2 minutes during the morning in the summers of 2010-2011. I used parental behavior to find offspring and noted the timing and location of offspring provisioning. I used these locations to quantify fledgling mobility and dispersion, parent home range size, separation between parents, parent foraging travel distances, and provisioning rates. Red-faced warblers and gray-headed juncos displayed different parental care behaviors during the fledgling period. Red-faced warblers divided the brood among parents, whereas dark-eyed junco parents cared for all offspring within the brood. Changes in fledgling mobility varied between the species, such that dark-eyed junco fledglings, but not red-faced warbler fledglings, increased the distance moved between observation periods as they grew older. Fledgling dispersion peaked at intermediate ages of the fledgling period in both species. Parent foraging distance depended upon whether parents fed the same fledgling consecutively or switched between fledglings. As fledglings increased dispersion, the distance traveled when switching between fledglings increased, while the distance traveled when feeding the same fledglings did not change. Contrary to predictions associated with resource depletion, travel distance did not increase when fledglings were aggregated versus dispersed, and travel distance did not decrease with larger fledgling movements. Other factors, such as differences in nestling energy demand, parental investment or predation risk, may explain differences in parent foraging strategies.

**W11.12 Goldstein, Gerald**, (Ohio Wesleyan University, Delaware, United States); Sroka, Jenna; Coss, B. V.; Schroeder, Morgan; Schroeder, Max; Sisson, Rebecca; Burt, Edward (Ohio Wesleyan University, Delaware, OH, United States)

POSSIBLE EFFECT OF THE SPECIES OF BIRD, ITS BEHAVIORAL ECOLOGY, AND THE SAMPLING SITE ON DIFFERENCES IN THE FEATHER DEGRADING GENE OF PLUMAGE BACTERIA FROM DIFFERENT SPECIES OF SONGBIRDS.

$\beta$ -keratin, the structural protein of feathers, is unusually resistant to microbial degradation, yet seven microbial species exhibit feather-degrading activity and four additional species have the keratinase gene. We cultured Gram-positive feather-degrading bacilli from avian plumage and identified bacilli by PCR amplification of fragments of the keratinase gene. Of 144 isolates of Gram-positive, feather-degraders, 105 (0.729) were identified as *Bacillus subtilis*, 40 (0.278) as *B. licheniformis*, and 1 (0.007) as *B. pumilus*. These were collected at sites in Arizona, Louisiana, Ohio and Washington and from 13 families of songbirds (Passeriformes) and hummingbirds (Apodiformes). Absorbance at 230 nm by oligopeptides released into the medium by degrading feathers was converted to protein concentration ( $\mu\text{g}$  protein/ml) with respect to a BSA standard curve. The final concentrations of degraded feather protein suggest a discontinuous distribution of fast, moderate, and slow feather-degrading bacilli. All three categories were found in most families, but families and species that tended to be ground-foraging were more likely to have feather-degrading bacilli and to have fast isolates than species and families that foraged in foliage or the air. Seven species harbored multiple strains of feather-degrading bacilli that had different degradation rates. These results suggest that feather-degrading bacilli are readily acquired by birds, probably from the soil, and that the degradation rate is not specialized for particular species of birds. We found no association between particular gene sequences and particular avian species or families.

**W3.1 Gomez, Juan Pablo**, (University of Florida, Gainesville, United States); Bravo, Gustavo (Louisiana State University, Baton Rouge, LA, United States); Brumfield, Robb (Louisiana State University, Baton Rouge, LA, United States); Tello, Jose (Long Island University, Brooklyn, NY, United States); Cadena, Daniel (Universidad de los Andes, Bogota, Columbia)

A PHYLOGENETIC APPROACH TO DISENTANGLING THE ROLE OF COMPETITION AND HABITAT FILTERING IN COMMUNITY ASSEMBLY OF NEOTROPICAL FOREST BIRDS

Methods that assess patterns of phylogenetic relatedness, as well as character distribution and evolution, allow one to infer the ecological processes involved in community assembly. Assuming niche conservatism, assemblages should shift from phylogenetic clustering to evenness with decreasing geographic scale because of the scale dependency of the mechanisms that shape assemblages. Whereas habitat filtering is more likely to act at regional scales, competition is more likely to act at local scales. We used species lists to assess assemblage composition, data on ecologically-relevant traits, and a molecular phylogeny, to examine the phylogenetic structure of antbird assemblages at three different geographical scales: regional, intermediate and local. Further, we used patterns of phylogenetic beta diversity and beta diversity to separate factors that structure assemblages at regional scales. Contrary to previous findings, we found a shift from phylogenetic evenness to clustering with decreasing geographical scale. This does not reject the hypothesis that

habitat filtering is the predominant force in regional community assembly, because analyses of trait evolution and structure indicated a lack of niche conservatism. In some cases, phylogenetic evenness at regional scales can be an effect of historical biogeographic processes instead of niche-based processes. However, regional patterns of beta diversity and phylogenetic beta diversity suggested that phylogenetic structure in our study could not be explained by the history of speciation and dispersal, further supporting the habitat-filtering hypothesis. Finally, our analyses suggested that competition might not be important locally, which would provide a plausible explanation for the high alpha diversity of antbirds in Amazonia.

**PS2.118 Gómez, Leticia**, (Universidad Autónoma de Hidalgo, Pachuca, Mexico); Ortiz-Pulido, Raúl (Universidad Autónoma de Hidalgo, Pachuca, Mexico); Lara, Carlos (Centro Tlaxcala de Biología de la Conducta. Universidad Autónoma de Tlaxcala, Tlaxcala, Mexico)

RISK SENSITIVITY DURING THE HUMMINGBIRD FORAGING: EFFECTS OF ENERGY BUDGET, PREVIOUS EXPERIENCE AND NECTAR TEMPERATURE

RISK SENSITIVITY DURING THE HUMMINGBIRD FORAGING: EFFECTS OF ENERGY BUDGET, PREVIOUS EXPERIENCE AND NECTAR TEMPERATURE M. in C. Leticia Gomez Rosas<sup>1,3</sup>; Dr. Raúl Ortiz Pulido<sup>1</sup>. Dr. Carlos Lara Rodríguez<sup>2</sup>. <sup>1</sup>Centro de Investigaciones Biológicas. UAEH. Tlaxcala <sup>2</sup>Centro Tlaxcala de Biología de la Conducta. UAT-UNAM. <sup>3</sup> Author E-mail: laetiziag@gmail.com The animals have been shown to respond behaviorally to the variability of food resources in the environment, a phenomenon known as risk sensitivity. This phenomenon suggests that the behavior of animals depends on their energy state, i.e. with positive energy budget are aversive and negative energy budget are prone to the risk. However, other factors such as previous experience and the food temperature can influence such behavior. Typically, the research focused on the topic, where rewards are used varies quantity, quality and time in which they are obtained. However, these studies usually make no reference to other aspects influencing the behavioral response of foragers. In this project My aim is to assess the sensitivity to risk during foraging of two species of hummingbirds, *Hylocharis leucotis*, (resident) and *Selasphorus platycercus* (migratory) in natural conditions, manipulating their energy budget (by modifying the % nitrogen in the diet from 0 to 4%), previous experience of the hummingbirds and the food (nectar) temperature (4 to 39 °C) have an really effect on sensitivity risk among hummingbird species *H. leucotis* and *S. Platycercus* in the Parque Nacional La Malinche, Tlaxcala, México. Preliminary results show in that the species *S. Platycercus* aversive to risk, preferring constant rewards.

**W7.5 Gómez, Valentina**, (SELVA: Research for Conservation in the Neotropics, Bogota, Columbia); Bayly, Nicholas; Gómez, Camila; Botero-Delgado, Esteban; Cardenas, Laura (SELVA: Research for Conservation in the Neotropics, Bogota, Columbia) DIVERSITY AND ABUNDANCE OF NEOTROPICAL MIGRATORY LANDBIRDS ACROSS AN ALTITUDINAL GRADIENT IN NORTHERN COLOMBIA DURING SPRING MIGRATION

Understanding the distribution of Neotropical migratory landbirds across geographical and altitudinal ranges during the non-breeding period is essential in order to effectively deploy conservation measures. We studied migrant species richness and relative abundance across an altitudinal gradient at stopover sites in the Sierra Nevada de Santa Marta, northern Colombia, during

two consecutive spring migrations (2010 – 2011). Variable-distance transects covering an altitudinal gradient from 175 to 2200 m and constant effort mist-netting at three sites in the same altitudinal range, were carried out between March and May. Using the program DISTANCE we analyzed transect data to estimate densities across the altitudinal gradient, firstly pooling all migrant species, and secondly for individual species with more than 60 observations. Constant effort capture data served as a complement to determining species richness and relative abundance by altitude and habitat type. 50 species of migrant landbirds were recorded during spring migration and species richness peaked between 500 m and 1400 m. Migrant density also peaked at mid-altitudes (600 and 1500 m), however, the relative abundance of individual species across the altitudinal gradient varied widely e.g. Blackburnian Warblers *Dendroica fusca* were most abundant between 1500 m and 2100 m. The distribution of species and individuals across the altitudinal gradient, as well as the occurrence of priority species, imply that conservation measures would be most effective at mid-altitudes, however, the needs of individual species should be considered.

**SAT16.3 Goodrich, Laurie,** (Hawk Mountain Sanctuary Association, Orwigsburg, United States); **brittingham, margaret** (Penn State University, University Park, PA, United States)  
ENERGY-MINIMIZATION FLIGHT STRATEGY REVEALED FOR AUTUMN-MIGRATING ACCIPITERS IN THE CENTRAL APPALACHIANS, PENNSYLVANIA.

Understanding migration patterns and the influence of landscape and weather on the choices migrants make can be helpful to conservation efforts for migratory birds. The Kittatinny Ridge of the Central Appalachians is one of the most important corridors for autumn-migrating raptors in the eastern United States. We radio-tracked Sharp-shinned and Cooper's hawks (*Accipiter striatus*, *A. cooperii*) on the Kittatinny Ridge during the autumn and measured their daily migration attributes in autumn 2003 and 2004. We compared flight behavior by species, age, topographic region, and by weather. Data was collected for 89 days from 44 individuals, including 30 days from 12 Cooper's Hawks and 59 days from 32 Sharp-shinned Hawks. The two species followed different mean flight directions with Sharp-shinned Hawks migrating to the southwest (216°) and Cooper's Hawks migrating more southerly (190°). Direction did not vary by age or region. Cooper's Hawks spent more time per day migrating than Sharp-shinned Hawks, while adult Cooper's Hawks flew farther and faster on average than Sharp-shinned Hawks and hatch-year Cooper's Hawks. Wind direction and cold fronts did not have a strong influence on flight behavior, but lack of cloud cover was associated with greater migration activity. Both Cooper's and Sharp-shinned hawks appear to utilize an "energy-minimization" strategy of migration with short flights followed by daily hunting and movement occurring under a wide variety of conditions.

**S3.4 Gordon, Caleb,** (Normandeau Associates, Gainesville, United States);  
UTILITY OF HIGH RESOLUTION IMAGING SURVEYS FOR OFFSHORE WIND BIRD RISK/IMPACT STUDIES

Visual observer-based surveys have provided most baseline bird distributional information to date for offshore wind risk and impact studies, but the utility of these conventional methods is severely limited by bird disturbance/ attraction effects, observer effects, and the requirement to fly within the altitudes swept by wind turbine rotors. We conducted a two-year pilot study for the Bureau of Ocean Energy Management (BOEM, US Department of the Interior) intended to pave the way for conducting high altitude, high resolution digital marine wildlife

surveys in support of the US offshore wind industry, in hopes of achieving the improvements in scientific data quality that have already been realized through the application of this methodology to offshore wind ecological risk and impact studies in Europe. Through a series of high resolution imaging flight trials with both manned and unmanned aircraft, conducted alongside conventional aerial and boat-based surveys, we have evaluated the performance of high resolution imaging survey data for application to offshore wind wildlife risk/impact studies. Performance was evaluated both in relation to conventional, visual-based methods, and also across a variety of high resolution imaging experimental treatment factors, including camera type, image resolution, camera angle, and others. Results were evaluated with respect to both censusing (density estimation) and taxonomic identification criteria. Overall, high resolution imaging surveys represent a significant improvement over both boat-based and aircraft-based visual observer surveys with respect to both density counting and taxonomic identification. However, visual discrimination of certain sets of species with very similar dorsal appearance is a significant challenge, necessitating image resolutions below 2 cm in most cases, and requiring supplementation with boat-based surveys for the most difficult species sets.

**SAT13.1 Gough, Danielle,** (Trent University, Peterborough, Canada); **Nol, Erica** (Trent University, Peterborough, ON, Canada); **Mennill, Daniel** (University of Windsor, Windsor, ON, Canada)

EFFECTS OF CHRONIC NOISE ON THE SINGING BEHAVIOUR OF PACIFIC WRENS (TROGLODYTES PACIFICUS) IN THE PACIFIC NORTHWEST

In birds, anthropogenic sources of noise raise stress levels, mask predator arrivals, and constrain acoustic communication. For male songbirds, the main functions of song include territory defense and mate attraction. Poor signal transmission can result in males having to physically fight off neighbouring males and possible decreased breeding success. Studies have shown that birds can mitigate the effects of acoustic masking by increasing their signal amplitude or by singing with higher minimum frequencies. Pacific Wrens (*Troglodytes pacificus*) are old-growth specialists and are known for their complex songs and thus, we hypothesize that they will be able to compensate for the effects of chronic noise in their environments. Songs produced by Pacific Wrens (N=63) were recorded at different distances away from two sources of ambient noise (ocean and traffic) in Pacific Rim National Park Reserve, B.C. to assess long-term modifications to song due to chronic noise. We hypothesized that more complex songs would counter masking and be better transmitted in noisy habitats. Ocean noise was louder and affected song structure more than road noise. Songs produced by wrens near the ocean were longer (P = 0.063) and had greater syllable diversity (P = 0.052) than songs away from oceans, near or away from roads. Songs near the ocean and highway were significantly more variable than songs sung by Pacific Wrens in the quiet forest interior. Studies such as this one are important since the amount of environmental noise in a territory contributes to its quality and thus affects the behaviour of these males.

**F6.3 Gow, Elizabeth,** (University of Saskatchewan, Saskatoon, Canada); **Wiebe, Karen** (University of Saskatchewan, Saskatoon, SK, Canada)

TRADE-OFFS IN PARENTAL CARE DECISIONS OF MALE AND FEMALE NORTHERN FLICKERS DURING THE POST-FLEDGING PERIOD

Mortality of juvenile birds is often high during the first few weeks after leaving the nest but parental care may reduce the mortality risk to fledglings. However, different life histories or sex roles mean that both parents may not invest equally in offspring. Because there are few studies on parental care of males and females during the post-fledging period, we investigated the length of time that northern flicker (*Colaptes auratus*) parents fed fledglings. We monitored 25 flicker pairs at our study site at Riske Creek, B.C. Canada over a three year period, by radio-tracking parents for one hour sessions every other day until they left the study area or stopped feeding the fledglings. We specifically tested several factors that may influence the length of parental care. Although some females abandoned the brood early, the average length of care was not significantly different between the sexes or according to parental age. Similarity, brood condition, and male body condition did not affect the length of care, but females in higher condition, both males and females with higher provisioning rates during the nestling period, and parents with larger broods fed fledglings longer. Our results indicate that good parents during the nestling period are also good parents during the post-fledging period. Additionally, females and males may have different parental investment strategies, with females in poor condition more likely than males to reduce care in favour of self-maintenance and survival.

**PS1.191 Gow, Elizabeth**, (University of Saskatchewan, Saskatoon, Canada); Musgrove, Annessa (University of Saskatchewan, NA, Canada); Wiebe, Karen (University of Saskatchewan, Saskatoon, SK, Canada)

#### OFFSPRING DEMANDS AND BODY CONDITION INFLUENCE SEX-SPECIFIC PARENTAL PROVISIONING PATTERNS IN THE NORTHERN FLICKER (*COLAPTES AURATUS*)

Parents of altricial young alter provisioning effort based on offspring demand. However, life-history differences between the sexes can influence the willingness of each to invest in a brood. Previous studies on sex-specific provisioning roles in altricial species suggest that males are more fixed, while females are more flexible in their responses to brood demands. The Northern Flicker (*Colaptes auratus*) is unusual among altricial birds, as it has partly reversed sex roles with males investing more in parental care than females, no-extra-pair young, and facultative polyandry. We investigated sex-specific provisioning patterns to see what factors (brood size, nestling age, adult age, body condition and partner provisioning level) affected provisioning rates. Based on 232 filmed provisioning bouts at 80 nests, we found that males provisioned at a slightly higher rate than females. In addition, male provisioning rates were affected by nestling age, brood size, partner's feeding rate and male body condition. The same variables influenced female provisioning rates, except that female body condition was not important. Our results suggest that both parents responded to the changes in brood demands, but do so, governed by different factors. In particular, body reserves play a role for males who invest more in parental care and hence may have a smaller energy buffer than females.

**PS1.107 Gowen, Fiona**, (Occidental College, Los Angeles, United States); Cicero, Carla (University of California, Berkeley, Berkeley, CA, United States); Peterson, A. Townsend (Kansas University, Lawrence, KS, United States); McCormack, John (Occidental College, Los Angeles, CA, United States)

#### A GENETIC PORTRAIT OF DIVERGENCE AND GENE FLOW AMONG TWO LINEAGES OF WESTERN SCRUB-

#### JAY (*APHELOCOMA CALIFORNICA*) BASED ON MITOCHONDRIAL AND NUCLEAR MARKERS

We present data on divergence and gene flow between two lineages of the Western Scrub-Jay (*Aphelocoma californica*) that meet in a few narrow hybrid zones in the western United States. Hybrid zones are important to understanding the speciation process. The level and directionality of gene flow can inform taxonomic and conservation decisions. Data for hundreds of individuals within and outside the hybrid zones show that two lineages are well differentiated in mtDNA, with little introgression outside the contact zones. Nuclear data from 13 microsatellites tell a similar story, with limited introgression compared to mtDNA. We unexpectedly found low-level introgression of interior nuclear DNA into the genetic background of coastal populations in southern California and north Baja California, suggesting ancient hybridization, perhaps when woodlands were more expansive during the last glacial maximum. The clear genetic differentiation, evidence for restricted introgression, and diagnostic phenotypic differences between these lineages make a compelling case for their species-level recognition.

**PS2.191 Goyette, Jennifer**, (Biodiversity Research Institute, Gorham, United States); Eggert, Lisa (Biodiversity Research Institute, Gorham, ME, United States); Jodice, Patrick (US Geological Survey-SC Cooperative Fish and Wildlife Research Unit, Clemson University, Clemson, SC, United States); Evers, David (Biodiversity Research Institute, Gorham, ME, United States)

#### INVESTIGATING OVER-WINTER DISTRIBUTION OF BLACK SKIMMERS FROM THE SOUTHEASTERN US USING TELEMETRY AND BAND RECOVERY DATA

Black Skimmers (*Rynchops niger*) span a wide geographic range during the breeding season; in the US they occur in California and in every state from Massachusetts to Texas. While the populations in northern states are known to be migratory, the extent to which skimmers breeding in the southeastern states migrate, if at all, is relatively unknown. Furthermore, skimmers are widely believed to be strictly coastal in their movements. We present data from a telemetry study ( $n = 64$ ) and band recoveries ( $n = 488$ ; birds banded from Virginia to Texas) to describe the range of skimmer movements during the non-breeding season. In 2010-2011, as part of a pre-assessment study for the Natural Resources Damage Assessment of the Deepwater Horizon oil spill, we deployed satellite and/or VHF radio transmitters on skimmers captured in Louisiana, South Carolina, and Georgia and monitored devices by satellite and by airplane, boat, and ground surveys. Our telemetry data, the first of its kind for the species, demonstrate that skimmers from the southeastern US do in fact travel long distances of 800 km or more, in one instance transversing the Gulf of Mexico. Band recovery data also indicate long distance movement, in one case appearing over 3700 km from the banding location. Furthermore, band resights and recoveries indicate that skimmers may cross land; skimmers from the southeast have been observed from Sinaloa, Mexico through Honduras. These data improve our basic understanding of skimmer behavior and inform further research and conservation-related actions for the species.

**PS2.151 Grageda, Miguel**, (Sul Ross State University, San Luis Potosi, SLP, Mexico); Warnock, Bonnie; Harveson, Patricia; Platt, Steven (Sul Ross State University, Alpine, TX, United States); Panjabi, Arvind (Rocky Mountain Bird Observatory, Fort Collins, CO, United States)

## WINTERING GRASSLAND BIRDS AS BIO-INDICATORS IN THE RIO GRANDE BASIN, WEST TEXAS AND CHIHUAHUA

Several species of grassland birds migrate every year from northern United States and Canada to spend the winter in the grasslands of the Chihuahuan Desert. The area of study is formed by the desert grasslands found within the Rio Grande Basin in the states of Texas in the United States and Chihuahua in Mexico. Grasslands separated by mountains or extensive shrublands were considered as different study sites. We wanted to determine which birds may be considered as indicators of grassland quality, or describe certain grassland attributes in this area. We conducted bird and vegetation surveys during winter 2009 and 2010 using a total of 150 1-km line-transects. We used the distance line transect method to record bird observations, obtaining occurrence and density of birds. Also vegetation height and cover, type of grassland and dominant species were estimated every 100 meters of the line transect. We used logistic regression analysis in order to compare occurrence of species of birds and vegetative attributes. During both years a total of 67 species of birds were recorded, but only the species with a high occurrence ( $\geq 10$  observations) were included in the analysis ( $n = 27$ ). We obtained the habitat attributes that related positively or negatively to each species of bird. Also we identified the locations that seem to be critical for these migratory birds in the region. Important species that were considered as indicators of low bare ground and low shrub cover were Grasshopper Sparrow (*Ammodramus savannarum*), the genus *Ammodramus* and the genus *Sturnella*; significant indicator of a combination of tall grasses and tall shrubs was Vesper Sparrow (*Poocetes gramineus*); indicators of low grass height with high cover and low to none shrubs was Chestnut-collared Longspur (*Calcarius ornatus*); Horned Lark (*Eremophila alpestris*) was also good indicator for grasslands with low height but preferring areas with high bare ground and poor grass cover; indicator of high shrub cover were Black-throated Sparrow (*Amphispiza bilineata*), Pyrrhuloxia (*Cardinalis sinuatus*). Grassland birds may be used by landowners to ascertain the condition of their land as habitat for other wildlife species and rangeland management strategies. The presence of species of birds such as Baird's Sparrow, Sprague's Pipit, and Chestnut-collared Longspur represent land with potential for conservation for other species that prefer conserved grasslands as main habitat.

**PS2.234 Graham, Brendan**, (University of Windsor, Windsor, Canada); Mennill, Daniel (University of Windsor, Windsor, ON, Canada)

## REPERTOIRE SHARING BETWEEN THREE POPULATIONS OF A DUETTING TROPICAL SONGBIRD: THE RUFOUS-AND-WHITE WREN (*THRYOTHORUS RUFALBUS*)

Exploring patterns of song sharing is important for understanding how bird song varies geographically at both local and range-wide scales. Distance, number of neighbours, repertoire size and song learning mechanisms, all affect patterns of song-sharing and can potentially promote song divergence between populations. In this study we analyze song-sharing in the solo songs and duets of the Rufous-and white Wren (*Thryothorus rufalbus*) a Neotropical resident songbird. We recorded songs from three different locations in Costa Rica: Santa Rosa National Park, Rincón de la Vieja National Park, and the Eternal Children's Rainforest in Monteverde. All three locations featured abundant Rufous-and-white wren populations and their proximity allowed us to quantify song sharing over short, intermediate, and large geographic distances. From each population, we recorded solo songs and duets from  $\geq 10$  males

and females. To evaluate and quantify differences in song repertoires between populations, we measured song-sharing coefficients using Jaccard's similarity coefficients and plotted song differences against geographic distance. Comparisons of acoustic differences over different geographic scales show notable differences between populations, different patterns of geographic variation in males versus females, and interesting patterns of variation in birds' duets. We discuss the implications of these patterns for our understanding of song learning and dispersal.

**T17.1 Gratto-Trevor, Cheri**, (Environment Canada, Saskatoon, Canada); Haig, Susan; Miller, Mark; Mullins, Thomas (USGS Forest and Rangeland Ecosystem Science Center, Corvallis, OR, United States); Maddock, Sidney (Contractor, Buxton, NC, United States)

## CONNECTIVITY OF PIPING PLOVERS, A SPECIES AT RISK, FROM A PREVIOUSLY UNKNOWN MAJOR WINTERING AREA, THE BAHAMAS

Piping Plovers are a species at risk with a global population of about 8000. They nest across Canada and the U.S. and winter on the Atlantic and Gulf coasts of the U.S. and Mexico, as well as in the Caribbean. Recently, over 1000 birds were found wintering in The Bahamas. Because survival may differ in birds wintering in different areas, it is important to identify their breeding origin. In early 2010, 57 Piping Plovers were captured from seven beaches and three islands of The Bahamas. All birds were uniquely colour-marked, and 79% (45) were observed in 2010 and/or 2011 breeding along the Atlantic coast from Newfoundland to North Carolina. None were reported from the Great Lakes, or the Canadian Prairies/U.S. Northern Great Plains (Interior). Fidelity to specific wintering locations was high: of 337 resightings (of 43 birds) in the following two winters, none were seen more than 10 km from their banding location despite considerable searching of other areas. Breeding site fidelity was similar as 24 birds returned to the same beach in two summers, 4 nested at a nearby beach, and only 2 moved 50-55 km away. mtDNA analyses of 70 unique haplotypes in 48 Bahamas-caught birds indicated 44 possessed a haplotype allied with the Atlantic subspecies. The remaining four birds possessed "Interior" haplotypes. Microsatellite analyses of 8 variable loci in 50 Bahamas-caught birds suggested they were more closely associated with the Atlantic subspecies. STRUCTURE analyses further revealed that most individuals have higher probabilities of being associated with the Atlantic subspecies. In most cases, however, assignment probabilities were only slightly greater than 0.5 and suggested that the microsatellites did not conclusively identify subspecies affinities. Comparing field and molecular results provides a much clearer picture of migratory connectivity than using either method alone.

**T6.2 Grava, Angelique**, (University of northern BC, Prince George, Canada); Grava, Thibault (University of northern BC, Prince George, BC, Canada); Otter, Ken (University of Northern BC, Prince George, BC, Canada)

## CHARACTER DISPLACEMENT IN DAWN CHORUSING BEHAVIOUR OF SYMPATRIC BLACK-CAPPED AND MOUNTAIN CHICKADEES.

Closely related species tend to be more distinct when occurring in sympatry than when they are allopatric. Such differences allow species specific identification and avoid interspecific matings. However, within overlapping ranges of usually-allopatric populations, such differences might not be obvious. In chickadees, dawn chorus behaviour is known to impact female mate choice. Within a contact zone between black-capped and

mountain chickadees, we previously found directional hybridization occurs through female mountain chickadees engaging in extra-pair behaviour with male black-capped chickadees. By comparing the chorus behaviour from this contact zone with dawn chorus recordings from allopatric populations of either species, we found that mountain chickadees in sympatric populations with black-capped chickadees alter their chorus. They use more chick-a-dee calls than songs when they co-occur with black-capped chickadees whereas they use similar proportions of calls and songs in areas without black-capped chickadees. We also found differences in the fine structure of the song, both species typically have a descending first note in their song, but we found that mountain chickadees that share their habitat with black-capped chickadees used an ascending first note. These differences in chorus pattern illustrated possible character displacement from the subordinate mountain chickadees, providing the potential to reduce acoustic overlap with the dominant black-capped chickadees. Also, by making their chorus easily distinguishable from the black-capped chickadee, mountain chickadee might signal their identity to conspecific females and limit mis-leading signals that could promote hybridization.

**PS2.20 Grava, Thibault**, (University of northern BC, Prince George, Canada); Grava, Angélique; Otter, Ken (University of Northern British Columbia, Prince George, BC, Canada)  
HABITAT QUALITY AFFECTS THE PERCEPTION OF DOMINANT MALES BASED ON THEIR RELATIVE SONG STRUCTURE

The ability to maintain internal song structure in black-capped chickadees is known to be affected by both rank and habitat quality. Further, lab studies show that females discriminate between songs of dominant and subordinate males that vary in acoustic structure. This study was set up to investigate whether males also rely on acoustic structure to assess males quality during diurnal interactions and whether habitat quality affects the perception of male social rank, based on their relative song structure. We conducted a playback experiment to simulate an intrusion by dominant males recorded either in low-quality (young forest) and high-quality (mature forest) environment into the territory of dominant males breeding in both habitats. The playbacks reflected the difference in song structure already known to exist across habitat. Our results show that stimuli from young forest elicited less territorial response from dominant males in either habitat. We also found that males in mature forest responded less to young-forest stimuli compared to mature-forest stimuli, despite the stimuli in both cases being recorded from dominant males within their own winter blocks. We demonstrate in this study that the ability to maintain internal song structure in the black-capped chickadee constitutes a signal that appears to be used by males to assess the level of threat of perceived intruders, and that this perception is affected by habitat quality in which the stimulus was recorded.

**T12.8 Graves, Emilie**, (University of California, Davis, Davis, United States); Eadie, John (University of California, Davis, Davis, United States)  
FEMALE-SPECIFIC PLUMAGE TRAITS IN WOOD DUCKS (AIX SPONSA): INDICATORS OF INDIVIDUAL QUALITY?

Despite an extensive body of literature on male plumage ornaments, relatively little research has considered female plumage ornaments in species with conventional sex roles. Female ornaments may evolve through male mate choice, female competition over resources, or correlated selection. The

Wood Duck (*Aix sponsa*) is a sexually dimorphic species of North American cavity-nesting duck. Female Wood Ducks possess a distinct patch of white feathers around the eyes that varies greatly among individuals. This female-specific ornament may act as a social signal of individual female quality. Female Wood Ducks (N=147) were caught during incubation in 2010 and 2011 and photographs were taken of each individual. The eye patch was measured digitally from these photographs using ImageJ. Our results indicate that females in better body condition have larger eye patches than females in poorer body condition. Older females also tend to have larger eye patches than do younger females. These results demonstrate that female Wood Ducks exhibit a conspicuous ornament that reflects individual age and body condition and we discuss how such a signal might function.

**T17.6 Green, M. Clay**, (Texas State University - San Marcos, San Marcos, United States); Ballard, Bart (Texas A&M Kingsville, Kingsville, TX, United States); Palacios, Eduardo (Depto. de Biología de la Conservación, La Paz, Mexico); Geary, Brock (Texas State University, San Marcos, TX, United States); Reed, Daniel (Texas A&M Kingsville, Kingsville, TX, United States); Hill, Austin (Texas State University, San Marcos, TX, United States)

MOVEMENT AND GENE FLOW THROUGHOUT THE BREEDING RANGE OF NORTH AMERICAS RAREST HERON, THE REDDISH EGRET (*EGRETTA RUFESCENS*)

The global distribution of the Reddish Egret (*Egretta rufescens*) extends from western populations in Baja California, Mexico, throughout the coastal U.S. and Mexico along the Gulf of Mexico and eastward to the Bahamas. Using molecular tools coupled with satellite telemetry and color banding, we examined gene flow and movement between geographically isolated colonies of Reddish Egret in Baja California, Texas and the Bahamas. We also examined potential differences in gene flow, movement and dispersal between color morphs of the plumage dimorphic Reddish Egret. We found significant genetic differentiation (global  $F_{st} = 0.161$ ) throughout the Reddish Egret's range; differentiation occurred among three distinct regions ( $F_{st} = 0.238$ ) but not among colonies/islands within regions suggesting regional philopatry. Banding data (2006 – 2012) and satellite telemetry ( $n = 25$  juveniles,  $n = 20$  adults) showed significant movement within the distinct regions but little movement and/or dispersal between the populations. We found no significant differentiation between color morphs within the same region (e.g. Texas) but did find increased movement for dark morph individuals. Our evidence of limited gene flow between the three major population centers suggests these regions be conservation priority areas for the species and managed as three distinct units.

**PS2.69 Green, Michael**, (US Fish and Wildlife Service, Portland, United States); Kritz, Kevin (US Fish and Wildlife Service, Denver, Canada); Swem, Ted (US Fish and Wildlife Service, Fairbanks, United States); Delphey, Phil (US Fish and Wildlife Service, Bloomington, United States); Cameron, Sue (US Fish and Wildlife Service, Asheville, United States); Koppie, Craig (US Fish and Wildlife Service, Annapolis, United States); Millsap, Brian (US Fish and Wildlife Service, Albuquerque, United States)

RESULTS OF MONITORING THE AMERICAN PEREGRINE FALCON SINCE DELISTING IN THE U.S.

The American Peregrine Falcon (*Falco peregrinus anatum*) was removed from the list of threatened and endangered species

(delisted) by the U.S. Fish and Wildlife Service (FWS) in 1999 because population goals had been exceeded in every recovery region across its range. In 2003 the FWS, in cooperation with other stakeholders, completed a monitoring plan for the American Peregrine Falcon. This plan described the objectives and methods for post-delisting monitoring of the species, as required by the Endangered Species Act (ESA). Every three years, from 2003 through 2012, the FWS has organized and coordinated post-delisting monitoring of the American Peregrine Falcon. In 2015 we will complete our commitment to monitor American Peregrine Falcons “not less than five times,” a requirement of the ESA for species delisted due to population recovery. We will provide a summary of the results to date of this post-delisting monitoring effort. Our results will highlight estimates of territory occupancy, nest success, and productivity across six regions and nationally; these are measures of population health required by the monitoring plan developed by the FWS.

**SAT1.6 Greenberg, Russell,** (Smithsonian Migratory Bird Center, Washington, United States); Danner, Raymond (Virginia Tech University, Blacksburg, VA, United States)

#### THE INFLUENCE OF THE CALIFORNIA MARINE LAYER ON BILL SIZE IN A GENERALIST SONGBIRD

The hypothesis was tested that birds in hotter and drier environments may have larger bills to increase the surface area for heat dissipation. Previous thermographic experiments on eastern subspecies of song sparrows showed that the larger bills of birds from a more xeric environment release over 30% more heat. California provides a climatic gradient to test the influence of climate on the hypothesis. California provides an ideal climatic gradient to test the influence of climate on bill morphology. Much of California experiences dry warm/hot summers and coastal areas experience cooler summers than interior localities. Based on measurements from 1488 museum skins, song sparrows showed decreasing bill size from the coastal islands and mainland coast to the interior. Song sparrows on larger, warmer islands also had larger bills. Both the average high summer temperature for the hottest month, and the highest monthly potential evapotranspiration accounted for approximately 40% of the variation in song sparrow bill size. Bill surface area at the hot interior sites averaged 32.5% greater than at the cooler coastal sites. No other climate or geographic variable showed a strong association. A subsample of radiographed specimens shows that skeletal bill size was even more strongly associated with temperature than overall bill size, demonstrating that bill size differences were not a result of variation in growth and wear of keratin. These relationships are not driven by patterns of overall body size, of which temperature only explained 0.1% of the variation (n=6250).

**SAT2.1 Grinde, Alexis,** (University of Minnesota, Duluth, Duluth, United States); Niemi, Gerald (University of Minnesota, Duluth, Duluth, United States)

#### METAPOPULATION DYNAMICS AND CHARACTERISTICS OF WOOD-WARBLERS IN THE WESTERN GREAT LAKES REGION.

Based on the USGS Breeding Bird Survey, Minnesota's northern forest ecosystems have among the richest diversity of breeding bird species in North America, including many species of high conservation priority. Due to concerns with increased levels of forest harvesting and management and effects of climate change in Minnesota, a long-term (1995-2011) forest bird monitoring program was established in two of Minnesota's National Forests. Using data from this National Forest Bird monitoring program, we applied a conceptual approach to

incorporating detectability with multi-season occupancy modeling to determine metapopulation dynamics and associated habitat characteristics within forest stands over 16 years. Over 15,000 10-minute point counts were conducted in 346 forest stands each year in the National Forests. Here we illustrate these results for four warbler species with high conservation priority: Black-throated Blue Warbler (*Setophaga caerulescens*) (n=265), Cape May Warbler (*Setophaga tigrina*) (n=293), Connecticut Warbler (*Oporornis agilis*) (n=430), and Golden-winged Warbler (*Vermivora chrysoptera*) (n=585). Each of the species analyzed has different ecological requirements and concerns. For example, the Connecticut Warbler has a very restricted breeding distribution and has shown a marked decline of 7.8% per yr over the past 16 years. The Golden-winged Warbler has shown a decline of -4.85% per yr in Chippewa NF but a 4.53% per year increase in Superior NF thus showing a rather stable population trend for this region. The results of this study will be useful for ultimate incorporation into long-term management objectives within this region.

**F8.1 Grunst, Andrea,** (University of California, Riverside, Riverside, CA, United States);

#### SEXUAL COLORATION, ANTIOXIDANT STATUS, AND REPRODUCTIVE STRATEGIES IN YELLOW WARBLER (SETOPHAGA PETECHIA): LINKED VIA INDIVIDUAL QUALITY OR ALTERNATIVE ALLOCATION DECISIONS?

Researchers have recently begun to study sexual ornaments as life-history investments, whose development trades off with other elements of reproductive effort and survival. In birds, producing sexual pigments may generate costs by expending molecules with antioxidant and immuno-stimulatory potential, enforcing honest signaling of individual quality. Alternatively, individuals may invest in pigmentation and mating at the expense of other allocation alternatives, such that pigmentation does not positively predict survival and parental care. In Yellow Warbler (*Setophaga petechia*), I explored if carotenoid and phaeomelanin-based sexual pigmentation honestly signals condition, antioxidant status, and parental care, or if birds invest in pigmentation and mating over condition and parental capacity. I quantified phaeomelanin color using photography, carotenoid color using reflectance, and condition using residual mass. I also assayed antioxidant capacity and reactive oxygen metabolites in plasma. Finally, I measured parental effort by quantifying incubation attentiveness, incubation provisioning, and nestling provisioning, and male mating effort via song rate. Bright carotenoid color predicts high condition, antioxidant status, and incubation attentiveness in females. In contrast, male carotenoid color shows little variation or association with condition, and does not predict paternal care, suggesting sexual selection for allocation towards carotenoid color, irrespective of condition. Further, male phaeomelanin color correlates with size, but not condition, and positively predicts song while negatively predicting incubation provisioning. Thus, while female carotenoid color positively signals phenotypic and parental quality as traditionally predicted, male pigmentation reflects aspects of quality (size) and reproductive allocation strategy. These results have significance to understanding sexual signaling and reproductive strategies within the framework of life-history theory.

**F6.1 Grunst, Melissa,** (University of California, Riverside, Riverside, CA, United States);

#### CONTEXT-DEPENDENT REPRODUCTIVE ALLOCATION RULES WITH RESPECT TO MALE QUALITY IN THE BIPARENTAL SONGBIRD MELOSPIZA MELODIA



The differential allocation hypothesis proposes that females increase reproductive effort with male quality due to greater fitness returns on investment, enhancing fitness differences between males and driving sexual selection. Conversely, the reproductive compensation hypothesis posits that females with low quality mates increase reproductive effort to ameliorate fitness costs of reduced genetic or paternal benefits, decreasing fitness differences between males and dampening sexual selection. In addition, an under-explored contingency is that female allocation rules vary as costs or benefits of increasing investment change. For instance, elevated nest predation risk may increase costs of reducing incubation attentiveness, benefits of increasing effort may rise across the nesting stage as the brood increases in value, and differential paternal support by males varying in quality may dampen fitness costs of reduced female effort. I tested whether differential allocation, reproductive compensation, or context-dependent allocation best describes female reproductive allocation in song sparrows (*Melospiza melodia*). I assessed male quality using baseline corticosterone, which negatively correlates with survival probability and song repertoire size, a sexually selected trait. I measured three aspects of female reproductive effort: incubation attentiveness, incubation attentiveness under elevated perceived nest predation risk, and nestling provisioning rates. Allocation rules displayed context-dependency. Incubation attentiveness positively correlated with male baseline corticosterone in absence of predation risk, supporting reproductive compensation. This pattern may arise if nest-guarding by high quality males lowers costs of reduced female attentiveness. However, under elevated perceived predation risk, male quality and female attentiveness did not correlate, suggesting that attentiveness equalizes across females as costs of reducing attentiveness rise. During the nestling stage, female provisioning rates negatively correlated with male corticosterone, consistent with differential allocation. Differential allocation may occur during the nestling stage, but not during incubation, due to heightened benefits of increased investment. Importantly, context-dependency in female allocation rules may result in spatiotemporal variation in the strength of sexual selection and impact evolution of sexually selected signals.

**PS2.217 Guereña, Katherine**, (University of Delaware, Newark, United States); Adalsteinsson, Solny (University of Delaware, Newark, DE, United States); Castelli, Paul (New Jersey Division of Fish and Wildlife, Port Republic, NJ, United States); Nichols, Theodore (New Jersey Division of Fish and Wildlife, Woodbine, NJ, United States); Williams, Christopher (University of Delaware, Newark, DE, United States)

#### INFLUENCE OF LAND-USE ON PRODUCTIVITY OF TEMPERATE-NESTING CANADA GEESE IN NEW JERSEY

Atlantic Flyway Resident Population (AFRP) Canada geese (*Branta canadensis*) in New Jersey have grown so considerably during the last 30 years that it is now considered a nuisance in urban areas. Corporate centers, parks, golf courses, and residential areas with manicured lawns and artificial ponds support high nesting densities of AFRP geese. We estimated nesting parameters of AFRP geese in New Jersey during 1985–1989, 1995–1997, and 2009–2010, and identified covariates that influenced variation in nest success within and across the 3 decades. Nest success was 0.512 (SE ± 0.057) during 1985–1989, 0.422 (SE ± 0.102) during 1995–1997, and 0.403 (SE ± 0.041) during 2009–2010. Rural residential and commercial/industrial lands, nest density, year, nest age, and extreme weather were important to nest success in 1985–1989,

at a time when population increase was most substantial. Rural residential and agricultural lands, nest age, initiation date, year, physiographic stratum and extreme weather were important to nest success in 1995–1997, as the population approached its peak. No land use variables were important to nest success during 2009–2010; however, nest age and initiation date were important during this time. Nest success decreased through the duration of the study, likely due to a statewide increase in reproductive control efforts. As the population increased rapidly during the 1980's, geese nested in high densities on commercial/industrial and rural residential lands. During the 1990's, reproductive control was used to target the high-density nesting areas, and permit applications from reproductive control increased from private landowners. The population has decreased substantially during the last decade, due to a combination of special early and late hunting seasons and intensive reproductive control. We recommend that managers target commercial/industrial and rural residential land uses for reproductive control efforts. Managers are also encouraged to use these productivity estimates, along with the corresponding population trends, to track annual population change.

**PS2.216 Guereña, Katherine**, (University of Delaware, Newark, United States); Castelli, Paul (New Jersey Division of Fish and Wildlife, Port Republic, NJ, United States); Nichols, Theodore (New Jersey Division of Fish and Wildlife, Woodbine, NJ, United States); Williams, Christopher (University of Delaware, Newark, DE, United States)

#### GOSLING SURVIVAL OF TEMPERATE-NESTING CANADA GEESE IN NEW JERSEY

Atlantic Flyway Resident Population (AFRP) Canada goose (*Branta canadensis*) summer mortality is dominated by losses during the gosling stage and especially during the first 2 weeks following hatch. Unfortunately, obtaining reliable survival estimates of hatchling waterfowl through fledge has been shown to be very challenging, primarily due to their small size, precocial behavior, and the habitats in which they live. During 2009 and 2010 we studied gosling survival in New Jersey using mark-resight-recapture of adults and young. We estimated gosling survival through calculations of: complete brood loss, partial brood loss, overall brood survival combining total and partial brood loss estimates, and daily gosling mortality during the first two weeks following hatch. The proportion of breeding adults that experienced complete brood loss was 0.316. The remaining proportion of breeding adults was subject to partial brood loss (0.684), which we estimated at 0.465 (SE ± 0.026) for 56 days. The overall brood survival estimate for 56 days after hatch was 0.318 (SE ± 0.018). Select environmental and density-dependent variables were used to build candidate models to identify sources of variation in partial brood loss. Brood survival was negatively related to the number of broods and positively related to the percent agriculture at the nest site. Our survival estimate was lower than those of prior studies; however, we were able to account for loss of entire broods through use of marked adults. We recommend that managers utilize these estimates in determining annual recruitment of temperate-nesting Canada geese.

**W16.3 Guerrero, Mario**, (Universidad Autónoma de Nuevo León, saltillo, Coahuila, Mexico); Nuñez, Adriana (Universidad Autónoma de Nuevo León, saltillo, Coahuila, Mexico); Farquhar, Craig (Texas Parks and Wildlife Department, austin, TX, United States); González, Jose Ignacio (Universidad Autónoma de Nuevo León / FCB, San Nicolas de los Garza, NL, Mexico)

## MODELING BREEDING HABITAT PREFERENCES OF BLACK CAPPED VIREO IN MEXICO AT DIFFERENT SPATIAL SCALES

Knowledge of the breeding distribution of Black-capped Vireos (*Vireo atricapilla*) in Mexico is limited, the records obtained to date are opportunistic, so do not represent precise continuous geographic surfaces in the distribution of the species. We developed a distribution model based on presence/absence data using Maxent. The data records were obtained through literature review and field work during 2002-2007. Thirty GIS layers with climatic (scale 1:1 000 000), physical and environmental information (scale 1:250 000), were obtained including a normalized difference vegetation indexes (NDVI) that were developed based on satellite imagery. The layers were subjected to multicollinearity tests to detect possible correlation between them to provide information relevant to the model. We then ran the model with categorical and continuous layers, using 30% of the records for assessment. The statistical results include an adjustment to the ROC curve to increase model robustness. At tree scale levels, seasonality of precipitation, the precipitation of april, type of soil, and geomorphological attributes were the most significance variables, as well, the potential breeding habitat surface estimated were 150,000; 40,000 and 8,000 square kilometers.

On the field, the habitat was often on the northern slopes and frequently at the higher elevations of the chaparral and scrubland communities on diverse exposures of the rugged Sierra Madre Oriental. Find a wide distribution in isolated environments from human activity, for a species considered threatened, sets the standard to evaluate other aspects such as reproductive success and population size, to reassess its conservation status.

**S10.3 Guglielmo, Christopher**, (Western university, London, Canada);

### PHYSIOLOGICAL VARIATION AMONG INDIVIDUALS AND ITS EFFECTS ON MIGRATION PERFORMANCE

Migration imposes the most intensive energetic demands that birds ever experience. It is also a time of high mortality risk. Migratory flight requires birds to reach and sustain a level of metabolic performance unparalleled by other vertebrates, and rapid refueling between flights places tremendous demands on organs involved in digestion and post-absorptive nutrient processing. As a consequence the “physiology” of migrants is tremendously dynamic as birds repeatedly transition between the flying and refueling states. Most of the research on migration physiology has focused on how birds prepare for migration seasons, or upcoming endurance flights by altering body composition, biochemical capacity and hormonal controls. Others have examined how population sub-groups defined by sex or age may differ in physiology or migration ability in ways that may affect fitness. However, much more work is required to understand how individual variation in physiology affects migration performance and fitness. Studies of shorebirds provide a nice example of how individual variability in digestive system structure relates to diet choice (hard vs soft prey), which may influence refueling and migration performance. Research on neo-tropical passerine migrants provide examples of how condition as determined by wintering ground habitat quality affects subsequent migration and reproduction, as well as how conditions during nesting affect individual migration in autumn. Wind tunnel experiments are beginning to reveal the how individual variation physiological traits like constitutive immunity and personality relate to flight performance, however much more work remains to be done. New tracking technologies are facilitating studies of the relationships between individual

physiological traits and migration ability, and these may eventually be used to make the final link to fitness.

**PS2.50 Guigueno, Mélanie**, (Western University, London, Canada); MacDougall-Schackleton, Scott; Sherry, David (Western University, London, ON, Canada)

### SEX DIFFERENCES IN SPATIAL COGNITION IN BROWN-HEADED COWBIRDS (*MOLOTHRUS ATER*): USING TOUCHSCREENS TO TEST THE ADAPTIVE SPECIALIZATION HYPOTHESIS IN A SPECIES WITH SEX-ROLE-REVERSED USE OF SPACE

The adaptive specialization hypothesis (ASH) proposes that cognition and the brain are specialized to serve specific ecological functions. In many mammals, for example, males have larger home ranges and better spatial ability than females. Brown-headed cowbirds (*Molothrus ater*) are a rare example of a species demonstrating reversal of sex-typical space use because they are obligate brood parasites and only females search for and remember the location of multiple host nests. There is a higher demand for enhanced spatial cognition in female cowbirds and females have a larger hippocampus than males in the breeding season. However, spatial cognition has not been measured in cowbirds. The ASH predicts that females will outperform males on a spatial task during breeding, whereas performance on a non-spatial task will not differ between the sexes. We used touchscreens to test female and male cowbirds with a hippocampus-dependent test (spatial task) and a non-hippocampus-dependent test (colour task) when subjects were in breeding and non-breeding conditions. We addressed the following questions: Are there more pronounced sex differences in breeding than in non-breeding and can females remember a spatial location longer than males? Our study connects cognition and neuroscience to provide a strong test of the ASH in the context of sex differences in brood parasites.

**SAT12.1 Guindre-Parker, Sarah**, (University of Windsor, Windsor, Canada); Gilchrist, Grant (Environment Canada, Ottawa, ON, Canada); Baldo, Sarah (University of Windsor, Windsor, ON, Canada); Love, Oliver (University of Windsor, Windsor, ON, Canada)

### ALULA SIZE IN AN ARCTIC-BREEDING PASSERINE: CONDITION-DEPENDENT ACHROMATIC SIGNALLING OF A RARELY STUDIED PLUMAGE TRAIT

Despite its common occurrence in birds, studies of achromatic plumage signalling (white, black or grey plumage) are scarce. The few studies that have focused on this type of visual signal have found that achromatic plumage quality is usually indicative of an individual's dominance or of its condition. I examined inter-individual variation in achromatic plumage signalling in an Arctic-breeding passerine, the Snow bunting (*Plectrophenax nivalis*), to determine whether male plumage quality acts as a signal and whether it is linked to dominant behaviour or to condition-dependent traits. Furthermore, I investigated the potential relationship between achromatic plumage quality and fitness-related traits. Selected results from my MSc research focused on one of many plumage traits studied – alula size (a small set of feathers on the wing of birds) – will be presented. Male Snow buntings are unique in having a conspicuously coloured alula, and inter-individual variation in alula size suggests that this trait has the potential to act as a signal of male quality in this species.

My findings show that male alula size is related to condition – but not dominance – and to multiple metrics of reproductive success. Males with a relatively larger alula produce more offspring through increased nestling survival within their brood,

as well as higher quality offspring. These same males have higher humoral immune function and are better able to cope with the cost of reproduction.

This study is the first to suggest that the alula may act as a signal of immune health and is related to reproductive success. Consequently, female Snow buntings may use the alula when choosing a social mate in order to assess a male's chick-rearing potential. The strength of this research is twofold: firstly, studying achromatic plumage signalling is helpful in understanding the evolution of plumage colouration as a whole and secondly, combining the sub-disciplines of physiology and ecology is necessary to gain a holistic understanding of free-living systems.

**PS1.222 Guindre-Parker, Sarah**, (University of Windsor, Windsor, Canada); Parker, Ryan; Love, Oliver (University of Windsor, Windsor, ON, Canada)

#### CHARACTERIZING VARIATION AND REPEATABILITY IN ACQUIRED HUMORAL IMMUNITY: THE EFFECT OF AGE, DIET QUALITY AND BODY CONDITION ON IMMUNOGLOBULIN Y LEVELS

Immunoglobulin Y (IgY) is the primary antibody in birds and makes up an important part of the acquired humoral immune system. The advantage of measuring baseline IgY levels as opposed to other measures of immune function is that no prior manipulation is required. Unfortunately, few studies have aimed to place variation in IgY levels within an ecological context and therefore interpreting this measure is often controversial: it is unclear whether increased IgY levels represent parasitic load (i.e. symptomatic of infection) or increased immune capacity.

In a captive colony of Zebra finches (*Taeniopygia guttata*), we characterized variation in IgY levels between age and sex classes within an ecological context. We assessed the condition-dependence of IgY levels by performing a diet manipulation: maintenance diet (seed and water ad libitum) vs. maintenance diet plus a protein-rich supplement (12g of egg-food daily). We measured within-individual changes in body condition and IgY levels over the course of several weeks.

We found no sex difference in IgY levels, although younger birds had significantly lower baseline IgY levels than adults. Surprisingly, our diet supplementation had no effect on body condition. However, the protein-rich diet significantly increased IgY levels in younger birds, but not in adult birds and therefore IgY levels were highly repeatable in adults, but not in young birds.

Variation in IgY levels in young birds appears to be driven by variation in individual condition more so than in older birds. These results suggest that baseline IgY levels must build over maturation until adult levels are reached, at which point IgY may be a repeatable trait at the population level (i.e., among individuals). This has important implications for the interpretation of the role of the immune system, as repeatability is required for natural selection to act on a trait. Our results support the hypothesis that IgY levels are indicative of immune capacity and that individual variation in these levels may be an ecologically relevant measure of avian condition.

**F11.7 Gurney, Kirsty**, (University of Alaska Fairbanks, Fairbanks, United States); Clark, Robert (Environment Canada, Saskatoon, SK, Canada); Slattery, Stuart (Ducks Unlimited Canada, Stonewall, MB, Canada); Ross, Lisette (Ducks Unlimited Canada, Winnipeg, MB, Canada)

#### SEASONAL PATTERNS OF OFFSPRING DIETS AND SURVIVAL IN LESSER SCAUP IN RELATION TO TEMPORAL FLUCTUATIONS IN AQUATIC FOOD RESOURCES IN NORTHERN BOREAL ECOSYSTEMS

Typically, reproductive success of temperate-breeding bird species declines seasonally, but the relative contributions of parental quality and environmental variability to seasonal patterns of reproductive success are not clear and underlying biological mechanisms remain poorly quantified. The food resource hypothesis posits that seasonal declines in quantity and quality of key food items during the breeding cycle drive seasonally variable reproductive success by influencing survival of offspring. However, evidence of seasonal fluctuations in food resources for avian consumers is generally limited, and information is needed from a broader range of systems. In our studies of boreal-breeding lesser scaup (hereafter scaup), we demonstrated that hatch date effects on pre-fledging survival depend on maternal mass and found anatomical evidence consistent with nutrient limitation in late-hatched ducklings. To test the food resource hypothesis in this system, we assessed temporal variation in the diet of scaup, and in abundance and quality (indexed by lipid content) of key prey items, at a northern boreal forest site. To examine temporal variation in food resources for scaup across a broader geographic scale and to assess possible susceptibility of this species to trophic mismatch, we also quantified seasonal patterns in food resource abundance at a second boreal forest site. We found no evidence for a seasonal change in diet of scaup ducklings and limited evidence for seasonal declines in quantity or quality of potential prey. Seasonal patterns in total numbers and biomass of invertebrate prey items were consistent at both sites, but differed among taxonomic groups, with only one invertebrate taxon declining throughout the brood-rearing season. Similarly, we did not detect seasonal variation in lipid content of prey. These results suggest that scaup ducklings exploit temporally stable prey resources. Our findings represent a critical first step in understanding the implications of changing environmental conditions for individuals and populations of this species and others that depend on aquatic resources in boreal ecosystems.

**T17.4 Haché, Samuel**, (University of Alberta, Edmonton, Canada); Hobson, Keith (Environment Canada, Saskatoon, SK, Canada); Villard, Marc-André (Université de Moncton, Moncton, NB, Canada); Bayne, Erin (University of Alberta, Edmonton, AB, Canada)

#### ESTIMATING NATAL DISPERSAL OF OVENBIRDS (*SEIURUS AUROCAPILLA*) USING D2H AND D34S ISOSCAPES

Dispersal has rarely been quantified for many animal species owing to logistical constraints in following individuals through time and space. Low recapture rates suggest that songbirds have low fidelity to their natal site and the rare data available indicate that they may disperse over thousands of kilometres. Conversely, experienced breeders (ASY) show high fidelity to their breeding territory, thus connectivity among songbird populations would mostly reflect natal dispersal movements. We used stable isotope ratios from two elements that can vary along spatial gradients (i.e. hydrogen [ $\delta^2\text{H}$ ] and sulphur [ $\delta^{34}\text{S}$ ]) to estimate the putative natal origin of first-year breeders (SY) from sub-populations of Ovenbirds (*Seiurus aurocapilla*) in New Brunswick. For both elements, we generated a species- and year-specific isoscape. Both isoscapes were then used along with a likelihood-based assignment test to determine the natal origin of SY males ( $n = 35$ ). There were low variations around the mean isotopic values of rectrices ( $\delta^2\text{H}_f$ ) taken from ASY (-

67.0 ± 5.3%, mean ± SD; known returning individuals; n = 23) and SY (-68.0 ± 10.3%) males. According to the spatial resolution of our preliminary isoscapes, these results suggest that the distance of dispersal of SY males was less than 100 km. Our findings have important implications regarding the relevant spatial scale that should be considered in monitoring and managing songbird populations. Also, given that we explicitly accounted for several assumptions underlying this approach and used a multi-isotopic framework, we will discuss the current limitations of the spatial resolution available to track individual movements using stable isotopes as markers.

**W6.2 Hadley, Adam,** (Oregon State University, Corvallis, United States); Robinson, W. Douglas; Frey, Sarah; Betts, Matthew (Oregon State University, Corvallis, OR, United States)

#### BIGGER IS BETTER: SIZE OF TROPICAL FOREST PATCHES, NOT TOTAL FOREST COVER, IS ASSOCIATED WITH POLLINATION OF AN ORNITHOPHILOUS UNDERSTORY HERB

Loss and fragmentation in native vegetation cover are thought to be one of the major drivers of widespread declines in pollination success. However, the specific mechanisms through which these landscape changes are driving declines remain unknown; little is known about the relative contribution of landscape composition versus configuration on disruption of pollination services. We tested the relative importance of landscape composition versus configuration on the reproductive success of *Heliconia tortuosa*, a hummingbird pollinated forest herb, near Las Cruces, Costa Rica. We used a stratified random sampling design to select sites across orthogonal gradients in patch size, amount of forest, and elevation (N=34 patches [166 plants]). We examined proportion of successful fruits out of the total flowers attempted and number of seeds produced out of the total possible given the number of flowers. Using linear mixed models, with 'patch' as a random effect, we modeled the effects of patch size, proportion of forest within 1 km and the interaction between these variables. We controlled statistically for the influence of elevation.

We found support for a positive influence of patch size on proportion of successful fruits. The top model for proportion of successful fruits was the additive relationship of patch size and distance to edge. Patch size had a cumulative importance weight of 0.6. After controlling for elevation, the top model for proportion of seeds also included patch size. Patch size had a cumulative importance weight of 0.61. Patch size was clearly more important than proportion of forest (2.03 times more plausible given the data and candidate models). It appears that as patch size increases plants are setting more seeds. We hypothesize that these differences in reproductive success are a result of differential rates of hummingbird movements across a gradient in landscape configuration (i.e., patch size).

**PS1.90 Hager, Stephen,** (Augustana College, Rock Island, United States); Cosentino, Bradley (2Department of Natural Resources and Environmental Sciences, Urbana, United States); McKay, Kelly (3BioEco Research and Monitoring Center, Hampton, United States)

#### SCAVENGING AFFECTS PERSISTENCE OF AVIAN CARCASSES RESULTING FROM WINDOW COLLISIONS IN AN URBAN LANDSCAPE

Collisions with windows remain an important human-related threat to bird survival in urban landscapes. Accurately

estimating the magnitude of avian mortality at windows is difficult and may be influenced by many sources of error, such as scavenging of carcasses. Failure to account for removal of carcasses by scavengers can bias estimates of window mortality. We tested the hypothesis that carcass survival depends on local habitat factors known to influence scavenger behavior. Scavenger activity on bird carcasses was documented at 20 buildings in an urban landscape in northwestern Illinois for one week during each season of a year. Known-fate models were used to relate carcass survival to local habitat composition and to evaluate temporal variation in survival. We also documented species of scavengers and the timing of scavenging using motion-triggered cameras. Daily carcass survival was greater in winter than during spring, summer, and fall. Survival was related negatively to canopy cover (trees and shrubs within a 50-m buffer) and window area, and positively to pavement cover. Using an exponential model of survival time, estimated mean time of survival of carcasses ( $t \pm SE$ ) was 82.9 ± 11.7 days for winter and 11.8 ± 7.2 days for other seasons. Raccoons (*Procyon lotor*) scavenged more carcasses than other species and feather piles remained in 53% of all scavenging events. Our results suggest that (1) carcass survival may be low at locations with predictable sources of food and preferred habitats of known scavengers, and (2) knowledge of scavenger distribution and activity can inform predictive models of persistence. Studies on bird-window collisions would minimize the influence of scavenger bias by maintaining short time intervals between carcass searches. Search intervals can be inferred by estimating the number of days that a carcass should persist at a site, which can be calculated using predicted daily survival probabilities of carcasses at study buildings.

**W12.2 Hager, Stephen,** (Augustana College, Rock Island, United States); Cosentino, Bradley (Department of Natural Resources and Environmental Sciences, Urbana, United States); McKay, Kelly (Bio-Eco Research and Monitoring, Hampton, IL, United States); Monson, Cathleen (Cathleen Monson, Reynolds, IL, United States); Zuurdeeg, Walt (Western Illinois University, Moline, IL, United States); Blevins, Brian (Pete Peterson's Wild Bird Shop, Davenport, IA, United States)

#### AVIAN MORTALITY FROM WINDOW COLLISIONS IS HIGHEST AT ONLY A SMALL SUBSET OF BUILDINGS IN AN URBAN LANDSCAPE

Collisions with building windows may represent an important source of mortality for urban birds. However, the proximate drivers influencing risk of collisions are not well understood, and no study has examined the potential for spatiotemporal variation in mortality in an urban setting. We set out to better understand the environmental and structural factors believed to influence the number of avian window fatalities in an urban landscape. We hypothesized that the number of fatalities varies with structural attributes of buildings and habitat features that place birds in close proximity to those buildings. A stratified random sample of 20 buildings (ranging from small residential to large commercial) allowed us to assess avian mortality in multiple land cover settings for a year. For each building and season, we conducted 21 daily surveys for carcasses and nine point count surveys to estimate relative abundance and richness of live birds. Generalized estimating equations were used to evaluate how bird community structure, landscape composition, and structural features of buildings influenced mortality. We created models with different combinations of predictor variables to explain variation in the total number of collisions, and a model selection approach was used to evaluate the support of each model. We found that abundance of live birds was significantly different among seasons and highest at buildings

with bird feeders. Bird richness correlated positively with wooded vegetation and negatively with pavement. Mortality was (1) highest in the non-winter seasons relative to winter, (2) observed at 50% of the buildings, (3) documented in 21 species (46 total carcasses), and (4) highest in hatch-year juveniles relative to adults. The top two models explaining variation in mortality included window area and species richness; 70% of carcasses were located at the four largest structures (i.e., commercial buildings) displaying high levels of sheet glass and in quality habitat. This is the first study to demonstrate that bird mortality resulting from window strikes was (a) variable across an urban landscape, (b) highest in buildings with large window area in preferred habitat, and (c) non-existent at residential houses in all habitat contexts. Accounting for spatiotemporal variation in bird-window collisions would increase the accuracy of estimates of mortality and allow for more focused management practices aimed at reducing strike-related impacts.

**PS1.254 Hale, Jennifer**, (Ohio State University, Columbus, United States); Augustine, Jacqueline (Ohio State University, Lima, OH, United States)

#### ROLE OF VOCAL CHARACTERISTICS IN INDIVIDUAL RECOGNITION AMONG MALE GREATER PRAIRIE-CHICKENS, TYMPANUCHUS CUPIDO

In many taxa, vocal communications play an integral role in aggression signaling, territory defense, and female choice. The acoustic structure of vocalizations is influenced by physical constraints on the vocalizer, suggesting a potential for individual recognition in some species. In the lek-mating Greater Prairie-Chicken (*Tympanuchus cupido*), vocalizations are an integral part of the ritualized display. We investigated whether variation among vocal characteristics of individual male Greater Prairie-Chickens played a role in female choice and during male-male competition. Vocal recordings varied among males, but were consistent throughout the season, suggesting that vocalizations could be used by prairie-chickens to identify individuals. Female choice was evaluated by comparing characteristics of vocalizations produced by reproductively successful and unsuccessful males, but no differences were found. Playbacks of familiar and unfamiliar males were conducted on the lek to assess the role of vocalizations during male-male competition. Male aggressive response increased with less familiar male vocalizations and with increasing proximity to the aggressor's territory. Our results suggest that significant variation is present among the vocal characteristics of individual male Greater Prairie-Chickens, but is not related to female choice among males on a lek. However, females may select which leks to visit based on male vocalizations, as these vocalizations can be heard at great distances. In light of our results, it is more likely that vocal variation is used to discriminate between neighbors and intruders as well as to assess whether another individual is an active threat to the listener's territory.

**PS1.30 Halkin, Sylvia L.**, (Central Connecticut State University, New Britain, United States);

#### PLACEMENT OF OBJECTS OF DIFFERENT COLORS AROUND SATIN BOWERBIRD BOWERS

Satin bowerbirds, *Ptilonorhynchus violaceus*, with bowers on the grounds of a resort in southeastern Queensland, Australia, place diverse colored plastic and natural objects around their stick courtship bowers. Satin bowerbirds are known to prefer blue objects in choice tests; while blue objects predominate in bower decorations, objects of other colors are also used, and their locations may not be random. For example, at one active bower green objects mainly occupied peripheral positions, while blue objects identical in size and shape to peripheral green ones

were dispersed throughout the display. On two different occasions, a set of green objects that I moved to the bower entrance were returned to the periphery by the next day, although not to their exact original locations. I will report on further examples, manipulations, and responses.

**F3.3 Hall, Linnea**, (Western Foundation of Vertebrate Zoology, Camarillo, United States); Corado, Rene (Western Foundation of Vertebrate Zoology, Camarillo, CA, United States)

#### TRASH AND CONTAMINANTS IN THE MOTAGUA RIVER OF GUATEMALA: IMPLICATIONS FOR BIRD SPECIES OF THE REGION

Avian population dynamics, habitat use, and egg contaminant loads were studied in the Rio Motagua Valley of Guatemala between 2006 and 2011. The Motagua River, the largest river in Guatemala, runs through one of the hottest and driest regions of all of Central America, one that is unique for its thorn scrub-dominated uplands. Unfortunately, contamination of the River itself is extensive, with extremely high heavy metal, fecal bacteria, agricultural runoff, and hard trash loads. The authors conducted point counts of birds at sites along the river from 2006 to 2011, and measured contaminants in egg contents during the same time period. Iron, zinc, manganese, and copper were found in significantly high quantities in eggs of 14 bird species, across multiple foraging guilds. DDT and Dieldrin residues also were found in eggs of several insectivorous species. Implications for Guatemala's thorn scrub and riparian-using bird species – and people – will be discussed.

**PS1.213 Halley, Matthew**, (Delaware State University, Dover, United States); Heckscher, Christopher (Delaware State University, Dover, DE, United States)

#### MULTIPLE MALE FEEDERS AT NESTS OF THE VEERY (CATHARUS FUSCESCENS)

Despite two hundred years of intermittent research, the breeding ecology and behavior of the Veery (*Catharus fuscescens*) remains largely unknown. With a lack of empirical data to the contrary, ornithologists have widely assumed that Veeries are socially monogamous on their Nearctic breeding grounds. We tested that hypothesis by examining a color-banded population of Veeries in northern Delaware via field observation and the use of a small video camera. Five of six nests (83%) were attended by a male that was also detected feeding nestlings at a second or third nest. Three of six nests (50%) were attended by one female and two males. No females were detected feeding at more than one nest. Our results lead us to reject the hypothesis that social monogamy is ubiquitous in this species, thereby invigorating the scientific discourse with regard to its social evolution and behavioral ecology. Modes of parental care that feature multiple males provisioning single-female broods are rare in birds, especially among species that migrate over long distances. This is the first report of such behavior in a North American passerine that practices annual intercontinental migration.

**PS2.49 Hallman, Tyler**, (Southern Illinois University Carbondale, Carbondale, United States); Kim, Daniel (Platte River Whooping Crane Trust, Wood River, NE, United States)

#### SPECKLING PATTERN ANALYSIS AS A TOOL FOR MONITORING BROWN-HEADED COWBIRD POPULATION AND PARASITIC BEHAVIOR

Individual female Brown-headed Cowbirds produce eggs with distinct dimensions and speckling patterns. In 2007 and 2008, photographs of cowbird eggs were taken on a series of 16 ha grassland study plots in south-central Nebraska. We tested the

efficacy of photographing clutches parasitized by Brown-headed Cowbirds by analyzing egg speckling patterns with the program Image J. We used cluster analyses to group the eggs, within and between individual host nests and estimate the number of female cowbirds active on each field. We varied the minimum size of speckling included in the analysis to evaluate the importance of micro-patterns. The estimates from cluster analyses matched well with each field's maximum female cowbird estimates derived from visual surveys, supporting this method's accuracy. The minimum size of speckling pattern analyzed did not greatly affect the results of the cluster analyses, as estimates were altered by no more than one female. On four extensively sampled study plots with a mean of 43.25 photographed clutches, female cowbirds averaged 2.17 host species parasitized, 4.72 eggs laid per season, and 1.36 eggs per host nest. Less heavily monitored fields had inaccurate estimates, indicating the importance of sufficiently large sample sizes. Our data confirm Brown-headed Cowbirds as generalist brood parasites that spread their reproductive effort across many host nests. The ability to answer these questions using egg morphology and speckling pattern provides a non-destructive low-cost alternative for analyzing female-egg relationships.

**S2.8 Hallworth, Michael**, (Smithsonian Migratory Bird Center, Washington, United States); Sillett, Scott (Smithsonian Institution's Migratory Bird Center, Washington, DC, United States); Marra, Peter (Smithsonian Institution's Migratory Bird Center, Washington, United States)

#### QUANTIFYING MIGRATORY CONNECTIVITY FOR A NEOTROPICAL MIGRATORY BIRD USING DIRECT AND INDIRECT TECHNIQUES

To date, determining the strength of migratory connectivity for small migratory warblers has been quantified only with the use of stable hydrogen isotopes because until recently we lacked the technology to measure migratory connectivity directly for small organisms. Directly tracking annual movements of small passerines is now possible through the use of archival geolocators. A combination of both indirect and direct methods may be required to accurately quantify migratory connectivity. Our objective was to compare direct (geolocators) and indirect (deuterium ( $\delta D$ )) measures of migratory connectivity using the Ovenbird (*Seiurus aurocapilla*) from two locations within their wintering distribution in the Caribbean basin. Geolocators were deployed on Ovenbirds (>19.5g) that were captured at Fonthill Ecological Reserve, Jamaica and Everglades National Park, USA during March 2010 and March 2011, respectively. Location of breeding ground assignment was conducted two ways, 1) from recovered geolocators of returning individuals and 2) using stable-hydrogen isotope analysis of feathers. Only feathers sampled upon geolocator retrieval were used to compare  $\delta D$  and geolocators. Locations were constructed using light data from the geolocators transformed into latitude and longitude. Utilization distributions (UD) were calculated for stationary periods of the annual cycle (breeding and non-breeding). The expected  $\delta D$  values in feathers were calculated following Hobson and Wassenaar (1997) and extracted from the UD determined by geolocators. Twelve Ovenbirds with geolocators were recaptured from Jamaica ( $n = 9$ ) and the Everglades ( $n = 3$ ). Predicted feather  $\delta D$  (Jamaica = -66.95‰; Everglades = -85.69‰) did not differ from feather  $\delta D$  (Jamaica = -57.11‰; Everglades = -61.38‰) values ( $F_{1,15} = 2.55$   $P = 0.13$ ) or between wintering locations ( $F_{1,15} = 1.01$ ,  $P = 0.33$ ). The current study measures the accuracy of using stable-hydrogen isotopes from feathers collected during the non-breeding season to measure migratory connectivity and suggests that deuterium accurately assigns breeding latitudes. This study

is the first to directly quantify migratory connectivity of Ovenbirds during the non-breeding season as well as compare two methodologies of measuring migratory connectivity.

**PS1.151 Halstead, Katherine**, (Oregon State University, Corvallis, United States);

#### REGIONAL INFLUENCES ON LOCAL BIRD DIVERSITY IN OAK COMMUNITIES OF THE ROGUE BASIN, OREGON

Determining mechanisms for observed associations between landscape and local diversity is critical to understanding the processes which structure biotic communities, and to developing ecologically-sound landscape management. However, few studies have examined potential causes underlying local community patterns across multiple spatial scales. Our results link landscape and community approaches to address mechanisms for regional influence on local bird diversity. We tested the regional species pool hypothesis, which suggests various drivers for associations between local and regional species richness. We focused on dispersal as a mechanism for this relationship in songbirds, using a predictive modeling approach in heterogeneous oak communities of the Rogue Basin of Southern Oregon. We conducted a large, Basin-wide point count study in the spring of 2011 to describe avian community patterns across a gradient of oak vegetation types, including oak savannah, oak woodland, oak chaparral and mixed oak-conifer. Species distribution models were developed using LIDAR data and an extensive long-term point count dataset from Oregon. Models for selected species were superimposed in GIS and used to predict selected species richness and community composition at each of our 2011 point count locations. We expected these models to be highly accurate if dispersal ability of each species across the landscape was the most important driver of local richness. Through rejection or confirmation of the regional species pool hypothesis in this system, our results explored two alternatives: 1) individualistic species habitat preference is a primary driver of local bird richness and community structure via landscape-level dispersal ability, or 2) emergent qualities of songbird communities override individual preference-based community assemblage, perhaps structured instead by local interactions such as competition or social information. This work improves our understanding of multi-scale factors affecting bird diversity, and has immediate applicability to landscape-level maintenance and restoration of functional oak habitat in Southern Oregon.

**PS2.28 Ham Dueñas, José Gerardo**, (Universidad Nacional Autónoma de México, Mexico, Mexico); Ornelas Rodríguez, Juan Francisco (Instituto de Ecología, A.C., Xalapa, Mexico)

#### BIOGEOGRAPHY OF LAMPORNIS (AVES: TROCHILIDAE): NEOGENE DIVERSIFICATION ACROSS MEXICAN AND CENTRAL AMERICAN HIGHLANDS

The genus *Lampornis* has a distribution that extends from southern USA to western Panama, mainly inhabiting mountain forests. In a previous study of mtDNA sequences were obtained to infer phylogenetic relationships within the genus but monophyly and relationships among species depended on the exclusion of *L. hemileucus*. We used their mtDNA sequences and increased both intraspecific and interspecific sampling with new sequences to test monophyly of the genus. We conducted a Statistical Dispersal-Vicariance Analysis (S-DIVA) to reconstruct the ancestral ranges distribution on the main nodes. A coalescent-based divergence time inference was integrated in the estimation of interspecific divergence times using BEAST. We found good nodal support for interspecific relationships of the genus, although the relationship *Lampornis rhami* -

*Eugenes fulgens* showed low support values. Interspecific relationships were similarly supported in the topologies obtained using maximum parsimony, maximum likelihood and Bayesian inference, and generally agreed with results of the previous study. The phylogenetic reconstructions indicate that *Lampornis* is monophyletic but *L. hemileucus* forming a basal and most divergent lineage, even though we increased interspecific sample size. The origin of the genus occurred in the Miocene, where the ancestral node shows a wide distribution according to the ancestral ranges reconstruction. Some terrestrial dynamic events and Pliocene-Pleistocene glaciations may have intervened in the intraspecific genetic divergence and the dynamic tectonic along Miocene may have favored the interspecific divergence. Divergence estimation within *Lampornis* corresponded temporally and geographically to the formation of the Trans-Mexican Volcanic Belt and mountainous systems in southern Mexico and Central America. Undoubtedly the use of phylogenetic and space-time data, and increased sample size, helped to produce a more robust hypothesis of the genus relationships and, consequently, a more reliable approach in the biogeographic history.

**PS2.78 Hamel, Nathalie.** (Puget Sound Partnership, Tacoma, United States); Sauer, John (USGS Patuxent Wildlife Research Center, Laurel, MD, United States); Pearson, Scott (Washington Department of Fish and Wildlife, Olympia, WA, United States)  
WHAT BIRDS CAN TELL US ABOUT BIG PROJECTS:  
USING BIRDS AS INDICATORS OF ECOSYSTEM  
RECOVERY IN PUGET SOUND, WA

Conservationists and managers are interested in demonstrating the effectiveness of ecosystem restoration actions. Carefully chosen indicators tell us not only about the health of systems but also can diagnose why some actions succeed while others do not. Puget Sound is a large estuary in the Salish Sea, Washington State, USA, where multi-stakeholder, region-wide efforts to restore the health of the ecosystem are underway. A portfolio of indicators and ecosystem recovery targets was designed to track the outcome of recovery efforts and spur management and conservation actions, with terrestrial birds as one of the selected components. Bird populations are compelling candidate indicators as species often show specific habitat preferences and long-term datasets exist from citizen-science derived monitoring, thereby meeting published criteria for useful indicators (e.g., sufficiently sensitive, data are available, spatially broad, etc.). Using the North American Breeding Bird Survey, which has 45 years of data and >40 routes around the Salish Sea, we developed indicators based on annual abundance of terrestrial bird species. We calculated values both for individual species but also for functional groups of species that characterize specific aspects of communities (forest interior, riparian, and human development); collectively, changes in the species abundances should reflect changes in the quality and quantity of these habitats. Of the species analyzed, results showed significant declines for over a quarter of the species and 15% of species significantly increasing (mainly synanthropic species), possibly reflecting the loss of forest and riparian habitat throughout the region but also the increase in urban habitat. Species within groups did not have consistent trends and displayed imprecise composite indices, thereby limiting the usefulness of the selected functional groups as indicators of habitat condition. Annual abundance of select terrestrial bird species or groupings may prove informative for telling us whether we achieved our restoration goals, but may need to be coupled with actual changes in ecosystems and parsed by life history attributes of the species.

**F4.4 Hamel, Paul,** (US Forest Service, Stoneville, United States); McNicholl, Martin (Burnaby, BC, Canada); Kirkconnell, Arturo (Museo Nacional de Historia Natural, Habana, Cuba)

MIXED SPECIES MIGRATORY WARBLER FLOCKS ON  
CUBA WITH AND WITHOUT THE NUCLEAR SPECIES  
YELLOW-HEADED WARBLER (TERETISTRIS  
FERNANDINAE)

Mixed Species Bird Flocks are a familiar component of the avian ecology of Neotropical habitats, including some Caribbean islands. We studied the occurrence of mixed species bird flocks in Cuba, to address questions related to flock membership by nonbreeding migratory wood warblers (Family Parulidae) in different Cuban habitats during the Nearctic winter. In certain portions of the island, mixed species flocks of migrants form around small groups of Yellow-headed Warblers (*Teretistris fernandinae*); flocks also form in habitats in which the Yellow-headed Warblers do not occur. We tallied more than 160 mixed species flocks in native vegetation in Matanzas Province and in anthropogenic habitats in La Habana Province. Virtually all mixed species bird flocks in native habitats within the range of Yellow-headed Warbler include at least one individual of this species. However, migratory warbler abundance and species richness of flocks was independent of the presence of Yellow-headed Warblers (total migratory warblers:  $F_{1,159} = 1.1$ ,  $P=0.30$ ,  $R^2=0$ ; migratory warbler species:  $F_{1,159} = 1$ ,  $P=0.32$ ,  $R^2=0$ ). We did observe differences in migratory warbler composition of flocks among native habitats in Matanzas Province. The average flock observed in this study included  $4.2 \pm 0.31$  individuals of  $2.5 \pm 0.13$  migratory warbler species. That the migratory warbler abundance and richness in flocks was similar within and outside the range on Cuba of the nuclear species Yellow-headed Warbler indicates that as a group the migratory species are facultative flock followers.

**F3.6 Hammerly, Susan,** (University of North Texas, Denton, United States); Dunn, Peter; Whittingham, Linda (University of Wisconsin-Milwaukee, Milwaukee, WI, United States); Johnson, Jeff A. (University of North Texas, Denton, TX, United States)

AN EVALUATION OF INBREEDING AND POSSIBLE  
FITNESS CONSEQUENCES ASSOCIATED WITH  
IMMUNOCOMPETENCE AND SURVIVAL OF THE  
CRITICALLY ENDANGERED ATTWATER'S PRAIRIE-  
CHICKEN

The critically endangered Attwater's Prairie-chicken (*Tympanuchus cupido attwateri*; APC) has been managed in captivity since 1992 and the current population is based on 17 founding individuals. Allelic richness in the contemporary captive APC population (2006) is significantly less than the historic wild population (<1948) and contemporary populations of other *Tympanuchus* grouse. Each year the wild APC population is supplemented with captive breed individuals, however survival is low (21%), which could be the result of multiple factors including inbreeding depression. Here we explore the consequences of reduced population size and inbreeding in the APC population by investigating the correlation between neutral genetic diversity and individual fitness-related traits in the captive-release breeding program, specifically focused on immune function and survival. Based on preliminary results, we found variability in survival to two weeks of age, with a significant negative correlation between inbreeding coefficient (F) and chick survival. To evaluate immune function, all birds were sampled immediately prior to release (n=147) in the fall of 2011, and a subset of the surviving

birds were resampled approximately five months post-release (n=37). An individuals' immunocompetence was obtained using multiple techniques that assessed both innate and acquired immune response, results of which will be forthcoming at the conference.

**PS2.82 Hammond, Ruby**, (Kauai Forest Bird Recovery Project, Hanapepe, United States); Foster, Jeffrey (Northern Arizona University, Flagstaff, AZ, United States); Crampton, Lisa (Kauai Forest Bird Recovery Project, Hanapepe, AZ, United States); Theimer, Tad (Northern Arizona University, Flagstaff, AZ, United States)

#### EFFECTS OF RODENT PREDATION ON NESTING SUCCESS OF FOREST BIRDS ON KAUA'I

Kaua'i is home to eight indigenous forest bird species, six of which are endemic. Two endemics, the 'Akikiki (*Oreomystis bairdi*) and 'Akeke'e (*Loxops caeruleirostris*), were listed as federally endangered in 2010 due to a nearly 50% decline in population numbers and a reduction in both species' ranges (88km<sup>2</sup> – 40km<sup>2</sup>) since the 1970s. The reproductive biology of both species is poorly understood but, like all Hawaiian forest birds, they evolved in the absence of native rodents. Nest predation by the arboreal black rat (*Rattus rattus*) is believed to impact nesting success of 'Akikiki and 'Akeke'e, and is potentially a primary cause for their decline. To assess the reproductive success of 'Akikiki and 'Akeke'e, and to quantify the impact of black rats on these and other arboreal nesting species on Kaua'i, we searched for and monitored their nests and those of five other forest bird species. Of these, the introduced Japanese White-eye (*Zosterops japonicus*) presumably has a different response to nest predation due to a long evolutionary history with several native rodent predators in its native range. We measured nest-site characteristics and evaluated the relationship between nest height and nest predation by comparing predation rates of native birds and the Japanese White-eye. Additionally, we used an artificial nest study to determine if nest predation was greater at lower nest heights. We present results from the first year of studying forest bird nesting success.

**F12.8 Hanley, Daniel**, (University of Guelph, Guelph, Canada); Norris, Ryan (University of Guelph, Guelph, ON, Canada); Diamond, Tony (University of New Brunswick, Fredericton, NB, Canada); Holberton, Rebecca (University of Maine, Orono, ME, ME, United States); Kelly, Kevin (University of New Brunswick, Fredericton, NB, Canada)

#### HOW HAVE LONG-TERM CHANGES IN CLIMATE AND OCEAN PRACTICES INFLUENCED ATLANTIC PUFFIN DIET AND BILL COLORATION?

Global climate change and fisheries practices threaten to alter the behaviour and fitness of many species, and the ability to understand how past events have influenced wildlife is imperative for planning effective management strategies in the future. In this study, we examined long-term changes in diet and bill colouration in the Atlantic Puffin. We used stable isotope analyses from preserved feathers, and bill reflectance measures to estimate how puffin diets and bill colour have changed over the past 150 years. In addition, we coupled this information with long-term climate data to construct a model to predict how Atlantic Puffins have responded to patterns of global climate change. Here, we show that Atlantic Puffin diet and bill colouration are linked to broad environmental variables such as the North Atlantic Oscillations as well as historic records of baleen whale catch, both of which likely influence annual variation in krill abundance which is an important source of

dietary pigments. Our findings show that this colonially nesting seabird has experienced annual fluctuations in both environmental and anthropogenic pressures that have influenced diet, and consequently bill color. Understanding long-term fluctuations in diet and population dynamics is critical for management decisions for numerous species, and if those dietary fluctuations influence coloration, understanding the long-term fluctuations in diet may help have important behavioural implications as well.

**PS2.41 Hanley, Daniel**, (University of Guelph, Guelph, Canada);

#### EGGSHELL CONSPICUOUSNESS AND PATERNAL BROOD PATCH DEVELOPMENT IN THE AMERICAN THRASHERS

Conspicuous blue-green egg coloration has been of interest to scientists and naturalists for more than a hundred years; however the function of this trait has never been fully understood and has spurred extensive debate. Here I examined egg coloration and patterning within the American Thrashers which exhibit dramatic variation in both of these traits. By using avian visual modeling, I have shown that blue-green chroma is positively related to degree of discriminability, while brown chroma is negatively related; however, eggshell conspicuousness is greatly influenced by the coloration of nesting material, such that brighter nests made eggs more conspicuous, regardless of whether those eggs were blue-green, brown or white. Interestingly, I have shown that the degree of male brood patch development is directly related to eggshell conspicuousness, but only when considering those eggs which are most conspicuous and at greatest risk of predation or parasitism. This suggests that species with more conspicuous eggs provide greater male care, thereby reducing risk of visual detection. These results provide further insight into how parental strategies change in response to selection pressures at the nest.

**W10.3 Hannah, Kevin**, (Environment Canada, Ottawa, Canada); Russell, Rich; Weeber, Russ; Clouston, Andrea (Environment Canada, Ottawa, ON, Canada)

#### BRING ON THE NIGHT: USING AUTONOMOUS RECORDING UNITS TO HELP DEVELOP SURVEY DESIGNS FOR COMMON NIGHTHAWKS IN BOREAL LANDSCAPES.

The common nighthawk (*Chordeiles minor*) was recently listed as a Threatened species in Canada, but the development of effective and efficient monitoring programs for this species is limited by the scarcity of quantitative descriptions of the temporal patterns in their vocalizations. We used a model-based, randomized survey design to survey for the presence of common nighthawks in a boreal region of northwestern Ontario. Using autonomous recording units (ARU's), we made over 1300 hours of nocturnal field recordings, which were systematically sub-sampled and transcribed. We detected nighthawks at 61% of sites (n=44). Detections consisted primarily of vocal "peent" calls uttered by aerially foraging birds and less-often of non-vocal, territorial "booms" given by males in proximity of mates. Nighthawks were detected throughout the night, though there were pronounced peaks in both vocal and non-vocal activity after sunset and prior to sunrise. We found little variation in detectability of nighthawks associated with lunar cycle, even though this has been suggested as important for some nightjars. Recent advances in the programmability, durability, and cost-effectiveness of commercially available ARU's offer value-added benefits to broad-scale surveys. Transcribing sub-samples from large volumes of field recordings provides an effective and



efficient means of extracting data to confirm the presence of target species, while helping to improve on the design of future surveys.

**W14.3 Hanson, Matthew**, (Florida Atlantic University, Plantation, United States); Baldwin, John (Florida Atlantic University, Davie, FL, United States)

#### CHANGES IN THE FOOD HABITS OF BREEDING BALD EAGLES (*HALIAEETUS LEUCOCEPHALUS*) IN FLORIDA BAY, EVERGLADES NATIONAL PARK

Beginning in the late 1980s, Florida Bay underwent dramatic ecological changes due to altered freshwater inflows from the Everglades that caused a cascade of effects, including changes in prey assemblages. At nearly the same time, local Bald Eagle (*Haliaeetus leucocephalus*) populations began to decline and have continued ever since. We documented food habits of the struggling Bald Eagle population to look into the hypothesis that food is a limiting factor to their success. We collected prey remains from nest sites at the end of the breeding season and compared these to similar historical data from 1973-1974. 571 prey remains (30 species) from 34 collections at 21 nest sites were collected in 1973-74, and 419 remains (33 species) from 13 collections at 11 nest sites were collected in 2010-11. We found remains consisted of 81% fish and 16% birds in the 1973-74 and 77% fish and 21% birds in 2010-11. Hardhead Catfish (*Arius felis*) made up the majority of prey remains in both time periods, and increased from 68% to 81% of fish and 55% to 63% of all remains from 1973-74 to 2010-11. Of the top five avian species most common in 1973-74, only one, the Double-crested Cormorant (*Phalacrocorax auritus*), is apart of the top five most common avian species in 2010-11. Also, the two most present avian species in 1973-74 were not present in 2010-11. The overall compositions of prey remains from all nest sites are significantly different between time periods (ANOSIM,  $r$ -value = 0.171,  $p$  = 0.024). When comparing only nest sites where collections were made during both time periods, there is still a significant difference ( $p$  = 0.007). These results help support the theory that Bald Eagle food habits have recently changed due to altered prey assemblages of Florida Bay, possibly contributing to their declines.

**PS1.23 Hargrove, Lori**, (San Diego Natural History Museum, San Diego, United States); Unitt, Philip (San Diego Natural History Museum, San Diego, United States)

#### A CENTURY OF BIOGEOGRAPHIC SHIFTS IN THE AVIFAUNA OF SOUTHERN CALIFORNIA UNDER RAPID CLIMATE CHANGE (SAN JACINTO MOUNTAINS 1908-2008)

In 1908, Joseph Grinnell, Harry Swarth, Charles Richardson, and Walter Taylor thoroughly surveyed the San Jacinto Mountains, covering 20 sites ranging in elevation from 130 to 3300 m and recording all vertebrates, including 166 species of birds. The most intensive survey of the fauna of southern California before large-scale urbanization, it affords a unique opportunity for comparison. One century later we are retracing their path to assess how the area's wildlife has changed. The San Jacinto Mountains form a sky island surrounded by desert and urbanization in a region of rapid warming (up to 5 ° C since 1961). Warming is expected to cause upward elevational shifts, northward latitudinal shifts, and extirpations at the trailing edges of species' ranges. This study is testing how consistently these expectations are met—by habitat, taxon, range limit, and seasonal status—and will evaluate how fire and other environmental changes contribute to variation in responses. We have now completed >50% of three week-long surveys at

each site, allowing for comparison of coarse-scale relative-abundance rankings in the two periods, and we related species with strong differences to 100-year changes at each site including temperature, precipitation, urbanization, and time since fire. Preliminary results illustrate that some species are shifting in directions predicted by climate change, but many shifts are contrary to expectations. Of 50 passerines analyzed, 21 shifted upward in elevation and 5 shifted downward (average weighted mean elevation shift +127 m,  $p$  < 0.05). Canonical correlation analysis reveals that climate-change variables are relatively important in explaining upward shifts, while fire history and urbanization are more important in explaining downward shifts. Examples following climate-warming expectations include the probable extirpation of the Sharp-shinned Hawk, implying northward retraction of its breeding range, and upslope retraction of the Yellow-rumped Warbler. Yet ranges of other forest birds (e.g., Hermit Thrush, Townsend's Solitaire) have extended south, likely facilitated by lack of fires at higher elevations. At least 22 species have decreased, while 25 have colonized since 1908. This study is exploring interspecific differences in climate-change responses, updating species' conservation status, interpreting changes and their causes in the context of natural history, and establishing a new basis of comparison for long-term changes.

**SAT13.5 Harlow, Zachary**, (University of California, Los Angeles, Los Angeles, United States); Collier, Travis (University of California, Davis, Los Angeles, CA, United States); Kirschel, Alex (Edward Grey Institute, Oxford, United Kingdom); Taylor, Charles; Cody, Martin (University of California, Los Angeles, Los Angeles, CA, United States)

#### SONG TYPE USE DURING COUNTERSINGING AND THE FUNCTION OF DUETTING IN THE WHITE-BREASTED WOOD-WREN (*HENICORHINA LEUCOSTICTA*) USING SIMULATED INTRUSION PLAYBACK EXPERIMENTS AND MICROPHONE SENSOR ARRAY LOCALIZATION

Birds sing to attract prospective mates and to deter potential rivals from their territories. There is much evidence in the literature for song type matching and song type switching by male songbirds during countersinging displays, but little is known about possible differences in the signal value of individual song types in this context. The literature also supports a number of explanations for male/female duets while countersinging. I will present data collected from *Henicorhina leucosticta* in a lowland rainforest in Southern Mexico for two studies. In the first experiment we examined how responses by territorial males may vary based on the song type produced by potential rivals. 12 *H. leucosticta* were exposed to non-neighbor playback experiments consisting of four common song types, two of which are replicated with the addition of high-frequency introductory notes. Song type matching is a common response to playbacks except for one unique but otherwise common song type that is never matched. Introductory notes are found to be specific to certain song types and are associated with a significant time delay in initiating a response. These patterns suggest that the signal value of different song types and adding extra notes to song types play an important role in interactions between signalers and receivers. Additionally, I will describe an experiment to assess the function of duetting in this species conducted with a wireless eight-node (32-microphone) sensor array. We used a dual-speaker playback apparatus to broadcast male solos, female solos or simulated duets to seven established pairs. Preliminary results support territory defense over mate guarding as the primary function of duetting behavior in this species.

**T14.6 Harness, Richard**, (EDM International, Inc., Fort Collins, United States); Juvvadi, Pranay (Raptor Conservation Foundation, Hyderabad, Canada)

#### AVIAN ELECTROCUTIONS IN WESTERN RAJASTHAN, INDIA

Providing electricity to rural India communities is a government priority, but the environmental impacts of new infrastructure are not always considered. To assess avian electrocutions on developing infrastructure, we visited recently constructed distribution power lines in western Rajasthan. We visited 675 rural poles located south and west of Bikaner servicing farms and rural villages. These concrete poles were constructed with grounded metal crossarms and grounded pole top pin supports. We detected 162 bird carcasses under 103 structures, including 14 raptors consisting of Common Kestrels (*Falco tinnunculus*) (n=5), White-eyed Buzzards (*Butastur teesa*) (n=4), Tawny Eagles (*Aquila rapax*) (n=2), and three owl species.

Although burn marks were visible on some birds, we did not conduct necropsies. During inspections 60 House Crow (*Corvus splendens*) carcasses were noted under 50 poles. Due to reports of H5N1 virus responsible for mass death of crows in Jharkhand, India, (1500km from our study sites) we inspected 131 de-energized poles in similar habitat to help rule out disease as a significant causal factor. Only one carcass was discovered under de-energized structures, a House Crow. A chi-square test confirmed our hypothesis that carcasses were more likely detected under energized lines ( $X^2 = 25.04$ ,  $df = 1$ ,  $P < 0.001$ ). Using AICc modeling, the number of jumpers and the height of the center insulator effectively predicted electrocution risk. Specifically, electrocution risk increased with an increasing number of jumpers, and increased when tangent structures had their center pins mounted lower to the grounded pole top.

**F2.3 Harriman, Vanessa**, (University of Saskatchewan, Saskatoon, Canada); Clark, Robert (Environment Canada, Saskatoon, SK, Canada); Dawson, Russell (University of Northern British Columbia, Prince George, BC, Canada)

#### SEASONAL PATTERNS OF OFFSPRING QUALITY AND SURVIVAL RATES ARE RELATED TO PARENTAL AND ENVIRONMENTAL QUALITY IN TREE SWALLOWS (*TACHYCINETA BICOLOR*): RESULTS OF SHORT-TERM EXPERIMENTS AND MARK-RECAPTURE ANALYSES OF LONG-TERM DATA.

Two primary hypotheses could explain why late-breeding birds typically experience low reproductive success but the veracity of these ideas has not been fully resolved. The quality hypothesis predicts that early breeding individuals are of higher quality and produce more surviving offspring whereas the date hypothesis asserts that environmental quality declines within the breeding season (with seasonally declining food supply being the primary cause of reduced offspring survival, i.e., food limitation hypothesis). We tested the quality and date hypotheses by combining short-term experiments with mark-recapture analyses obtained from >8,500 nestlings over 19 years, and assessed whether nestling survival rates were positively related to breeding habitat quality (indexed by wetland abundance) and favorable overwinter conditions (indexed by global climate indices). Short-term experiments were conducted on two separate breeding sites during two years. To control for parental quality, hatching date of some clutches was delayed by 4 days. Concurrently, brood size manipulations were applied to control and delayed nests to alter food available to each nestling. Results of the experimental manipulations were most consistent with the date hypothesis. Enlarged broods contained lighter

nestlings in both delayed and control nests as predicted by the food limitation hypothesis. Furthermore, nestling head-bill and primary feather lengths grew faster with increasing food abundance. Mark-recapture analyses confirmed that late-breeding individuals produced fewer surviving offspring and also that apparent survival was negatively related to nestling body mass and positively related to the age of the female parent irrespective of hatching date. Furthermore, nestling survival was positively related to wetland abundance (which is strongly linked to food abundance) in the year of hatching. Our short-term manipulations suggest that seasonal decline in nestling quality is closely associated with food abundance. Our long-term data suggest that nestling quality and conditions experienced during the breeding season, rather than winter climate, are better predictors of first-year survival. These findings have important implications for population dynamics of temperate-breeding insectivorous birds, for which food availability is intricately linked to local climatic conditions.

**PS1.106 Harris, Rebecca**, (University of Washington, Seattle, United States); Birks, Sharon (Burke Museum of Natural History, Seattle, Canada)

#### EVOLUTION OF NESTING BEHAVIOR IN MEGAPODES.

Megapodes (family Megapodiidae) have evolved curious nesting strategies, which releases them from many of the constraints of post-laying parental care. These birds use diverse types of environmental heat sources for incubation, including solar radiation, geothermal heat, and microbial decomposition. They harness these heat sources via two main nesting strategies: 1) mound-building or 2) burrow-nesting. Nearly every aspect of their ecology, physiology, and behavior is influenced by this unique adaptation. A previous phylogeny using one mitochondrial and one nuclear loci showed a deep, early division within megapodes, which grouped most mound-building genera with an unusual burrow-nesting species, the Maleo, - surprising given some earlier conjectures about relationships within this family. Here, we present a multi-locus phylogeny of the megapodes, providing greater resolution for most relationships, which is critical for inferring the evolution of nesting behavior. We include two species missing from the previous phylogeny (*Megapodius laperouse* and *Aepyodius brijnii*) and a number of new subspecies of *Megapodius*, which aids in resolving the complex relationships within this island-hopping genus. We discuss the biogeography and evolution of the unique incubation behaviors of the megapodes within the context of this new phylogenetic framework.

**W15.3 Harvey, Michael**, \* (Louisiana State University, Baton Rouge, United States); Smith, Brian (Museum of Natural Science and Department of Biological Sciences, Louisiana State University, Baton Rouge, United States); Brumfield, Robb (Museum of Natural Science and Department of Biological Sciences, Louisiana State University, Baton Rouge, LA, United States); Faircloth, Brant (Department of Ecology and Evolutionary Biology, University of California, Los Angeles, Los Angeles, CA, United States); Glenn, Travis (Department of Environmental Health Science and Georgia Genomics Facility, University of Georgia, Athens, GA, United States)

#### PHYLOGEOGRAPHIC DISCORD IN THE COMPARATIVE GENOMICS HISTORY OF NEOTROPICAL BIRDS

Massively parallel sequencing (MPS) can generate large amounts of genomic sequence data, but its application to comparative research has been limited by the difficulty associated with efficiently generating data from orthologous loci for many individuals. Generating this data requires a set of

markers that can be compared across individuals and laboratory methods for isolating loci and labeling them with unique identifiers for multiplexing on an MPS instrument. Comparative phylogeography serves to benefit from genomic data from MPS because it can provide sufficient volumes of data for robust analyses of complex models of evolutionary history. Neotropical lowland birds, in particular, display complex and varied patterns of phylogeographic structure that might be better understood with large datasets and complex models. We analyzed two samples from each of four populations in the lowland Neotropics (Central America, Chocó, Northwest Amazonia, and Southwest Amazonia) for each of five study species (*Xenopus* *marginatus*, *Cymbilaimus lineatus*, *Schiffornis turdinus*, *Querula purpurata*, and *Microcerculus marginatus*). We used custom probes corresponding to elements conserved across the genomes of Chicken (*Gallus gallus*), Zebra Finch (*Taenopygia guttata*), and Carolina anole (*Anolis carolinensis*) to enrich barcoded genomic libraries from each individual. Although these ultraconserved elements are invariant, the flanking regions that are sequenced are highly polymorphic and informative for phylogeographic research. Sequencing on two lanes of an Illumina HiSeq 2000 MPS instrument resulted in thousands of resulting alignments, depending on the study species. Information content varied across loci, and was generally low. Cumulatively, however, the dataset contained sufficient information for robust phylogeographic estimates. Phylogenetic trees from Bayesian analyses resolved relationships between the four populations in all species with high support. All species showed older divergences across the Andes than between the two trans- and two cis-Andean populations. Relative ages of the splits between the two trans- and two cis-Andean populations, however, differed between species. Ages of splits between all areas differed widely across species, with *Q. purpurata* and *M. marginatus* showing recent divergences and *S. turdinus* showing very old divergences. These results demonstrate the utility of ultraconserved elements and MPS in comparative phylogeography.

**F12.4 Hass, Todd**, (Burke Museum - UW, Seattle, United States); Hyman, Jeremy (Western Carolina University, Cullowhee, NC, United States); Semmens, Brice (Scripps Institution of Oceanography, San Diego, CA, United States)  
CLIMATE CHANGE, HEIGHTENED HURRICANE ACTIVITY, AND EXTINCTION RISK FOR AN ENDANGERED TROPICAL SEABIRD, THE BLACK-CAPPED PETREL *PTERODROMA HASITATA*

The destructiveness of major (Category 3-5) hurricanes along the U.S. Atlantic Ocean seaboard has been recognized for centuries. While the effects of hurricanes on coastal ecosystems is well known, the influence of hurricanes on pelagic seabirds is difficult to assess. During the annual Atlantic hurricane season (1 June - 30 November), the endangered Black-capped Petrel (*Pterodroma hasitata*) aggregates in Gulf Stream habitats from Florida to North Carolina. On at least eight occasions over the past century, hurricanes have driven petrels far inland (sometimes as far as the Great Lakes) suggesting the demise of tens to hundreds of individuals. Several recent climate change models predict a doubling in the frequency of Category 3-5 hurricanes making landfall over the next century. This paper models more than 100 years of data to characterize and compare key aspects of hurricanes that did and did not drive petrels inland. While the mode outcome of our model suggests that the increase in major hurricanes will likely double the expected number of wrecked petrels over the next century, a small but significant percentage of the simulations show the cumulative demise of nearly all extant breeders (2000 pairs). Since our

mortality projections only examine the demographic threat posed by hurricanes, our results underscore the need for mitigation of other mortality sources if the species is to avoid the risk of a population bottleneck, or worse, extinction.

**PS1.230 Hatch, Margret**, (Penn State Worthington Scranton, Dunmore, United States); Zenzal, T. J. (University of Southern Mississippi, Hattiesburg, United States); Smith, Robert (University of Scranton, Scranton, PA, United States)

A COMPARISON OF DIFFERENTIAL LEUKOCYTE COUNTS BETWEEN FIVE SPECIES OF SONGBIRD CAPTURED AT A SOUTHERN MIGRATORY STOPOVER SITE AND A NORTHERN BREEDING SITE

It remains unclear whether migratory birds suppress their immune system during migration due to energetic or other physiological costs. This question would best be addressed by sampling the same individuals along their migratory route from wintering to breeding grounds. Because this is not yet possible, another approach is to compare immune function between conspecifics captured at a southern stopover site and at a northern breeding location. Immunosuppression would be suggested if immune function was lower during migratory stopover than at the breeding location. We collected blood samples from Gray Catbirds (*Dumetella carolinensis*), Red-eyed Vireos (*Vireo olivaceus*), Ovenbirds (*Seiurus aurocapillus*), Veerys (*Catharus fuscescens*) and Wood Thrushes (*Hylocichla mustelina*) in southwestern coastal Louisiana and northeastern Pennsylvania. We used differential leukocyte counts as our initial measure of immune function. Lower leukocyte counts in all species sampled during stopover would support the hypothesis that at least one aspect of immune function is reduced during migration. Migrating Red-eyed Vireos and Veerys had lower total leukocyte counts relative to conspecifics sampled on Pennsylvania breeding grounds though we found no difference in Gray Catbirds, Ovenbirds or Wood Thrushes. Lymphocyte number did not differ between conspecifics captured at the two locations, though other types of leukocytes tended to be more prevalent in Pennsylvania birds. We plan to compare additional measures of immune function between Louisiana and Pennsylvania conspecifics to better understand potential tradeoffs between immune function and migration.

**T12.10 Hatt, Joanna**, (University of Georgia, Athens, United States); Cooper, Robert; Hepinstall-Cymerman, Jeff (University of Georgia, Athens, GA, United States)

INFLUENCE OF INSECT AVAILABILITY ON FLEDGLING SURVIVAL OF BLACK-THROATED BLUE WARBLERS

For many birds, the most critical life stage is the period after the bird has departed the nest, or the post-fledging period. However, few studies have examined the mechanisms that underlie fledgling survival. Additionally, major environmental changes could influence fledgling survival, especially through variation in food availability. The Black-throated Blue Warbler (BTBW) is a Neotropical migrant songbird that depends almost entirely on larval insects to provision its offspring. Warmer spring temperatures caused by climate change could result in a phenological mismatch between BTBW nesting and larval insect emergence. The effects of mistiming could influence BTBW productivity, but the magnitude and specific timing of influence are unknown. Our study focuses on the influence of larval insect availability on BTBW fledgling survival in the Nantahala National Forest of North Carolina, USA. For two years, we observed BTBW fledglings during the dependency period (15 days) and conducted concurrent larval insect surveys. Survival

and detection probabilities were calculated using Cormack-Jolly-Seber models in Program MARK. We developed models to test the relative importance of larval insect abundance, fledge date, and condition at fledge on probabilities of fledgling survival. We compared model fit using Akaike's Information Criterion, corrected for small sample size (AICc). Fledge date and larval insect abundance were most important in explaining fledgling survival, as represented by an additive model including these covariates. These results show that a mismatch between larval insect availability and nesting could have negative consequences for BTBW fledgling survival, and similar relationships are expected for other insectivorous migrant songbirds.

**W7.1 Hawk, Luke C.**, (Cooperative Wildlife Research Lab. and Department of Zoology, Southern Illinois University-Carbondale, Carbondale, IL, United States); Eichholz, Michael W. (Cooperative Wildlife Research Lab., Center for Ecology, and Department of Zoology, Southern Illinois University-Carbondale, Carbondale, IL, United States); Stafford, Joshua D. (U.S. Geological Survey, South Dakota Cooperative Fish & Wildlife Research Unit, Department of Wildlife and Sciences, South Dakota State University, Brookings, SD, United States)

#### APPLICATION OF LIGHT-LEVEL GEOLOCATION TO MIGRATORY BIRD MANAGEMENT

Estimates of the distribution of migratory birds during migration are important for addressing both management decisions and questions of basic migration ecology. Evidence that historical techniques such as VHF and satellite telemetry provide biased data is mounting. A proposed alternative to these techniques is the use of light-level geolocators (geolocators). Although accuracy is sacrificed with geolocators relative to some other techniques, geolocators are extremely small and lightweight decreasing the likelihood of bias associated with the ability of the bird to transport the tracking device. While the accuracy of location estimates from a geocator placed in a set position is relatively high (~190 km), the accuracy of estimated locations can be affected by various habitats producing variability in shading regimes that impede the photocells' ability to give accurate photoperiod recordings. Each habitat type encountered will have its own unique shading regime and effect on perceived photoperiod. To evaluate geocator precision we moved geolocators within and among various habitats found in southern Illinois. Geolocators maintained location estimates for latitude within a range of ~300 km in a single cover type; however, movement between cover types resulted in ranges >500 km. The range of longitude estimates doubled from 150 km to 300 km when movement was included. Our results indicate geolocators will provide an adequate level of accuracy for species that use a variety of habitats at only the largest of scales.

**PS2.218 Hayes, Matthew**, (University of Wisconsin-Madison, Madison, United States); Ivey, Gary (Oregon State University, Corvallis, OR, United States); Palmer, Charlie (Hemmera, Vancouver, BC, Canada); Casazza, Michael; Fleskes, Joseph (U.S. Geological Survey, Dixon, CA, United States); Herziger, Caroline; Dugger, Bruce (Oregon State University, Corvallis, OR, United States); Berres, Mark E. (University of Wisconsin - Madison, Madison, WI, United States)

#### POPULATION GENETIC STRUCTURE OF SANDHILL CRANES IN THE PACIFIC FLYWAY OF WESTERN NORTH AMERICA

All three migratory subspecies (Lesser, Canadian, and Greater) of Sandhill Crane (*Grus canadensis*) are found within the Pacific

Flyway of western North America. While birds from different breeding populations share common wintering grounds, each population has a distinctive migratory pathway and strong breeding site fidelity. Morphological and behavioral differences exist between populations, yet overlap of these characteristics occurs between groups. Genetic relationships and origins of these populations have not yet been evaluated. The degree of population differentiation was evaluated using genetic markers (Amplified Fragment Length Polymorphisms (AFLP) and mitochondrial DNA haplotypes), morphological measurements, and geographic breeding locations using satellite telemetry. Using birds (n=40) from three known breeding grounds as standards, GENELAND categorized most birds (91%, n=34) of unknown breeding location to one of these three breeding areas. The modal K=4 genetic clusters included these three populations but also partitioned three Canadian Sandhill Cranes (*G. c. rowani*) into a unique cluster. Based on available genetic data (including  $F_{st}$  and  $N_m$ ), we found these four distinct groups consistent with previous analyses based on morphological, behavioral, and habitat differences. We suggest the name Pacific Coast Population of Canadian Sandhill Cranes for the currently unnamed population of Canadian Sandhill Cranes breeding in coastal British Columbia and southeastern Alaska. This will differentiate it from the Pacific Flyway Population of Lesser Sandhill Cranes (*G. c. canadensis*) in southwestern Alaska and the Central Valley Population of Greater Sandhill Cranes (*G. c. tabida*) in interior British Columbia, Washington, Oregon, and California.

**PS2.197 Hayes, Matthew**, (University of Wisconsin-Madison, Madison, United States); McDonald, Mara (University of Wisconsin-Madison Bioco, Madison, WI, United States); Johnson, Kendra; Beilke, Stephanie; Louis, Michelle (University of Wisconsin-Madison Biocore Prairie Bird Observatory, Madison, WI, United States); Simmons, MS, Jerome (University of Wisconsin-Madison Bioco, Madison, WI, United States)

#### ENHANCED BIRD DYNAMICS IN SMALL PATCHES OF RESTORED TALL GRASS PRAIRIE IN WISCONSIN

Long-term studies are important in assessing habitat preferences, changes in community structures, and population dynamics in birds. We have been banding birds at the University of Wisconsin's Biocore Prairie Bird Observatory for more than 10 years. Although we are limited to one morning a week, thus giving us smaller sample sizes, we have begun to see distinct patterns within and between species. In 2001, we started comparing bird communities in a restored prairie started in 1997 versus an adjacent old field. In 2005, prairie restoration sites were increased next to the old prairie. One objective is to determine how restoration of tall grass prairie affects the associated community of birds. We started comparing <2 acres of restored prairie to an adjacent old field site of similar dimensions. We found significant differences in bird species and insect order diversities seven years after the beginning of restoration in 2004. In 2007, we found significantly higher diversity of birds and plants in the original restoration and a new restoration (2005), as compared to the old field. We also observed differences in numbers originally banded and their recapture rates for several species, both found in the prairie or on its edge. Recapture rates for five selected species were inversely correlated with their originally banded numbers (e.g., Black-capped Chickadees had  $N=48$ , recaptures 8 (~17%) whereas Song Sparrows had  $N=338$  and recaptures of only 11 or 3.2%). We hypothesized that the low recapture rates for Song Sparrows (SOSP), our most abundant summer species, might be due to an influx of early migrants moving north in the spring and south in the fall. Analyses show that most of the SOSP

recaptures were obtained during the breeding season. Thus, larger populations and not smaller territories or earlier migration may explain the low recapture rate in SOSP. Our goal is to begin to analyze population size and survivability with our data for other species. We predict we should observe higher numbers of hatch year birds in the new prairie, versus the older prairie. We will also present data on longevity of species discussed.

**PS1.125 Haynam, Robert,** (Craighead Beringia South, Bozeman, United States); Bedrosian, Bryan (Craighead Beringia South, Kelly, WY, United States)

#### GPS TRANSMITTER BIAS OF GREATER SAGE-GROUSE SURVIVAL

The greater sage-grouse (*Centrocercus urophasianus*) is a ground dwelling upland game bird in the family Phasianidae that is entirely dependent on sagebrush for successful reproduction and winter forage. The current distribution of sage-grouse is estimated to be 56% that of their pre-settlement distribution and there has been a negative trend in population sizes since extensive monitoring began circa 1965. Inspired by the tenuous conservation status of the sage-grouse, survival data was sampled from the population in Jackson Hole, WY. This known-fate data was derived from GPS/PTT and VHF monitoring and was analyzed in STATA 11.0 using the Kaplan-Meier product-limit (KM) estimator and Cox proportional hazards models. A top Cox model was selected using Akaike's Information Criterion to rank all possible models using the following covariates: age class, sex, transmitter type, and year. The top ranked model was used to estimate hazard ratios (HRs) for the best supported covariates which were sex, age class, and transmitter type. The hazard ratios for age class and transmitter type were statistically significant. The HR for transmitter type was of alarming magnitude and indicated that GPS transmitters negatively affect the survival of sage-grouse. The annual survival rate that was estimated with KM was low compared to published survival rates. A core assumption of any demographic research using telemetry devices is that there is no transmitter bias. This assumption may be particularly vulnerable to violation for GPS/PTT outfitted sage-grouse.

**F12.3 Heath, Julie,** (Boise State University, Boise, United States); Steenhof, Karen (Owyhee Desert Studies, Murphy, ID, United States); Foster, Mark (Boise State University, Boise, ID, United States)

#### CHANGES IN AMERICAN KESTREL MIGRATION AND WINTERING ARE ASSOCIATED WITH WARMER WINTER TEMPERATURES IN WESTERN NORTH AMERICA

Global climate change has affected avian migration patterns and nesting phenology. Changes in one phase of a bird's cycle will most likely affect other stages, but few studies focus simultaneously on multiple life-history events. We used western North American banding records and Christmas Bird Counts to examine whether changes in migration and over-wintering patterns were concordant with advancing American kestrel (*Falco sparverius*) nesting phenology. Consistent with previous findings, male kestrels migrated shorter distances than female kestrels, and kestrels nesting in southern latitudes migrated shorter distances than kestrels nesting in more northern areas. In addition, kestrel migration distance decreased significantly from 1960-2009 and was negatively associated with winter minimum temperatures. Christmas Birds Counts from the same time period showed increasing indices of overwintering kestrel abundance in northern states (Washington, Idaho, and Utah), where winter minimum temperatures have increased

significantly, and concomitant decreases in southern states (California and Arizona). Finally, changes in nesting phenology of kestrels in southwestern Idaho were best explained by warmer winters, not springs. Warmer winters may decrease energetic demands on migrants by allowing for shorter migration distances, decreasing thermoregulatory costs, or both. Decreased energy demands during winter may allow birds to gain resources necessary for reproduction earlier in the nesting season. Higher winter temperatures that decrease (former) constraints on early nesting may be a particularly important mechanism leading to advancing nesting phenology for species with strong seasonal declines in fecundity or intense early season competition for high-quality nesting areas.

**S2.2 Heckscher, Christopher,** (Delaware State University, Dover, United States);

#### SPATIAL AND TEMPORAL ASPECTS OF INTRATROPICAL MOVEMENT OF THE VEERY (*CATHARUS FUSCESCENS*) USING GEOLOCATORS

The Veery (*Catharus fuscescens*) is the only North American breeding songbird known to undertake intratropical migration between widely separated geographic regions. Thus, the Veery accomplishes three migrations during the course of its annual cycle and each individual maintains two geographically separate winter sites. At a Delaware study site, I affixed light-level archival units (geolocators) to adult Veeries. Migratory movements and wintering sites were documented for five adult Veeries in 2009 and ten in 2010. There was no gender bias in the arrival time of Delaware Veeries in South America; however, individuals that entered the continent prior to 15 October arrived at first winter sites earlier than those entering South America after 15 October. Males arrived at first winter sites earlier than females suggesting that some males had to compensate for late arrival into South America. Some geolocators failed in February and March but all individuals with adequate light-level data (n = 11) showed intratropical migration to a second winter site. Arrival dates at second winter sites were inversely correlated with longitude supporting the hypothesis that intratropical migration was ultimately prompted by the cyclical flood pulse of the Amazon Basin. For each individual, the geographic location of winter sites will be presented and wintering regions known to date will be delineated. This research demonstrates that geolocators can adequately document the spatiotemporal aspects of avian movement within dense tropical forests of equatorial South America and can be used to delineate critical conservation areas for species of concern.

**F14.3 Heindl, Barbara,** (Hawaii Division & Forestry and Wildlife, Pacific Cooperative Studies Unit, Hanapepe, United States); Crampton, Lisa (Hawaii Division & Forestry and Wildlife, Pacific Cooperative Studies Unit, Hanapepe, HI, United States); VanderWerf, Eric (Pacific Rim Conservation, Hanapepe, HI, United States)

#### NEST SITE LIMITATION IN THE PUAIOHI OR SMALL KAUAI THRUSH (*MYADESTES PALMERI*): USING NEST BOXES TO EXPAND THE RANGE OF AN ENDANGERED SPECIES

The Puaiohi (*Myadestes palmeri*) is a critically endangered thrush endemic to the island of Kaua'i, Hawaii, where it is restricted to the remote, high elevation forests. Puaiohi primarily nest in cavities found in steep stream-side cliffs, and nest site availability may limit the species' abundance and distribution. To address this limitation from 2000-07 nest boxes were placed in three streams occupied by Puaiohi, and have

been used several times. Nest predation by rats is a major cause of nest failure and mortality of nesting females in natural nest sites and potentially in nest boxes. Ground based rodent control near nests has limited efficacy in reducing nest predation, and the most commonly used nest box designs had not been tested for rat resistance prior to field installation. We tested these boxes in areas known to have high rat densities, but outside the range of Puaiohi, by baiting nest boxes and monitoring nightly activity with automated field cameras. Based on information from these trials, three new designs were developed that reduced the ability of rats to access boxes. We erected ten copies of each of the three rat-resistant designs beside existing boxes (n=75) in the above streams to assess whether modifications to make boxes more rat resistant deter Puaiohi from using nest boxes in the wild. Boxes were installed in the area prior to release of captive bred Puaiohi familiar with boxes and were monitored during the breeding season by field cameras and staff to assess use. We present results from our design trials and field deployment, and summarize past and present challenges and successes in the development and use of artificial nest boxes to increase reproductive potential of the Puaiohi.

**SAT9.5 Heiss, Rebecca**, (University of Memphis, Memphis, United States); Small, Thomas; Schoech, Stephan (University of Memphis, Memphis, United States)

#### AN EXPLORATION OF AGE, OXIDATIVE DAMAGE AND SURVIVAL IN THE FLORIDA SCRUB-JAY (APHELOCOMA COERULESCENS)

The predominant theory to explain aging postulates a key role for oxidative damage to biomolecules. An accumulation of oxidative damage has been documented in a wide variety of aged organisms, however, relatively little research has addressed the ability of an organism to cope with such damage via either repair or replacement of damaged molecules. We studied a relatively long-lived species, the Florida Scrub-jay, to address if oxidized biomolecules: 1) varied with age across the population; 2) varied within individuals across early developmental stages; and 3) were predictive of survival. In addition to the assessment of natural variation among young birds, we employed an experimental supplementation protocol that aimed to reduce oxidative damage in a subset of nestlings. We found that oxidative damage: 1) was significantly lower in older individuals in our population; 2) varied in biologically significant ways during early developmental stages; and 3) was not significantly related to early life survival. Our results suggest that the accumulation of oxidative damage to proteins and DNA in plasma does not occur in older individuals as many current models of aging suggest, nor does it appear that individuals with high oxidative damage levels are being eliminated from the population based upon a model of “culling” weaker individuals. We conclude that the ability to replace damaged molecules may be of some importance, and this area of research necessitates further study.

**PS2.183 Helton, Lauren**, (Arkansas State University, Jonesboro, United States);

#### USE OF FISH FARMS AND WETLAND RESERVE PROGRAM PROPERTIES BY MIGRATING SHOREBIRDS IN EASTERN ARKANSAS

Historically, eastern Arkansas was mostly composed of wetlands, including shallow ephemeral ponds in the Grand Prairie region. However, through the 20th century, many of these wetlands were converted to agricultural fields, resulting in the loss of migratory stopover habitat for a multitude of shorebirds. Currently, shorebirds have suffered extensive population declines, and little migratory stopover habitat

remains in eastern Arkansas. The Wetland Reserve Program (WRP) has converted nearly 80,000 ha of farmland in Arkansas back to wetlands, which may help provide stopover habitat for migratory shorebirds. The relatively recent growth of aquaculture in Arkansas likewise may provide foraging habitat for migrating shorebirds. Based on available WRP properties and fish farms registered with the Arkansas Game and Fish Commission, 60 sites comprising over 100 ha of wetland habitat were randomly selected for shorebird sampling. Using protocols established by the International Shorebird Survey, we are monitoring shorebird populations at 30 fish farms and 30 WRP properties. We are also measuring habitat variables, including vegetative cover, water depth, and available prey, to characterize the available habitat and habitat quality in both fish farms and WRP properties, and will relate these factors to observed shorebird species and densities. Specifically, we predict that fish farms will provide more suitable stopover habitat for shorebirds, because of available low water depth and lack of vegetative cover. Data collected during the spring migration season of 2012 will be analyzed and presented. Ultimately, our research will identify factors correlated with usage by migratory shorebirds and may indicate how best to manage these sites to provide enhanced habitat for shorebirds.

**F16.5 Henderson, Allison**, (University of Saskatchewan, Saskatoon, Canada); Stephen K., Davis (Canadian Wildlife Service, Regina, SK, Canada)

#### DOES A WORKING PRAIRIE LANDSCAPE WORK FOR WILDLIFE?: LINKING BIRD ABUNDANCE AND RANGE HEALTH IN SASKATCHEWAN, CANADA

Large-scale loss and degradation of North American native prairie coupled with sharp declines in grassland bird populations call for a clear understanding of the effects of livestock production, the dominant land use, on bird habitat selection. Ample research demonstrates that grassland birds select suitable breeding habitat based on a suite of structural and community vegetation features shaped by grazing. However, the connection between bird abundance and vegetation measures relevant to livestock grazing management is poorly studied. Range health indices are an emerging tool for assessing grassland structure and community composition that may offer biologists and range managers a common tool for achieving grassland bird recovery goals. We use point count surveys, vegetation measures and indices of range health to examine habitat- abundance relationships for ten species of grassland birds, three of which are currently listed as at risk under the Canadian Species At Risk Act. We use zero-inflated models and an information theoretic approach to assess the fit of candidate models comprised of structure and community variables associated with range health. Our preliminary results show that, across bird species, best-supported models of abundance comprise variables related to structural aspects of range health, namely litter mass (lb/acre), vegetation volume, and percent cover of bare ground. For three species, top models also contain plant species richness. Our results for five species indicate that not only structure, but the heterogeneity of key structural features, may be an important predictor of abundance. Overall, the magnitude, direction and shape of relationships between bird abundance and vegetation variables differ across bird species. We discuss implications of these findings for grazing management and grassland bird conservation with attention to the feasibility of using range health indices as a conservation tool for multiple prairie stakeholders.

**SAT16.9 Henkel, Jessica**, (Tulane University, New Orleans, United States); Sigel, Bryan; Coblenz, Kyle; Taylor, Caroline (Tulane University, New Orleans, LA, United States)

#### MIGRATION ECOLOGY OF SHOREBIRDS ON THE NORTHERN GULF OF MEXICO

The coastlines of the northern Gulf of Mexico represent important wintering and stopover habitats for 28 species of migratory shorebirds. As processes of climate change accelerate, these habitats are expected to experience accelerated and dramatic land loss. Accurate prediction of the impacts of these changes to shorebird populations requires a detailed understanding of the interactions between shorebirds and their habitats. However, the refueling performance and migration ecology of shorebirds on the northern Gulf have not been well studied. We compared plasma triglyceride (indicator of mass gain) and  $\beta$ -OH-butyrate (indicator of mass loss) concentrations in three species of migrating shorebirds (*Calidris alpina*, *C. pusilla*, and *C. mauri*) in four northern Gulf habitats. Shorebird density, foraging habitat availability, and benthic invertebrate biomass were also quantified at study sites. Across species, results suggest a relationship between fattening rates during spring migration and habitat type (Remnant wetland triglyceride levels significantly higher;  $p=0.05$ ). Shorebird density across species was highest in habitats with higher invertebrate abundance, however variation in habitat use within species was also observed. Of 72 *C. alpina* captured during Spring 2011, 51% of all adult females were captured in mudflat habitats, while 73% of all adult males were captured on sandy beaches. The results of this study highlight the importance of the northern Gulf of Mexico for migrating shorebirds, and provide the baseline information necessary for predicting the multiple ways climate change can affect populations.

**PS1.238 Hennig, Jacob**, (Illinois Natural History Survey and Department of Natural Resources and Environmental Sciences, University of Illinois, Champaign, United States); Benson, Thomas (Illinois Natural History Survey and Department of Natural Resources and Environmental Sciences, University of Illinois, Champaign, United States); Yetter, Aaron (Bellrose Waterfowl Research Center, Illinois Natural History Survey, University of Illinois, Havana, Canada); Stodola, Kirk (Illinois Natural History Survey and Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana, Canada); Stafford, Joshua (South Dakota Cooperative Fish and Wildlife Research Unit, South Dakota State University, Brookings, Canada)

#### IMPLEMENTING A NEW AERIAL SURVEY METHOD TO ESTIMATE ABUNDANCE OF SPRING-MIGRATING WATERFOWL

Anecdotal evidence suggests the Wabash River region in southeastern Illinois and southwestern Indiana is regionally important for spring-migrating waterfowl. Although the area contains a considerable amount of suitable habitat and preliminary surveys suggest extensive use by waterfowl, robust estimates of waterfowl use of this region are lacking as is information about factors influencing distribution and abundance. Examining abundance, population trends, or habitat-use of non-breeding waterfowl often involves aerial surveys, although most aerial methods are not structured to explicitly estimate error or account for imperfect detection. To begin addressing these topics, we implemented a new aerial-survey method to estimate waterfowl abundance and distribution in the Wabash River region. We divided the region into 260-ha grid cells and aerially sampled randomly selected cells each

week from early February through mid-April. Within each week, we re-sampled a subset of these cells using both aerial and ground-based surveys. Using this approach, we were able to investigate spatial and temporal patterns of waterfowl abundance while both estimating error and accounting for imperfect detection. Beyond estimating abundance, we feel this approach will be ideal for examining the effects of habitat and landscape characteristics on waterfowl distribution and, importantly, modifications of this approach to aerial surveys may be effectively applied to other regions and taxa.

**PS2.5 Hentze, Nathan**, (Simon Fraser University, Burnaby, Canada); Ydenberg, Ronald; Lank, David (Simon Fraser University, Burnaby, BC, Canada)

#### FLIGHT CHARACTERISTICS OF OVER-OCEAN FLOCKING DUNLIN (*CALIDRIS ALPINA PACIFICA*) AT BOUNDARY BAY, BRITISH COLUMBIA

Over-ocean flocking is a relatively safe but energetically-costly form of high-tide roosting where birds remain in flight. At Boundary Bay, in southwest British Columbia, this behavior became common from the mid-1990s onwards, coinciding with increasing raptor populations. Over-ocean flocking involves trade-offs between minimizing energy-expenditure and minimizing predation risk during non-migratory periods. In order to determine the energetic demands of this behavior, we tracked over-ocean flocking of Pacific Dunlin (*Calidris alpina pacifica*) with a marine radar system, video camera, and theodolite, at Boundary Bay between October 2009 and January 2011. The majority of individual Dunlins present at Boundary Bay participated in over-ocean flocking, with flocking lasting an average of  $187 \pm 14$  (SE) continuous minutes per day (range 75-390 min). We compared flight attributes of these over-ocean flocks with non-migratory transit flights. Visually, the flight styles differed, with over-ocean flocks appearing larger, irregularly-shaped, and with frequent but slow directional changes. Transit flights, comprising fewer individuals, were relatively straight and rapid. Birds in both flight types had the same wingbeat characteristics during the flapping phase, with wingbeat frequencies of 6.2 Hz. Over-ocean flocking birds incorporated lengthier gliding phases into their flight (14% of total flight time) than transit birds (1%). Comparing only individuals that exhibited at least some gliding behavior, 23.8% of flight time was spent gliding for over-ocean flocking birds compared to just 7.7% for individuals in transit flights. Over-ocean flocking Dunlins flew at 8.4 m/s, close to the predicted minimum-power speed of 9.5 m/s. In contrast, birds in transit flights flew at speeds exceeding the 15.9 m/s predicted maximum-range speed. These results show that individuals in over-ocean flocks, by incorporating lengthier gliding phases, are able to fly at speeds that minimize flight-energy expenditure. This is significant given the relatively large proportion of time spent in flight daily. In contrast, birds in transit flights are neither minimizing energy expenditure nor maximizing distance flown per unit of energy. Over-ocean flocking allows Dunlins to minimize flight-energy costs relative to other flight types, while simultaneously minimizing predation risk.

**PS1.43 Hepp, Gary**, (Auburn University, Auburn University, United States); Varner, Dana (Auburn University, Leesburg, GA, United States); Bielefeld, Ron (Florida Fish and Wildlife Conservation Commission, Sebastian, FL, United States)

#### NESTING ECOLOGY OF FLORIDA MOTTLED DUCKS USING ALTERED HABITATS

Much of the natural habitats of south Florida have been lost to urban and rural development and conversion to crop fields,

citrus orchards, and pastures. Information about Florida mottled ducks (*Anas fulvigula fulvigula*) nesting in these disturbed landscapes is limited. We used radio-tagged females to locate and monitor nests to determine how this unique subspecies has responded to changes in its environment. Nests were found in a variety of urban and rural habitats in the Upper St. Johns River Basin ( $n = 21$ ) in east-central Florida and in Martin, Palm Beach, and Broward Counties in south Florida ( $n = 56$ ). Preliminary results suggest that Mayfield nest success estimates in these areas are among the highest reported for mottled ducks (29.4%). Model results indicated that there was no difference in daily survival rates (DSR) of nests between the two study areas. Additionally, DSR did not vary with distance of nests to the nearest building, nest initiation date, and height and density of vegetation near the nest. Vegetation height and density were significantly greater at nests when compared to nearby points, but height and density of vegetation did not differ between hatched and failed nests.

**F11.1 Hepp, Gary**, (Auburn University, Auburn University, United States); Kenamer, Robert (Savannah River Ecology Lab, Aiken, United States)

#### INCUBATION TEMPERATURE INFLUENCES APPARENT SURVIVAL AND RECRUITMENT OF FEMALE WOOD DUCKS

Incubating avian parents must balance demands of self-maintenance with providing the proper thermal environment for egg development. Low incubation temperatures can lengthen the incubation period and cause changes to neonate phenotype that may influence subsequent survival. We artificially incubated Wood Duck (*Aix sponsa*) eggs at three temperatures within the range of temperatures of naturally-incubated nests and tested the effect of incubation temperature on duckling survival. Length of the incubation period was inversely related to incubation temperature. Newly-hatched ducklings incubated at the low temperature were smaller and had about 20% less lipid mass than ducklings from the mid or high temperatures. Ducklings were individually marked, and broods comprised of ducklings from each temperature treatment were placed with wild foster mothers within 24 hrs of hatching. Female ducklings are philopatric and were recaptured as nesting adults. We found that females that had been incubated at the low temperature were less likely to survive and be recaptured than females incubated at higher temperatures. To our knowledge, this is the first avian study to link developmental conditions experienced by neonates during incubation with apparent survival and recruitment of individuals to the breeding population.

**PS2.113 Hernandez, Norma**, (UNAM, MEXICO, Mexico); ARIZMENDI, MARIA DEL CORO (UNAM, MEXICO, Mexico)

#### SEXUAL DIMORPHISM IN MORPHOLOGICAL CHARACTERS IN HUMMINGBIRDS

Sexual dimorphism in shape and morphology is common in animals and dioic plants. Among birds and other vertebrates sexes are different in size and in the proportion of other body parts. Hummingbirds present sexual dimorphism in size, bill morphology and foraging strategies. Causes of sexual dimorphism are varied and difficult to probe unequivocally. Inside one species sexual dimorphism in bill length can appear if there is differential resource use and niche segregation has occurred. Territorial species are more closely associated with resources being more specialists. Wing chord have been associated with flight abilities and speed that can be also used by hummingbirds during territorial fights. The purpose of this work was to document the sexual dimorphism in bill and wing size

associated with territorial behavior and resource use. Bird collections at UNAM and Universidad Nacional de Colombia were analyzed. Bird species measured were the ones used by McGuire et al. (2009). For each individual bill length, wing chord and weight was recorded. Using a comparative phylogenetical approach we explored the allometric relationship among territorial and traplining individuals in 117 hummingbird species. The characters measured were positively correlated with body size; dimorphism in bill and wing chord size was positively correlated with territorial behavior.

Key words: sexual dimorphism, hummingbirds, territoriality, trapliners, body size.

**PS1.201 Herrera Alsina, Leonel\*** (Posgrado en Ciencias Biologicas. Centro de Investigaciones en Ecosistemas. Universidad Nacional Autonoma de Mexico, Morelia, Mexico); Arita, Héctor T. (Centro de Investigaciones en Ecosistemas. Universidad Nacional Autónoma de México, Morelia, Mexico)

#### WIND TURBINES AND BIRDS: A PHYLOGENETIC AND MORPHOLOGICAL APPROACH

Identifying those traits that make birds more prone to collisions is of paramount importance in reducing the risks associated with the operation of wind turbines. Here we analyze an extensive database of bird occurrence and fatalities caused by a wind farm in the Tehuantepec Isthmus of southern Mexico. We examined the set of collided bird species looking for morphological and ecological traits that could explain their proneness to collisions. We also examined how these traits are reflected in a phylogeny of all species present in the area, producing trends that can be detected by phylogenetic structure metrics.

Using maximum likelihood methods, a phylogeny that included all the species that potentially occurring in the area was constructed. Also, four morphological traits linked to aerodynamics were quantified for each species. Null models were constructed simulating 10 000 random subsets of species; for each simulated subset, phylogenetic metrics and the means of the morphological traits were calculated and compared to real figures.

Null models showed that birds that birds with longer wingspans and higher wing loadings are more likely to fly into the risk zone and, when flying close to the blades, smaller birds has an increased risk of crashing and dying. From a phylogenetic perspective, birds venturing into the risk zone tend to be related to each other, but species that are actually hit by the blades are small birds belonging to the several clades represented in the phylogeny.

**PS1.61 Hethcoat, Matthew**, (University of Wyoming, Laramie, United States); Chalfoun, Anna (University of Wyoming, Laramie, WY, United States)

#### INCREASED NEST PREDATION AND NATURAL GAS DEVELOPMENT; WHAT'S COMING DOWN THE PIPE FOR SAGEBRUSH OBLIGATE SONGBIRDS?

Natural gas development has rapidly increased within sagebrush dominated landscapes of the Intermountain West. Prior research in the Upper Green River Basin, WY, demonstrated increased nest predation of sagebrush-obligate songbirds with higher densities of natural gas wells. To better understand the mechanisms underlying this pattern, in 2011 we tested alternative hypotheses for increased songbird nest predation across a gradient of natural gas development intensity, indexed by well density. The predator abundance hypothesis states that increased nest predation is due to a numerical increase of predators with increased development intensity. Alternatively, the habitat structure hypothesis states that increased



development intensity influences habitat metrics such as nest concealment, thereby facilitating nest discovery by predators. We monitored nests of three focal species; Brewer's sparrow, sage sparrow, and sage thrasher at twelve sites within two energy fields. We conducted predator surveys via point counts, diurnal searches, maintaining scent stations, and deploying infrared nest cameras. In addition, we measured habitat metrics at nest sites and paired random points to determine which microhabitat features are important in nest site selection, how these features influenced predation risk, and how development intensity influenced their variation on the landscape. We modeled the effects of well density, predator abundance, and microhabitat features in relation to a constant survival model. Top supported models varied among focal species with strong support for shrub density, seasonal variation, and constant survival for Brewer's sparrow, sage sparrow, and sage thrasher respectively. However, there was not overwhelming support for a single model despite clear habitat selection preferences and decreased daily nest survival rates with increasing well density for sage sparrows and sage thrashers. Daily nest survival rates were relatively high in 2011, potentially muting predation patterns seen in previous years. Ongoing research will enable us to explore variation within and across seasons in predation risk. Shrubland bird populations are among the most rapidly declining groups of avian species in North America. With increasing demands for domestic sources of energy, the identification of specific mechanisms influencing nest predation is a critical next step in developing clear strategies for mitigating the impacts to songbirds breeding in energy fields.

**PS1.56 Heung, Mary**, (Trent University, Peterborough, Canada);

#### THE EFFECTS OF SOIL MOISTURE ON AVIAN INSECTIVORES

Soil moisture can have significant effects on the food web, as many important interactions exist between the environment, plants and animals. We are particularly interested in its effects on nest site selection, nest success and parental provisioning of avian communities. The effect of soil moisture was studied in the Ganaraska Forest, located in Southern Ontario. Our project focused on insectivorous birds from different feeding guilds - Red-eyed Vireos (*Vireo olivaceus*), Ovenbirds (*Seiurus aurocapilla*), and Eastern Wood-Pewees (*Contopus virens*). Parental provisioning rates at the nest were observed at various sites with different moisture levels, and nest site selection was also examined to compare wet and dry sites. Vegetation surveys and soil samples were taken from the field to be analyzed. Soil moisture is crucial to insect reproduction as they need the moisture to lay eggs and to ensure that they will hatch and survive. Lower moisture levels would lead to the production of fewer insects. In areas of lower insect abundance, we predicted that birds will have a lower provisioning rate as they will have to travel a greater distance to find food for their young. This could potentially reduce their nest success as they will have to leave their nest unattended for longer periods of time with a higher chance of it being predated. Preliminary results show the provisioning rates of the EAWP to be not significantly different in the respective sites. The study will hopefully provide an overall understanding on the bottom-up effects of avian insectivores and further insight on the management of deciduous and coniferous forests.

**SAT2.3 Hill, Jason**, (Pennsylvania Cooperative Fish and Wildlife Research Unit, University Park, United States); Diefenbach, Duane (U.S. Geological Survey, Pennsylvania

Cooperative Fish and Wildlife Research Unit, University Park, Canada)

#### POPULATION ECOLOGY OF GRASSLAND SPARROWS IN WOODY GRASSLANDS: AN EXPERIMENTAL TEST OF STRUCTURE ON RECLAIMED SURFACE MINE GRASSLANDS

Grasshopper and Henslow's sparrow populations have experienced substantial declines across their range. While the causes of these declines are many, loss of habitat due to agricultural conversion has been perhaps the most critical. Coal mining practices in the Eastern United States on the other hand have produced substantial new acreage of grasslands during the reclamation process. These surface mine grasslands have been recognized for their importance to grassland sparrow populations. In the absence of management actions, however, these grasslands eventually become covered in woody vegetation, and perhaps unsuitable to grassland birds. Several research projects have observed negative effects of woody vegetation in grasslands on these birds in observational settings. We designed a three-year experimental study to monitor grasshopper (*Ammodramus savannarum*) and Henslow's (*A. henslowii*) sparrow populations across eight 20.2 acre plots of surface mine grasslands with various amounts of scattered woody vegetation coverage (5-35%). After the first summer we removed the standing woody vegetation from half of the plots and monitored the change in grassland sparrow populations in the following summer. Grasshopper and Henslow's Sparrows populations did not uniformly increase following woody vegetation removal. Nest success for both species was unrelated to the amount of woody vegetation near the nest, and fledgling production did not increase following woody vegetation removal. Robust design models indicated large differences between male and female survival, recapture probability and temporary emigration for both species, but survival and return rates were not affected by the treatment effects. Our results suggest that the removal of woody vegetation from surface mine grasslands is expensive and has only a limited positive effect on these species. We highlight strategies, alternative to woody vegetation removal that may better conserve grassland bird populations on surface mine grasslands.

**PS1.35 Hill, Jason**, (Pennsylvania Cooperative Fish and Wildlife Research Unit, University Park, United States); Walsh, Jennifer (Department of Natural Resources and the Environment, University of New Hampshire, Durham, NH, United States); Kovach, Adrienne (Department of Natural Resources and the Environment, University of New Hampshire, Durham, United States); Elphick, Chris (University of Connecticut, Storrs, CT, United States)

#### SALTMARSH SPARROWS AND MALE-BIASED NESTLING SEX RATIOS

Avian species frequently have unbalanced adult sex ratios, but few species also have skewed offspring sex ratios. Adult females, however, should modify their offspring's sex ratios and invest more in the sex with the greatest future reproductive potential. We examined the relationship between adult female body condition, nestling morphology, reproductive timing, and brood sex ratios in the Saltmarsh Sparrow (*Ammodramus caudacutus*), a species with extreme levels of multiple paternity where males provide no parental care and in which highly biased adult sex ratios have been reported. We conducted molecular sexing of 150 nestlings from 49 Saltmarsh Sparrow nests over two years in salt marshes of coastal Connecticut. The nestling sex ratio was significantly male biased (58%), and did not vary with brood size. Nests initiated immediately after high spring

tides have been shown to have greater survivorship, but we found no relationship between sex-ratio bias and spring tides. Male and female nestlings differed morphologically just prior to fledging and the pre-fledging body mass of nestlings gradually declined through the nesting season in both sexes (0.06 g/day). Females in relatively good body condition, however, were no more likely to produce sons, contrary to expectation. Saltmarsh Sparrows appear to be an exception to the pattern found in other species with male-biased adult populations, which typically have balanced offspring sex ratios. These results may help to refine future population projections and should be incorporated in population viability analyses.

**PS1.244 Hillman, Matthew,** (Virginia Tech, Blacksburg, United States); Karpanty, Sarah (virginia Tech, Blacksburg, VA, United States); Fraser, James (Virginia Tech, Blacksburg, VA, United States)

#### ABUNDANCE, SURVIVAL, AND MOVEMENT RATES OF LEAST TERNS (*STERNULA ANTILLARUM*) AT CAPE LOOKOUT NATIONAL SEASHORE, NORTH CAROLINA

We color-banded and resighted Least Tern (*Sternula antillarum*) chicks and adults at Cape Lookout National Seashore, North Carolina, from May-August 2010-2011. We used bownets to capture 111 adults and performed resighting surveys twice weekly at each of 6 colonies. Of the 41 individuals banded in 2010, we resighted 73% in 2011; at least 2 of which nested within several meters of their 2010 nest sites. We resighted 60% of all banded adults at least once within their previous year's nesting colony, while 13% were observed at different colonies 5-30 km away. Of the 114 chicks banded in 2010, we observed 9 at or near their natal colonies in 2011, although none were nesting. We used Cormack-Jolly-Seber models in Program MARK to estimate within-season chick survival in 2010 and 2011. Our findings suggest high site fidelity of Least Terns at Cape Lookout National Seashore with some movement to and from adjacent islands outside the jurisdiction of the National Park Service. Resighting work in 2012 will provide additional information on apparent annual adult and chick survival, natal site fidelity, and the potential to document larger-scale regional movements of banded individuals.

**W8.2 Hindley, John,** (University of Lethbridge, Lethbridge, Canada); Burg, Theresa (University of Lethbridge, Lethbridge, AB, Canada)

#### EAST COAST, WEST COAST AND IN-BETWEEN: PHYLOGEOGRAPHIC STRUCTURE OF BLACK-CAPPED CHICKADEE

The common, non-migratory black-capped chickadee (*Poecile atricapillus*) has a continental-wide distribution that extends from the southern half of the U.S. into Canada, and as far as the Northwest Territories and Alaska in the west. Although no detailed phylogeographic study has been conducted on this species, several studies have suggested a possible Newfoundland refugium, as well as probable genetic structure. In order to investigate the phylogeographic structure of black-capped chickadees, we used a 440 bp sequence of mitochondrial DNA (control region), from 440 chickadees across 28 populations in North America. We also performed paleoecological distribution modeling (MAXENT) to verify locations of possible refugium(a) during the Last Glacial Maximum (LGM). Two main groups were found using multiple analyses (Maximum Likelihood, TCS, AMOVA, Fst, PCA): a monophyletic Newfoundland clade and a widespread polyphyletic continental group, with additional substructure evident in western populations (OR, WA, AK, MT, CO, and

UT). Black-capped chickadees show an East/West division on either side of the Cascades (Pacific) and Rocky Mountains (all other continental groups) consistent with late Pleistocene vicariance events, suggesting at least two refugia: a Newfoundland refugium, and at least one refugium located in the southern portion of their range. Additional evidence (private haplotypes, TCS, PCA) suggests a third potential refugium in the Pacific Northwest, with secondary contact between the Pacific and continental groups seen in Northwest British Columbia. Paleoecological distribution modeling predicted suitable habitat existed within similar possible refugia locations during the LGM.

**PS2.109 Hindmarch, Sofi,** (Environment Canada, Delta, Canada); Elliott, John (Environment Canada, Delta, BC, Canada)

#### INVESTIGATING THE POTENTIAL RISK OF SECONDARY RODENTICIDE POISONING TO URBAN OWLS INHABITING AND FORAGING IN URBAN LANDSCAPES OF THE LOWER MAINLAND, BRITISH COLUMBIA

Anticoagulant rodenticides are widely used to control pest rodents, but poisoning of non-target wildlife has been linked to these practices, including secondary poisoning of birds of prey, particularly owls. In this study, we investigate whether Barred owls (*Strix varia*), Great-horned owls (*Bubo virginianus*) and/or Barn owls (*Tyto alba*) inhabiting and foraging in predominantly urban landscapes of the Lower Mainland, British Columbia are at risk of consuming rodenticide-laden prey, such as rats and house mice. By conducting a pellet study, we found that urban Barred owls had the largest proportion of rats in their diet, with some individuals' diet consisting primarily of rats. Urban Great-horned owl pellets were also comprised mainly of rats, but there was a clear shift towards alternative prey base when urbanization within home ranges decreased. Field voles (*Microtus townsendi*) were the main prey item for Barn owls, regardless of the amount of urbanization within their home range. For all three species, consumption of rats and house mice appears to coincide with increased urbanization within home ranges. The shift in the diet of owls living in urbanized areas may potentially lead to an increased risk of secondary rodenticide poisoning. Radio telemetry was deployed to further investigate which landscape features urban Barn owls select as foraging habitat and whether they forage in proximity to buildings where rodenticide is applied. Urban Barn owls were found to predominantly forage in grass strips along highway interchanges and verges, and untended grass patches within the city. The majority of foraging was done within 100 m of commercial buildings where rodenticide had been applied. These findings will be discussed in conjunction with previous research done on rodenticide residues found in the livers of deceased owls and the current and historic sales of rodenticides in the Lower Mainland, BC.

**F11.8 Hipfner, Mark,** (Environment Canada, Delta, Canada); Elnor, Robert (Environment Canada, Delta, BC, Canada)

#### SEA-SURFACE TEMPERATURE AFFECTS BREEDING DENSITY OF A ROCKY INTERTIDAL PREDATOR, THE BLACK OYSTERCATCHER

We used data collected from 2003 to 2011 to test the hypothesis that the annual productivity of Black Oystercatchers (*Haematopus bachmani*) breeding on Triangle Island, British Columbia, Canada, declines with increasing spring sea-surface temperature. As predicted, the number of oystercatcher pairs that laid eggs in May and June was negatively correlated with the

mean sea-surface temperature in April of the same year, but contrary to prediction, the mean clutch size did not decline with increasing temperature. A reduction in the breeding propensity of individual birds, rather than increased rates of mortality or emigration, better explained why there were up to 40% fewer active oystercatcher nests in five warm-water years than in four cold-water years. We suggest that sea-surface temperature indirectly affected oystercatcher breeding density, mediated by behavioural and/or physiological responses to temperature in the oystercatchers' invertebrate prey. Our results suggest a novel mechanism through which ocean warming could affect predator-prey interactions in intertidal ecosystems.

**PS1.81 Hiriart-Bertrand, Luciano.** (Center for Marine Biodiversity and Conservation, Scripps Institution of Oceanography, University of California San Diego, San Diego, United States); Ballance, Lisa T. (Southwest Fisheries Science Center, NMFS, NOAA, USA, San Diego, United States)

#### CONSIDERATIONS FOR CREATING A MARINE PROTECTED AREA FOR SPHENISCUS PENGUINS IN SOUTHERN CHILE

Marine Protected Areas (MPAs) are gaining wide support as a management and conservation mechanism. MPAs target everything from a single species to an entire ecosystem and although success in achieving desired management goals varies on a case-by-case basis, their implementation has significantly changed management paradigms for the better. In southern Chile, Puñihuil Islets and Metalqui Island (42°S), separated by 35 km, are the sites of the largest described mixed-species colonies of Spheniscus penguins. Humboldt (*Spheniscus humboldti*) and Magellanic (*S. magellanicus*) penguins breed here sympatrically and provide an unprecedented opportunity to understand the ecological context which allows for successful resource partitioning between these closely related species. This region is also economically important for fisheries, such as Chilean abalone, mussel and corvine, as well as for ecotourism. Because bycatch in the coastal gillnet fishery has historically been described during the breeding season (September-March), with 50 penguins drowning in 2006 and one penguin drowning registered by a time-depth recorder in 2008, we propose a framework for establishing a protected area based on the biology of the penguins, and a cost-benefit analysis of the impacts of such an area on human use of the ecosystem. During chick rearing, foraging behavior based on 12 Humboldt and 10 Magellanic penguins tagged with geolocation and depth of dive tags indicates that the birds occupied an area up to 180 km<sup>2</sup> around the Puñihuil colony. After moulting, between April and August it has been described that certain individuals disperse over a coastal area ranging from the breeding site 1000 km to the north. We therefore recommend a time-sensitive protected area whereby coastal gillnets are allowed to fish in this area during this time. We further provide a cost-benefit analysis which compares the cost of restricted coastal gillnet fisheries with the benefit of an increase in ecotourism as a result of the protected area.

**PS1.126 Hitch, Alan.** (Museum of Wildlife and Fish Biology, UC Davis, Davis, United States); Engilis Jr, Andy (Museum of Wildlife and Fish Biology, UC Davis, Davis, United States); Irfham, Mohammad (Indonesian Institute of Sciences-LIPI, Cibinong, Indonesia); Dwi Putra, Dadang (Celebes Birding Club, Palu, Indonesia); Haryoko, Tri (Indonesian Institute of Sciences-LIPI, Cibinong, Indonesia)

#### COMPREHENSIVE AVIAN SURVEYS IN THE MASEMBO WATERSHED OF THE MEKONGGA MTNS. REGION IN SOUTHEAST SULAWESI, INDONESIA

We conducted a multi-year vertebrate (2009-2011) survey along an elevational gradient in the Masembo River watershed of the Mekongga Mtns. region in Southeast Sulawesi, Indonesia. This area had never been comprehensively surveyed for avifauna before. Sulawesi supports the highest level of vertebrate endemism and has one of the most fascinating and unique fauna found in Indonesia. It is second only to New Guinea in the number of endemic birds. We used a repeated sampling design that would account for differences in detectability as well as incorporate multiple detection methods. Our standardized sampling design combined mistnet arrays with aural and visual observations to obtain a more complete survey of the avifauna of this area and to determine probability of occupancy along an elevational gradient. We detected over 150 species of birds (both collected specimens and visual and aural detections) of which 50 species are endemic to Sulawesi. We have also documented numerous range extensions and altitudinal shifts in distribution for some species. Detection probabilities differed among species and also among survey methods. Surveys that incorporate estimation of detectability and multiple survey methods are critical to characterizing avifaunal bio-diversity especially in remote and difficult areas to survey. In addition, surveys of this type can be used to determine species-habitat relationships in order to better understand the distributions of these poorly studied species.

**PS2.168 Hoar, Tyler.** (Canadian Wildlife Service - Environment Canada, Toronto, Canada); Weseloh, D.V. Chip (Canadian Wildlife Service - Environment Canada, Toronto, ON, Canada)

#### OSHAWA SECOND MARSH: PREMIER SPRING STAGING AREA FOR NORTH AMERICAN LITTLE GULLS

The Little Gull (*Larus minutus*, LIGU) is the world's smallest gull; it is a very rare breeder in North America (NA) but a relatively common one in parts of Europe and Northern Asia. Although known in Canada and NA since the first Franklin Expedition (1819-20), its first nest in NA was not found until 1962 at Oshawa Second Marsh (O2M), east of Toronto, Ontario. After that it nested irregularly in small numbers in the Great Lakes area until 1989. Nests have been reported sporadically in the Canadian Arctic, where it is believed all of the current NA population now nests. The NA population has been estimated at 400 individuals.

In NA, the two most predictable places to see this gull and where it occurs in the greatest numbers in all NA, are the Niagara River (autumn and spring) and O2M (April-May). The purposes of this poster are: 1) to demonstrate the abundance of the LIGU in southern Ontario and O2M, 2) to detail its occurrence and behaviour at O2M and 3) to alert biologists to its presence and request other staging areas. Seventy-two percent of all LIGU reports on eBird (N=1887) come from Ontario and 88% of those come from Durham Region, which includes O2M. Forty-two percent of all LIGUs (N=187) reported on 22,147 Christmas Bird Counts across NA, 1999-2010, were from southern Ontario; twice as many as from any other jurisdiction. LIGUs were recorded at O2M on 228 of 308 survey days (March - May, 2001 - 2011) for an average of 13 birds/day; the greatest rate of occurrence of any long-term LIGU study in NA. LIGUs utilize O2M from late March - late May; they peak (114 birds/day) in late April. Aerial courtship was observed on 43 occasions, 12 April - 5 May 2001 - 2010. It occurred 30 - 200m above the marsh, involved 2 - 45 birds/event and lasted 4 - 73

minutes/event. Such courtship has not been recorded anywhere else in NA.

Migration departures, consisting of high altitude flights of Bonaparte's Gull/LIGU flocks flying off to the NW, have been observed leaving O2M on 4 occasions.

O2M is a very unique place in the life history of the LIGU in all of NA. We do not know of any other spring staging area in NA that predictably and reliably receives as many LIGUs as does O2M, nor one where their migration has been so thoroughly documented.

**PS1.137 Hockman, Emily**, (University of Tennessee, Knoxville, United States); Buehler, David (University of Tennessee, Knoxville, TN, United States)

#### BACHMAN'S SPARROW POPULATION, HABITAT REQUIREMENTS, AND DETECTABILITY IN OAK SAVANNAS AT FORT CAMPBELL, TENNESSEE-KENTUCKY

The Bachman's Sparrow (*Peucaea aestivalis*) is a species of national conservation concern due to declining populations and the loss of savanna ecosystems. Populations have averaged a 3.2% yearly decline from 1966 to 2009 based on analysis from the North American Breeding Bird Survey data. Bachman's Sparrows are traditionally found in pine savannas in their core range along the Gulf and Atlantic coasts, but use oak savannas in the northerly portion of their range. Fort Campbell, located on the border of Tennessee and Kentucky, contains the largest known breeding population of Bachman's Sparrows in oak savanna habitat. We studied the population at Fort Campbell in 2009 and 2010 to document population size, habitat use, and breeding ecology. Territory size per bird was  $2.66 \text{ ha} \pm 0.57$  and basal area per territory was  $2.25 \text{ m}^2/\text{ha} \pm 0.57$ . Occupied territories had a higher percent cover of forbs (27.67%) than the adjacent available savannas (20.45%), but did not differ in percent cover of native warm-season grasses (28.68%, 27.58%), standing senescent grass (6.79%, 4.56%), woody species (9.48%, 10.47%), litter (13.9%, 11.94%), or bare ground (15.11%, 16.62%). We used this vegetation information together with aerial photography to develop a habitat suitability model for all of Fort Campbell. Occupancy of Bachman's Sparrows on point counts was low during both breeding seasons ( $\psi=0.1$ ) demonstrating the difficulty of using traditional ground-based monitoring for accurate population estimates. Our long-term goal is to use these data to develop a conservation strategy to both monitor and enhance populations of the high-priority species at Fort Campbell and elsewhere in the region.

**T15.5 Hodum, Peter**, (Oikonos Ecosystem Knowledge, Tacoma, United States); Hagen, Erin (Island Conservation, Santa Cruz, CA, United States)

#### CONSERVATION THREATS TO, AND STATUS OF, THE SEABIRD COMMUNITY OF THE JUAN FERNÁNDEZ ISLANDS, CHILE

The breeding seabird community of the Juan Fernández Islands is comprised of six species of procellariiforms, of which four are endemic to the archipelago or to Chile. These same four species are classified as Vulnerable by IUCN/BirdLife. We undertook population estimates, monitored breeding biology and quantified threats as part of a long-term study of the seabird community of the islands. Juan Fernández and Stejneger's petrels (*Pterodroma externa* and *P. longirostris*, respectively) are single island endemics, breeding only on Alejandro Selkirk Island. Our population estimates for Juan Fernández petrels (850,000 breeding pairs) and Stejneger's petrels (<50,000 breeding pairs) are similar to and considerably smaller than previous

reports, respectively. The De Filippi's petrel (*Pterodroma defilippiana*) breeding population, estimated as <1,000 pairs, is dramatically smaller than previously reported. Pink-footed shearwaters (*Puffinus creatopus*) have a breeding population of approximately 8,600 pairs distributed amongst multiple colonies on Robinson Crusoe and Santa Clara islands. Fewer than 175 pairs of Kermadec petrels (*Pterodroma neglecta*), whose global population has declined by >90% since the early 1900s, breed in the archipelago. Four of the six species are currently vulnerable to predation by feral cats (*Felis catus*) and introduced rodents (Norway rats *Rattus norvegicus* and house mice *Mus musculus*), while the other two (De Filippi's and Kermadec petrels) may have been extirpated from Robinson Crusoe due to historic predation pressures. In addition, European rabbits (*Oryctolagus cuniculus*) and domestic cattle (*Bos taurus*) impact breeding shearwaters on Robinson Crusoe Island. Goats (*Capra hircus*) on Alejandro Selkirk Island degrade breeding habitat for the two endemic petrels. Multi-species eradication programs for introduced mammals, essential for the long-term conservation of this threatened seabird community, are currently being developed. Given the small population size for De Filippi's petrel and the rangewide declines in Kermadec petrels, we recommend that the conservation status of both species be considered for uplisting.

**PS1.193 Hof, David**, (University of Massachusetts, Amherst, United States);

#### ESCALATION OF AGGRESSIVE SIGNALS IN BLACK-THROATED BLUE WARBLERS: A SEQUENTIAL PLAYBACK STUDY

Many animal species follow specific sequences of signaling behaviors as agonistic interactions escalate. Signals in a sequence have been hypothesized to convey varying levels of aggressive motivation. I have recently shown that in black-throated blue warblers, use of two vocal display features reliably predicted subsequent physical attack on a taxidermic mount – specific song types (type II songs) and low-amplitude “soft” songs, the latter of which was by far the strongest predictor of attack. In this study, I test whether these two vocal display features convey varying levels of contest escalation. I hypothesize that some signals contain reliable information about motivation to escalate to higher levels of signaling, and each escalated step of signaling is an increasingly reliable predictor of attack. I tested this hypothesis using song playback in a two-speaker design. One speaker initiated an interaction from outside the territorial boundary, and a second speaker simulated an intrusion into the territory and was accompanied by a taxidermic mount that could be attacked. I found that the use of type II song in response to the boundary playback significantly predicted the use of soft song in response to playback inside the territory, which in turn predicted subsequent attack. However, use of type II song during either stage of playback did not significantly predict eventual attack. These results provide evidence that vocal signaling interactions in black-throated blue warblers follow a progressive sequence that conveys increasingly higher levels of threat.

**PS2.73 Hohman, William L.**, (USDA, NRCS, Fort Worth, United States); Norling, Wayne (USGS National Wetlands Research Center, Lafayette, United States); Pace, III, Richard M. (NMFS Northeast Fisheries Science Center, Woods Hole, United States)

#### RELATIVE VALUE OF AGRICULTURAL WETLANDS ALONG THE GULF COAST FOR ACCOMMODATING WATERBIRDS DISPLACED BY SEA-LEVEL RISE

Wetlands along the Gulf Coast historically provided habitat for untold millions of resident and migratory waterbirds. Extensive conversion of wet coastal prairie to agricultural uses began in the early 20th century with rice and crops-livestock produced in rotation with rice becoming a major component of the contemporary landscape of the region. Recent shifts in the distributions of waterbirds from coastal wetlands to inland agricultural wetlands coincide with ongoing loss and degradation of coastal wetlands and foretell the possible effects of sea-level rise caused by climate change. In an effort to assess waterbird use of agricultural fields in relation to flooding, vegetation characteristics, season, field size and rotational uses, we conducted biweekly roadside surveys of 727 fields distributed throughout the Texas-Louisiana Gulf Coastal Plain (May-October 1996-98). Using design considerations to ensure representative coverage throughout the region, we accommodated our hierarchical sampling using various generalized mixed models. We documented 67 species of waterbirds using agricultural habitats including at least 17 waterfowl, 33 shorebird, 15 wading bird, 2 rail and 1 crane species. Our rapid survey method detected waterbird occurrences on 30% of 19,352 observations (maximum of 15 per year for any one field) which was sufficient to demonstrate different conservation values among fields in different states. Peak detected density was nearly 7 birds/ha including 1.5 shorebirds, 1.8 waterfowl and 0.6 wading birds/ha. Waterbird species richness and diversity were highest in fallow fields and rice crop types, greatly exceeding other crop types and fields in rice-fallow rotation had higher richness and diversity scores than fields in 3-year rotations or rice rotations with other crops. Grazing negatively impacted richness and flooding increased richness. Duck densities were affected by rotation schedule, shorebird densities were affected by crop type (rice and other low) and grazing, and wader densities were affected by both crop type and rotation schedule. Densities of all 3 groups increased with flooding. Enhanced management of agricultural wetlands along the Gulf Coast may represent the best opportunity to accommodate waterbirds displaced by wetland loss associated with sea-level rise.

**T12.2 Holberton, Rebecca**, (University of Maine, Orono, United States); Diamond, Antony; Kelly, Kevin; Bowser, Kirsten (University of New Brunswick, Fredericton, NB, Canada); Leppert, Lynda (LLL, Marietta, GA, United States)  
BODY CONDITION IN ADULT AUKS IN RESPONSE TO ANNUAL VARIATION IN ENVIRONMENTAL CONDITIONS AT MACHIAS SEAL ISLAND IN THE GULF OF MAINE

Auk population studies have been conducted at Machias Seal Island (MSI) since 1995. Over the past decade, food essential for supporting seabird populations in the Gulf of Maine has become less predictable. Year-to-year variation in the timing of breeding onset, food type delivered to chicks, and nesting success has increased greatly since 2001. Links among variation in chick diet, chick growth rate, and fledging success are well documented, but less is known about how environmental conditions prior to and during breeding affect adults. Since 2009, we have collected data on a suite of adult body condition indices: mass (size-corrected mass), plasma metabolites of energy regulation (free glycerol, triglycerides), and immune activity (white blood cell counts) in Atlantic puffins (*Fratercula arctica*) and Razorbills (*Alca torda*) at MSI. 2009 was one of the best and 2010 one of the worst years on record for breeding events at MSI. During breeding onset in 2010, adults of both species had lower % heterophils and higher % lymphocytes (indicator of chronic stress), and higher glycerol (indicator of

burning fat) compared to 2009. Brood patch was absent in birds with elevated glycerol suggesting that they had been unable to allocate energy towards its development. Breeders had higher body mass and lower % lymphocyte counts than those of unconfirmed status. These data suggest that in years of poor breeding success, adults are also experiencing challenges to their own survival. The fact that such conditions are occurring more frequently raises concerns for long-term stability of Gulf of Maine seabird populations.

**PS2.173 Holberton, Rebecca**, (University of Maine, Orono, United States); Wright, Wesley; Bridges, David; Leppold, Adrienne (University of Maine, Orono, ME, United States); Williams, Sara (United States Fish & Wildlife Service, Milbridge, ME, United States)  
USING PASSIVE ACOUSTIC MONITORING OF MIGRATORY FLIGHT CALLS TO TRACK SPATIAL AND TEMPORAL PATTERNS OF BIRD MIGRATION IN THE GULF OF MAINE, A COMPLEX FLYWAY SYSTEM.

Recent initiatives for land-based and offshore wind energy development have spurred greater urgency for more comprehensive information about spatial and temporal patterns of bird movements in the Gulf of Maine region. The Northeast Regional Migration Monitoring Network (NRMMN) was established to bring together a wide array of expertise and resources to study this regional flyway on multiple scales. In 2010 and 2011, 5-7 inland, coastal, and offshore sites for recording migratory flight calls (MFC) were established from the Bay of Fundy to mid-coast Maine. Cornell's Raven Pro 1.4® software was used to analyze MFCs, which were extracted using detector parameters that yielded the most effective detector for each site. While all sites illustrated the general seasonal transition in species group composition (% 'warblers', 'sparrows', 'unknowns') from 'warbler'-dominated to 'sparrow'-dominated MFCs, nightly total calls and call rates (MFC/h) varied among sites. Higher numbers and call rates were more likely inland and further south, perhaps reflecting a greater catchment area of birds coming from the west as well as the north and northeast. Stable deuterium isotope signatures indicated that many birds originated from as far as 1000 km to the west. Coastal and island site recordings documented dawn arrival of trans-Gulf and wind-drifted migrants. MFC species group composition often reflected that of birds banded the following day, suggesting that passive acoustic recording may serve as a surrogate for banding when the latter is less feasible. Passive acoustic monitoring is helping to gain a better picture of this dynamic and complex flyway system.

**PS2.150 Holoubek, Nathan**, (Emporia State University, Emporia, United States); Jensen, William (Emporia State University, Emporia, United States)  
BIRD OCCUPANCY IN RELATION TO HABITAT STRUCTURE IN OAK SAVANNA

Nathan S. Holoubek, M.S. Graduate Student, Biological Sciences, Emporia State University William E. Jensen, Assistant Professor, Biological Sciences, Emporia State University Abstract – Oak savanna, once widespread across central North America, has functionally vanished from most of its range due to land conversion and disruption of historic disturbance regimes. The objective of our research was to quantify habitat associations of avian species across a gradient from open-canopy oak savanna to closed-canopy forest in the Cross Timbers region of south-central North America. By modeling bird occupancy in relation to habitat structure we predicted which species might benefit from restoration of open-

canopy savanna. Point counts were conducted at 32 stations over two years. We modeled species-specific detection and occupancy probabilities against vegetative variables using program Presence version 4.0. We first established the best predictors of detection ( $p$ ), and then used the top predictor(s) of  $p$  when modeling occupancy ( $\psi$ ). Of 24 species modeled,  $\psi$  for 7 was associated with variation in vegetative characteristics, though relationships varied among species. Occupancies of Blue Jay (*Cyanocitta cristata*) and Tufted Titmouse (*Baeolophus bicolor*) were positively related to a composite of tree density and canopy cover, and  $\psi$  of Northern Cardinal (*Cardinalis cardinalis*) increased with shrub density. Occupancies of Northern Cardinal, Carolina Wren (*Thryothorus ludovicianus*), Northern Bobwhite (*Colinus virginianus*), and Orchard Oriole (*Icterus spurius*) decreased with tree density and canopy cover; therefore, these species might benefit from managed reductions in tree density. In 2012 and 2013 we will conduct more extensive point counts and assess habitat correlates with nest success. Assessment of bird habitat use and productivity in oak savanna will be useful in guiding future savanna restoration practices.

**PS1.165 Horton, Kyle**, (University of Delaware, Attica, United States); Morris, Sara (Canisius College, NY, NY, United States); Tegeler, Amy (Powdermill Avian Research Center, Rector, PA, United States)

#### WOOD-WARBLER VOCALIZATIONS IN RESPONSE TO FLIGHT CALLS

During migration birds give simple vocalizations known as flight calls that are used primarily during sustained periods of flight. During the fall 2010 and 2011, we investigated flight calling in response to both conspecific and heterospecific calls at Braddock Bay Bird Observatory (Greece, NY) and Powdermill Nature Preserve (Rector, PA). Focal species included Magnolia Warbler (*Setophaga magnolia*) Blackpoll Warbler (*S. striata*), and Yellow-rumped Warbler (*S. coronata*). Each bird was presented with one of four cues, flight calls of one of the three species or a control (spring peeper, *Pseudacris crucifer*). We compared response rates across both seasons as well as across both field sites. In general, birds were more likely to give calls in response to other birds and were more likely to give calls in response to conspecifics. We documented large variation in rate of flight calling, ranging from 0.3 to 54.7 flight calls per minute. Higher conspecific response and calling rates were observed at Powdermill, yet found no difference between years. Examining the Magnolia Warbler, we observed mean conspecific calling rates of  $2.1 \pm 4.0$  ( $n=28$ ) at Braddock Bay and  $8.3 \pm 12.2$  ( $n=31$ ) at Powdermill. Understanding these variations has broader implications in the use of flight calls as a means of estimating density of passing migrants.

**T13.8 Hosner, Peter**, (University of Kansas, Lawrence, United States); Moyle, Robert (University of Kansas, Lawrence, United States)

#### TESTING THE PLEISTOCENE AGGREGATE ISLAND COMPLEX (PAIC) DIVERSIFICATION MODEL IN CO-DISTRIBUTED AVIAN LINEAGES

The distributional patterns of many Philippine organisms are well established, but the relative effects of different historical processes in creating these distributions remain poorly understood. We use nuclear and mitochondrial DNA sequence data from co-distributed polytypic avian species in a system of island populations to test the Pleistocene aggregate island complex (PAIC) diversification hypothesis. This hypothesis states that aggregate island boundaries formed during periods of

low sea level in the Pleistocene (which enabled admixture and prevented genetic differentiation within island groups) shaped the evolutionary history of organisms that inhabit them, rather than current island boundaries. The eight focal species (*Harpactes ardens*, *Ceyx melanurus*, *Pachycephala philippinensis*, *Pycnonotus urostictus*, *Irena cyanogaster*, *Dicaeum hypoleucum*, *Prionochilus olivaceus*, *Aethopyga pulcherrima*) represent seven avian families co-distributed throughout the Luzon PAIC and Mindanao PAIC, the Philippines' two largest aggregate island systems. These two PAICs are isolated across a single deep-water geographic barrier, the San Bernardino Strait between Luzon and Samar. Thus, the PAIC hypothesis predicts the San Bernardino strait should be the major phylogeographic break in all eight lineages. We test whether: (1) isolation by distance, (2) isolation across deep-water barriers between PAICs, (3) lineage-specific breaks in environmental suitability predicted from ecological niche modeling or (4) complex interactions of multiple historical processes drive diversification and genetic differentiation. Results indicate substantial population structure in all eight avian lineages, and all eight lineages exhibit a strong genetic break across the deep-water San Bernardino strait between Luzon and Samar consistent with the predictions of the PAIC diversification model. However, we also found complex phylogeographic patterns inconsistent with the PAIC hypothesis: PAIC parapatry in five of eight bird lineages, and multiple distinct geographic clades within PAICs associated with Pleistocene environmental suitability barriers inferred from ecological niche modeling. We conclude that although PAIC boundaries have a substantial role in limiting Philippine bird distribution, they are not the sole isolating mechanism that promotes diversification in Philippine birds.

**SAT9.1 Hostetler, Jeffrey**, (Smithsonian Institution, Washington, United States); Chandler, Richard; Royle, Andy (USGS Patuxent Wildlife Research Center, Laurel, MD, United States); Sillett, Scott (Smithsonian Institution, Washington, DC, United States)

#### A QUANTITATIVE APPROACH FOR ASSESSING AVIAN CLIMATE CHANGE VULNERABILITY

Many approaches to climate change vulnerability have been developed, but most of these have limitations such as subjectivity, focus on distribution, and failure to account for detection in surveys. Here, we present a model-based method for projecting abundance due to various scenarios of future climate change that accounts for detection probabilities and other sources of uncertainty. We extended existing statistical models for avian point-count data, and modeled the effects of seasonal weather from the breeding and wintering grounds on population growth rates and carrying capacities. The results of these analyses were combined with projections of future climate to estimate probabilities of quasi-extinction in local populations. We applied this approach to migrant passerines breeding in forested National Parks in the Washington, DC area, using data from the North American Breeding Bird Survey and other sources. Past and future responses to breeding ground and wintering ground climate varied between species. We discuss implications of these results for forest passerines and implications and possible extensions of this method for future vulnerability assessments.

**W6.1 Howerter, David**, (Ducks Unlimited Canada, Institute for Wetland and Waterfowl Research, Stonewall, Canada); Mack, Glenn (Ducks Unlimited Canada, Edmonton, Canada); Slattery, Stuart (Ducks Unlimited Canada, Institute for Wetland and Waterfowl Research, Stonewall, MB, Canada); Armstrong,

Llwellyn (Ducks Unlimited Canada, Institute for Wetland and Waterfowl Research, Stonewall, MB, Canada); Robin, Michael (Ducks Unlimited Canada, Edmonton, AB, Canada); Witherly, Susan (Ducks Unlimited Canada, Institute for Wetland and Waterfowl Research, Stonewall, MB, Canada)

#### ASSESSING CHANGE IN WATERFOWL ABUNDANCE RELATIVE TO ANTHROPOGENIC DISTURBANCE ACROSS CANADA'S BOREAL PLAINS

The North American western boreal forest (WBF) represents important breeding habitat for many avian taxa including waterfowl. Annually, approximately 32% of ducks counted in North America during the Waterfowl Breeding Population and Habitat Surveys (WBPHS) have been located in the WBF, second only to the prairie pothole region in continental importance for waterfowl. Nevertheless, within Canada, where the majority of boreal ducks are counted, the top four numerically important species within WBF strata have declined through time and are currently below targeted abundances established by the North American Waterfowl Management Plan. Reasons for these declines are unknown, though limited evidence suggests that proximal causes during the breeding season may be important determinants of population trajectories for some species. Landscapes within the WBF are experiencing unprecedented rates of anthropogenic change. Infrastructure related to timber harvest, petroleum exploration and extraction, agricultural expansion, mining, and hydroelectric development are all expanding in the WBF with unknown consequences for waterfowl. Mechanistically, anthropogenic disturbances may influence waterfowl demography in boreal ecosystems through bottom-up (e.g., road construction may change wetland hydrology, thereby altering abundances or availabilities of aquatic food sources) or top-down processes (e.g., linear disturbances may facilitate increased predator abundance or foraging efficiency) or both. We used random coefficient modeling to relate temporally-averaged waterfowl abundance estimates from WBPHS segments located within the Boreal Plain ecozone to landcover and anthropogenic disturbance variables. Separate analyses were performed for ground-nesting, overwater-nesting and cavity-nesting ducks. All three nesting guilds were negatively related to the proportion of coniferous forests near segment surveys. Disturbances related to seismic exploration for oil and gas extraction were associated with increasingly trajectories for all nesting guilds. Effects of other variables were less consistent among guilds, though when cumulative anthropogenic disturbances were considered, a strong negative spatial correlation between disturbance levels and waterfowl population trends was evident.

**PS1.112 Hubbard, Joanna**, (University of Colorado Boulder, Boulder, United States); Safran, Rebecca (University of Colorado Boulder, Boulder, CO, United States)

#### DO CANDIDATE GENES ASSOCIATED WITH MELANIN PIGMENTATION UNDERLIE PLUMAGE DIFFERENCES BETWEEN TWO RECENTLY DIVERGED SUBSPECIES OF BARN SWALLOW (*HIRUNDO RUSTICA*)

In most animals, coloration plays a key role in survival and/or reproduction, and is thus often the target of selection and may be involved in mechanisms of reproductive isolation. While some pigments, such as carotenoids, are derived from an animal's diet, melanin pigments are synthesized endogenously, and therefore, melanin-based colors are typically considered less condition dependent. Moreover, in vertebrates, the genes underlying melanogenesis are highly conserved and have repeatedly been shown to associate with melanin-based color polymorphisms in many taxa. The barn swallow species complex (*Hirundo rustica*)

consists of six recently diverged subspecies that vary morphologically, specifically in regard to ventral melanin-based plumage color. In addition to phenotypic variation, the strength and sources of selection on color also differ between populations. Given these differences, I am looking at allelic variation in known pigmentation genes between North American (*H. r. erythrogaster*) and European (*H. r. rustica*) populations. In contrast to previous work on vertebrate color and pigmentation genes, these two subspecies do not represent discrete color morphs, but rather extremes along a continuous gradient, with North American populations generally having darker plumage than their European counterparts. My results will provide a new understanding of how these conserved genes affect continuous color variation. Overall, these results will provide insight into the genetic determinants of continuous color variation commonly seen in nature, as well as the role of these phenotypic and genetic differences in driving population divergence.

**PS1.131 Hubbard, Laura**, (Western Illinois University, Macomb, United States); McCleery, Robert (University of Florida, Gainesville, United States); Peer, Brian; Treadway, Allison (Western Illinois University, Macomb, IL, United States)

#### THE ROAD AHEAD: CHARACTERISTICS OF ROADSIDE RIGHT-OF-WAYS THAT INFLUENCE AVIAN ABUNDANCE AND DIVERSITY IN AGRICULTURAL LANDSCAPES

More than 99% of the original prairie grassland in Illinois has been lost, much of this to agricultural development, making suitable habitat for grassland bird species scarce. Not surprisingly, grassland obligates have declined more than any other group of birds in North America. Much of the grassland that remains is in rural pastures and roadsides, with > 300,000 ha of marginal grasslands found adjacent to roads throughout the state. We conducted double observer transect surveys on both sides of 50 randomly selected roadside right-of-ways (ROWS) adjacent to agricultural production (corn and soybeans) in west-central Illinois. We used an information theoretic approach and developed 23 a priori models to determine the characteristics of ROWs that influenced bird abundance and diversity. Our best models of avian abundance included ROW width, visual obstruction, biomass ( $\text{VO} \times \text{width}$ ), and perch availability. Biomass ( $\beta = 0.0168$ , CI: 0.0007 - 0.0329) and  $\text{VO}$  ( $\beta = 0.3046$ , CI: 0.0345 - 0.5747) were relevant predictors of abundance. Our best models of species richness included ROW width,  $\text{VO}$ , and biomass. Biomass ( $\beta = 0.0107$ , CI: 0.0012-0.0202) was the only relevant predictor of species richness. To enhance the viability of ROWs for grassland birds, we recommend implementing a mowing regime that maximizes  $\text{VO}$  and nesting cover of grassland vegetation during the breeding season and increasing the width of ROWs where possible.

**PS1.7 Hucks, Katrina**, (University of Central Oklahoma, Edmond, United States); Butler, Christopher (University of Central Oklahoma, Choctaw, OK, United States)

#### DIETARY DIVERSITY OF BARN OWLS IN OKLAHOMA

We examined the prey composition of Barn Owl (*Tyto alba*) pellets from 25 counties in Oklahoma. A total of 47,835 pellets were collected from 1978 through 1992, representing a total of 57,725 prey items. The majority (98.6%) of the prey items were mammals, although birds, snakes, and invertebrates (1.43%) were also found. We hypothesized that pellets would disproportionately contain prey specimens with a mass between 40 and 80 g. The most frequently encountered specimens were

*Sigmodon hispidus* (n = 21,449, mass = 80-150 g), *Peromyscus* spp. (n = 9,056, mass = 15-32 g), and *Perognathus hispidus* (n = 7,374, mass = 30-47 g). These results suggest Barn Owls prefer to feed upon small mammals and are consistent with the hypothesis. Introduced rodents such as *Mus musculus* (n = 6, mass = 21 g), *Rattus rattus* (n = 103, mass = 200 g), and *Rattus norvegicus* (n = 49, mass = 450 g) were not an important component of the diet in Oklahoma. Future studies should investigate whether Barn Owls may help control populations of rodents with a mass between 40 and 80 g.

**W4.5 Hudon, Jocelyn**, (Royal Alberta Museum, Edmonton, Canada); Wiebe, Karen (University of Saskatchewan, Saskatoon, SK, Canada); Stradi, Riccardo (Università degli Studi di Milano, Milan, Canada)

#### DISRUPTION OF CAROTENOID PATHWAYS IN HYBRID NORTHERN FLICKERS: THE PATH TO SPECIATION

The Yellow-shafted ( *auratus* group) and Red-shafted ( *cafer* group) forms of the Northern Flicker ( *Colaptes auratus* ) (Linnaeus, 1758) differ in many aspects of plumage coloration, most notably the coloration of the underside and shaft of flight feathers, but hybridize freely where they meet in western North America. We identified the carotenoid pigments responsible for the color difference in shaft/vane color between *auratus* and *cafer*, their hybrids and feathers of the "wrong" color. The yellow feathers contain predominantly carotenoids commonly found in diets (lutein,  $\beta$ -cryptoxanthin and zeaxanthin). The orange to red feathers contain in addition several mono- and diketo-carotenoids (notably adonirubin,  $\alpha$ -doradoxanthin, canthaxanthin, astaxanthin, etc...), representing oxidized products at C-4(4') of the carotenoids in *auratus*. However the two forms do not differ merely in the degree of oxidation of their carotenoids. They differ also in the fraction of carotenoids with  $\epsilon$  end-rings, which can be expected to affect hue, and in the extent of hydroxylation at C-3(3'), not expected to affect hue. Our data also document idiosyncrasies in the pigment make-up of a subset of hybrids. These individuals had carotenoids not apparent in the majority of hybrids, notably 3'-hydroxy-echinenone and adonixanthin, but expected if the birds oxidized the C-4(4') of  $\beta$  end-ring(s) of dietary carotenoids non-discriminately. Curiously these birds also exhibited a mismatch between the hue of the feather vane and that of the shaft, the vanes being yellower than the corresponding shaft. Our observations suggest that color differentiation in the Northern Flicker has involved changes in the regulation of several carotenoid-metabolizing enzymes, some of which result in antagonistic epistasis between interacting genes in hybrids, the type of genetic change most often implicated in reproductive incompatibilities in nature.

**PS1.189 Humple, Diana**, (PRBO Conservation Science, Petaluma, United States);

#### WITHIN- AND BETWEEN-WINTER MOVEMENTS OF WESTERN AND CLARK'S GREBES

Little is known about the movements of *Aechmophorus* grebes within their predominantly coastal wintering range, or their fidelity to wintering regions. We examined banding and encounter data provided by the Bird Banding Laboratory for Western and Clark's Grebes from 1934 to 2011. Of the 3428 grebes banded during this period, 156 encounters were reported, an encounter rate of 4.6%. The majority of the grebes were banded following rehabilitation, including during oil spills; and most encounters were of beachcast dead or debilitated grebes. Encounters revealed previously undocumented within-winter movements of grebes, with roughly one-third of all within-winter encounters occurring in a region other than where they

were banded (e.g., movements from San Francisco Bay to southern California). Most between-year recoveries indicated winter site fidelity in grebes; however, others revealed extreme differences in wintering locations. Beachcast-generated encounter data are inherently biased towards individuals that do not survive, but still indicated some successful rehabilitation of grebes, including those that had been oiled. Both the within- and between- winter patterns suggest a plasticity in Western and Clark's Grebes, possibly due to their variable marine environment and food resources. Although recent technological advances (e.g., satellite and geolocator tags) will likely reveal additional and more precise insight into such movement patterns in subsequent years, for certain species – especially those whose beachcast frequency produces relatively high band encounter rates – traditional banding and encounter data remain an often untapped and useful source of movement data.

**PS2.228 Hund, Amanda**, (University of Colorado, Boulder, United States); Safarn, Rebecca (University of Colorado, Boulder, CO, United States)

#### PARASITE-MEDIATED SEXUAL SIGNALING: WHAT DO FEMALES GAIN?

The Hamilton-Zuk hypothesis proposes that host-parasite co-evolution maintains the honesty of sexual traits and predicts that attractive males with the greatest degree of sexual trait expression have lower parasite loads. Accordingly, this hypothesis also predicts that females use these signals as indicators of parasite resistance. Parasites are common in many avian species and represent a cost to their host as they can limit investment in reproduction and affect overall breeding success. Using parasite-linked sexual traits in mate selection could confer benefits to females in at least two ways: attractive males could 1) have greater genetic resistance to parasite, and/or 2) offer a lower probability of social transmission of contagious parasites to their mates and offspring in shared nest sites. In a large breeding population of North American barn swallows *Hirundo rustica* in Colorado, I applied a cross-fostering design where I experimentally eliminated parasites from both females and nests to establish 1) transmission rates from males to shared nest environments, and 2) the degree to which females use male ventral coloration – a sexual signal in this population of barn swallows - for information about parasite-resistant genotypes or parasite-free environments. By removing parasites, I isolated the parasite input of males to offspring and assessed transmission risk to females. Because parasites differ across spatial scales, parasite-mediated signaling may be based on different suites of parasites in different populations. This study will help me to tease apart the role of parasites in driving sexual selection and mate choice in North America before conducting larger comparative studies on barn swallow subspecies with divergent sexual selection on different plumage-based traits.

**PS2.212 Hunt, Lyla**, (Kansas State University, Manhattan, United States); McNew, Lance (Kansas State University, Manhattan, KS, United States); Gregory, Andrew (Northern Arizona University, Flagstaff, AZ, United States); Wisely, Samantha (University of Florida, Gainesville, FL, United States); Sandercock, Brett (Kansas State University, Manhattan, KS, United States)

#### GREATER PRAIRIE-CHICKEN NEST SURVIVAL WITHIN A FRAGMENTED GRASSLAND LANDSCAPE, IN NORTH CENTRAL KANSAS

Greater Prairie-Chickens have suffered significant range contractions due to extensive loss and fragmentation of prairie habitats in North America. Much of the species' remaining



habitat occurs in areas with high concentrations of agriculture and other human development. Alteration of breeding habitat can have significant effects on key vital processes of prairie-chicken population dynamics such as nest survival. We conducted a five-year study to evaluate the impacts of vegetation structure, habitat fragmentation and environmental variables on prairie-chicken nest survival. During 2007-2011, we monitored 260 nests of 171 female Greater Prairie-Chickens within a 1,500 km<sup>2</sup> study area in the Smoky Hills ecoregion of north-central Kansas. Grassland habitats at the study area were fragmented by a dense road network (1.4 km of road per km<sup>2</sup>) and variable land-use regimes (38% agriculture). We measured local nest-site vegetation structure, spatial attributes of larger nesting areas (landcover composition, edge habitat), and distance from nests to anthropogenic features (roads, transmission lines). We then took a hierarchical modeling approach to evaluate competing models of nest survival as related to habitat components at multiple temporal and spatial scales. Anthropogenic features had no substantial effect on nest survival. Precipitation events had a weak negative effect on nest survival. Local nest-site visual obstruction readings (VOR), forb density, and distance to nearest woodland edge were the most important vegetation characteristics influencing nest survival. Our findings indicate that management efforts aimed at increasing nest survival should implement burning and grazing regimes that provided adequate vertical cover (VOR~50cm) while preventing encroachment of woody vegetation.

**F16.11 Hunt, Pamela**, (NH Audubon, Concord, United States); Parent, Kyle (Plymouth State University, Plymouth, NH, United States)

#### HABITAT USE BY THE EASTERN WHIP-POOR-WILL (CAPRIMULGUS VOCIFERUS) IN MANAGED FOREST LANDSCAPES

Habitat loss has been proposed as an important factor behind rangewide population declines in the Eastern Whip-poor-will (*Caprimulgus vociferus*). This species has long been recognized as typical of early successional or edge habitats, including pine barrens, open woodlands, and areas where forest is adjacent to fields or other cleared areas. We mapped whip-poor-will home ranges at two sites in New Hampshire using a modified spot-mapping technique and supplemented by radio telemetry. In a forest characterized by a long history of varied management, edge and early successional habitats were represented disproportionately highly in whip-poor-will home ranges relative to the site as a whole. Home ranges tended to be centered on features such as powerline rights-of-way, regenerating wildlife openings, and field edges. Response to ongoing management varied, with birds colonizing a recently harvested area one year after harvest, but not moving into an area treated less intensively. In pine barrens habitat managed through prescribed burning, whip-poor-wills were more generally distributed, although activity was consistently low in areas lacking in significant understory. Taken together, these data, plus observations from other occupied sites, support the hypothesis that loss of suitable habitat may be a factor in whip-poor-will declines. Management that results in forest with low density understory, extensive forest canopy gaps, and/or openings adjacent to such forests has the potential to enhance whip-poor-will populations.

**F2.2 Hurley, Victor**, (Deakin University, Mildura, Australia); Cooke, Raylene (Deakin University, Burwood, VI, Australia)  
LIFETIME REPRODUCTIVE SUCCESS IN PEREGRINE FALCONS ACROSS AN URBAN GRADIENT IN AUSTRALIA

Presented are results from the first lifetime reproductive success (LRS) study of Peregrine Falcons (*Falco peregrinus macropus*) in Australia. In Victoria, in south eastern Australia, the Peregrine Falcon population is increasing naturally following the banning of the use of DDT in 1989 Australia. So this study covers a period of expansion in a healthy population. Monitoring included 153 active nest sites. From these site 2,325 nestling Peregrine Falcons were banded with visually identifiable metal bands from 1991 to 2010. Of these nestlings 283 (12.4%) have been recovered after fledging from the nest. Of the recoveries 107 (4.6%) were identified as breeding adults; 165 (7.1%) were found sick, injured or dead; and 11 (0.5%) were sighted alive and not breeding. We monitored the LRS success of these 107 breeding adults and established that 32% of the males produced 69% of the fledglings whereas 43% of breeding females produced 77% of the fledglings. LRS is influenced by the degree of urbanization with breeding adults (or either sex) living only half the median lifespan of those in largely natural landscapes. Although highly urbanized nest locations produce larger clutches, brood sizes remain below the statewide average and without nest site augmentation egg hatch rates tend to remain < 20%. Furthermore, the young from these sites have a significantly lower likelihood of breeding. These results are in contrast with other studies internationally on Peregrine Falcons. Reasons for these differences are explored.

**PS2.177 Husak, Michael**, (Cameron University, Lawton, United States); Landoll, Diane (University of Oklahoma, Norman, OK, United States); Jahn, Alex (Universidad de Buenos Aires, Buenos Aires, Argentina)

#### TRACKING THE MIGRATION OF SCISSOR-TAILED FLYCATCHERS (TYRANNUS FORFICATUS) AND WESTERN KINGBIRDS (T. VERTICALIS) USING LIGHT-LEVEL GEOLOCATORS

Understanding the annual cycle of migratory birds is imperative to understanding their life history strategies in any given season. Yet, information from the migratory and winter periods is still largely unknown for most North American migratory birds. We monitored the nests of Scissor-tailed Flycatchers (*Tyrannus forficatus*) and Western Kingbirds (*T. verticalis*) in Oklahoma in 2011, and attached light-level geolocators to 38 breeding Western Kingbirds and to 39 breeding Scissor-tailed Flycatchers in this population. We present data on their breeding strategies, migration timing, migratory routes and wintering locations, and compare our results to previously available information for these species, and to that of other studies of bird migration using geocator technology. We suggest future directions for research based upon our results, which could serve as a model for future studies on other migratory bird species.

**PS2.105 Hussey, Karen**, (Klamath Bird Observatory, Ashland, United States); Ralph, C.J. (USDA Forest Service, Pacific Southwest Research Station, Arcata, CA, United States); Alexander, John; Stephens, Jaime (Klamath Bird Observatory, Ashland, OR, United States)

#### USING A LONG-TERM DATASET TO UNDERSTAND REGIONAL BLACK TERN (CHLIDONIAS NIGER) POPULATION STATUS AND IMPROVE MONITORING METHODOLOGIES

It is believed that Black Tern (*Chlidonias niger*) populations have declined over the past four decades. Therefore this species has been listed as endangered, threatened, or of conservation concern in multiple U.S. states and Canadian provinces. However, regional population information is lacking in many parts of its range, including the Klamath Basin of southern

Oregon. In addition, common monitoring methods throughout North America, such as the Breeding Bird Survey, do not provide sufficient population measures. The need for effective Black Tern monitoring has been identified as a priority by the U.S. Fish and Wildlife Service, the Intermountain West Joint Venture, and others. In response, we conducted 13 years of breeding season surveys in the Klamath Basin. We summarize these data and consider annual patterns of distribution and abundance along with hydrologic data to improve our understanding of monitoring methods, sampling design, and regional population status and trends.

**S11.5 Huyvaert, Kate**, (Colorado State University, Fort Collins, United States); **Thinh, Vu** (Forestry University of Vietnam, Hanoi, Vietnam); **Hopken, Matthew** (USDA/APHIS/WS/National Wildlife Research Center, Fort Collins, United States); **Bui, Trinh** (Forestry University of Vietnam, Hanoi, United States); **Doherty, Paul** (Colorado State University, Fort Collins, United States); **Piaggio, Antoinette** (USDA/APHIS/WS/National Wildlife Research Center, Fort Collins, United States)

#### ECOLOGICAL FACTORS INFLUENCING PREVALENCE OF AVIAN BLOOD PARASITES IN WILD BIRDS IN NORTHERN VIETNAM

Avian blood parasites, or haemosporidia, constitute an important group of parasites linked to critical conservation concerns in wild birds. In particular, parasite prevalence is expected to be influenced by ecological factors. For example, prevalence is expected to be higher for birds inhabiting human-dominated landscapes because of increased exposure to vectors and other effects of habitat degradation; these landscapes are expected to increase as urbanization expands globally. Given these concerns and a paucity of information on haemosporidia in Vietnam, we investigated ecological factors affecting prevalence of avian blood parasites in free-ranging wild land birds. Samples were collected in Cuc Phuong and Tam Dao National Parks, and surrounding human-dominated areas, in northern Vietnam, in 2007 and 2008. Samples were initially screened by PCR for the presence of blood parasite DNA and overall prevalence in sample birds was ~46%. Infections were detected in the majority of bird species sampled, flocking species were more likely to be infected than solitary species, and older birds were more likely to be parasitized. While prevalence did not differ by habitat type using this initial screen, finer scale DNA sequence-based analyses revealed that birds from human-dominated landscapes were far more likely to be infected with *Haemoproteus* than *Plasmodium* and that the opposite pattern held for forest interior birds. Our findings contribute to the idea of a cosmopolitan host distribution for *Haemoproteus* and *Plasmodium* avian blood parasites in Vietnam and highlight the importance of considering ecological factors in studies of parasitism in wild birds.

**PS2.19 Hynes, Doug**, (Memorial University of Newfoundland, St. John's, Canada); **Miller, Ted** (Memorial University of Newfoundland, St. John's, NF, Canada)

#### VOCALIZATIONS OF RED CROSSBILLS (LOXIA CURVIROSTRA) IN NEWFOUNDLAND

It has long been assumed that Newfoundland is home to a single well marked form of Red Crossbill, the endemic *Loxia curvirostra percna*. On this basis, *L. c. percna* is currently listed as endangered in Provincial legislation due to habitat loss and population decline. However, evidence is lacking about (a) persistence of *percna* and (b) the possible presence of other Red Crossbill forms on the island. We studied vocalizations of Red

Crossbills in Newfoundland to help resolve these questions. Based on knowledge of Red Crossbill vocal differentiation in continental North America and Europe, and we predicted that vocalizations in Newfoundland would differ from mainland populations and would be uniform throughout the island if *percna* and only *percna* is present. If *percna* was not present in samples, we predicted that vocalizations would resemble those described for mainland forms. Finally, if both *percna* and other forms were present we expected a mixture of vocalizations, some distinctive and previously undescribed: these could be from *percna*. This study is the first quantitative analysis of Red Crossbill vocalizations from Newfoundland. We analyzed over 1200 calls from ~ 85 individuals, from >1000 minutes of recordings. Calls often exhibited rapid frequency modulation, fell within the 1.2-5.5 kHz frequency band, and were 35-71 ms in duration. Differences between individuals, accounted for most of the variation, but some calls were uniform across both individuals and sites. Newfoundland and mainland calls were acoustically differentiable. At least 4 Red Crossbills had pair-specific calls similar to those Red Crossbill forms from mainland areas, suggesting that multiple forms of Red Crossbill occur in Newfoundland. Some vocalizations were distinctly different from mainland samples, so *percna* may (a) be present and (b) be acoustically distinct. We encountered many juvenile and adult Red Crossbills during the study suggesting a recent population increase. However, questions remain about the demographic status and Provincial distribution of Newfoundland Red Crossbills. These topics plus analysis of vocalizations from other areas (e.g. Maritime Provinces, off shore islands) are needed to extend our findings and determine the status of the Newfoundland Red Crossbill.

**W16.8 Igl, Lawrence**, (USGS Northern Prairie Wildlife Research Center, Jamestown, United States); **Johnson, Douglas** (USGS Northern Prairie Wildlife Research Center, Saint Paul, MN, United States)

#### TOTAL-AREA COUNTS VERSUS POINT COUNTS FOR SURVEYING BREEDING BIRDS IN GRASSLANDS

Point counts have been popular among avian ecologists to assess breeding bird species composition and abundance. We tested whether total-area counts were an effective alternative to point counts in estimating species occurrence and abundance of grassland birds. We conducted total-area counts and point counts simultaneously on seeded grasslands enrolled in the Conservation Reserve Program in 1995 (313 fields) and 2000 (282 fields). Overall, 107 species were observed in the two years, including 90 species with point counts and 98 species with total-area counts. Less effort (min/ha) was required using total-area counts than point counts. Thirteen of 26 common species showed greater odds of detection during total-area counts than during point counts in both years. Four additional species showed greater odds of detection on total-area counts than on point counts in 2000 but not in 1995. Only the Common Grackle (*Quiscalus quiscula*) showed greater odds of detection on point counts. Northern Harrier (*Circus cyaneus*) density estimates were higher using total-area counts, and Bobolink (*Dolichonyx oryzivorus*) and Common Grackle densities were higher using point counts. Four additional species showed higher densities on point counts in 2000 but not in 1995. Total-area counts appear to be an effective alternative to point counts for avifaunal surveys in grasslands.

**S6.4 Inouye, David**, (University of Maryland, College Park, United States); **McKinney, Amy** (Rocky Mtn. Biological Lab and University of MD, Crested Butte, CO, United States); **CaraDonna, Paul**; **Bertelson, C. David** (University of Arizona,

Tucson, AZ, United States); Barr, Billy; Waser, Nickolas (Rocky Mtn. Biological Lab, Crested Butte, CO, United States)  
**ASYNCHRONOUS CHANGES IN PHENOLOGY OF MIGRATING BROAD-TAILED HUMMINGBIRDS AND THEIR EARLY-SEASON NECTAR RESOURCES**

Phenological advancements driven by climate change are especially pronounced at higher latitudes, so that migrants from lower latitudes may increasingly arrive at breeding grounds after the appearance of seasonal resources. To explore this possibility we compared dates of first arrival of Broad-tailed Hummingbirds (*Selasphorus platycercus*) to dates of flowering of plants they visit for nectar. Near the southern limit of the breeding range, neither hummingbird arrival nor first flowering dates have changed significantly over the past few decades. At a nearby migration stopover site, first flowering of a major food plant has advanced but peak flowering has not. Near the northern limit of the breeding range, first and peak flowering of early-season food plants have shifted to earlier dates, resulting in a shorter interval between appearance of first hummingbirds and first flowers. If phenological shifts continue at current rates, hummingbirds will eventually arrive at northern breeding grounds after flowering begins, which could reduce their nesting success. These results support the hypothesis that migratory species may experience the greatest phenological mismatches at the poleward limits of their migration, and yield the novel prediction that the poleward limit for some species may contract toward lower latitudes.

**S12.4 Irwin, Darren**, (University of British Columbia, Dept. of Zoology, Vancouver, Canada);

**TECHNOLOGICAL ADVANCES IN THE STUDY OF CONSERVATION GENETICS AND SEASONAL CONNECTIVITY OF LONG-DISTANCE MIGRANTS: AN EXCITING FUTURE**

Knowledge of migratory connectivity between breeding and wintering regions is fundamental to understanding the ecology, evolution, and conservation of Neotropical migrants. Technologies such as multiple-locus DNA analysis, feather isotope analysis, and geolocators have allowed exciting advances in our ability to elucidate patterns of connectivity. I review recent examples of migratory connectivity research, highlighting in particular the case of the Wilson's warblers. Our analysis of 257 variable DNA markers among breeding and wintering Wilson's warblers showed two highly divergent western and eastern breeding groups, apparently corresponding to two distinct migratory groups that are likely distinct cryptic species. A wide variety of other species also consist of western and eastern forms with different migratory routes and wintering areas. There is very little genetic variation within both the western and eastern groups of Wilson's warblers, making it challenging to discern patterns of connectivity within each group. Fortunately, recent advances in next-generation sequencing technology have provided a solution for such situations: by scanning many tens of thousands of single-nucleotide polymorphisms, one can determine the small subset of markers that vary geographically and are likely under selection, and then use those markers to reveal patterns of connectivity. Such an approach still depends critically on sufficient sampling of both the breeding and wintering regions, necessitating large collaborative arrangements and willingness of individual researchers to contribute genetic samples to such studies. I encourage funding agencies and conservation organizations to consider ways to establish and support DNA repositories that would enable such work. By creatively combining next-generation sequencing with technologies such as light-level geolocators and isotope analysis, researchers are

likely to make dramatic progress in the study of migratory connectivity within the coming decade.

**T16.5 Jackson, Allyson**, (Biodiversity Research Institute, Gorham, United States); Evers, David (Biodiversity Research Institute, Gorham, United States); Cristol, Daniel (College of William and Mary, Williamsburg, VA, United States); Tear, Tim (The Nature Conservancy, Albany, NY, United States)

**DO HIGH LEVELS OF MERCURY REALLY MATTER TO BIRDS? REDUCTION IN CAROLINA WREN NEST SUCCESS AND IMPLICATIONS FOR CONSERVATION**

Recently, mercury contamination of terrestrial ecosystems and subsequent bioaccumulation within insectivore songbird food webs has gained attention. Mercury affects many physiological functions, but in particular reproductive success. In 2010, we monitored nesting success of Carolina Wrens breeding along the mercury contaminated South River and uncontaminated reference rivers in Virginia (N = 45 nests). We found a strong negative relationship between female blood mercury concentration and modeled nest success and were able to, for the first time, estimate mercury concentrations that relate to actual reduction in nest success; a 10% reduction in nest success corresponded with 0.7 ppm mercury in blood, 2.4 ppm mercury in body feathers, 3.0 ppm mercury in tail feathers, and 0.11 ppm mercury in eggs. The effects concentrations determined on the South River help us to better interpret an 11-year dataset of 79 species of songbird blood mercury samples collected opportunistically throughout the Northeastern United States (N = 1878). In areas remote from point-source contamination, we found 12 species of songbirds with individuals having blood mercury concentrations that put them at risk to reproductive impairment, based on the Carolina Wren model. These data suggest that the scope of the mercury problem is likely larger than previously considered, and many terrestrial songbirds are at risk to atmospheric mercury deposition.

**PS1.173 Jahn, Alex**, (Universidad de Buenos Aires, Gainesville, United States); Cueto, Victor (Universidad de Buenos Aires, Buenos Aires, Argentina); Fox, James (British Antarctic Survey, Cambridge, United Kingdom); Pinto, Jesus (Museo de Historia Natural Noel Kempff Mercado, Santa Cruz de la Sierra, Canada); Levey, Douglas (University of Florida, Gainesville, United States); Mamani, Ana Maria (Museo de Historia Natural Noel Kempff Mercado, Santa Cruz de la Sierra, Canada); Masson, Diego (Universidad de Buenos Aires, Buenos Aires, Argentina); Tuero, Diego (Universidad de Buenos Aires, Buenos Aires, Canada)

**USING GEOLOCATORS TO TRACK MIGRATION OF TYRANNUS FLYCATCHERS IN SOUTH AMERICA**

Although more than 250 bird species migrate wholly within South America, very little is known about their seasonal movements. We attached light-level geolocators to eight White-throated Kingbirds (*Tyrannus albogularis*) breeding in Santa Cruz Department, Bolivia, and to five Tropical Kingbirds (*T. melancholicus*) and forty-three Fork-tailed Flycatchers (*T. savana*) breeding in Buenos Aires Province, Argentina. After ~1 year, we recovered geolocators from two White-throated Kingbirds, one Tropical Kingbird, and five Fork-tailed Flycatchers. Both White-throated Kingbirds overwintered in northern Brazil, approximately 2000 km from their breeding site. All Fork-tailed Flycatchers overwintered in central or southern Venezuela, and the Tropical Kingbird overwintered in central Colombia. These last two species overwintered approximately 7000 km from their breeding site. Combined,

these three species likely migrated through at least seven countries (Argentina, Bolivia, Brazil, Colombia, Peru, Uruguay and Venezuela). Given that many other migratory bird species, some endangered, spend their annual cycle in more than one country in South America, there is a need for broader research collaborations and natural resource management planning among scientists, conservation agencies and lawmakers across South America.

**S11.2 James, Adelman,** (Virginia Tech, Blacksburg, United States); Hawley, Dana (Virginia Tech, Blacksburg, VA, United States)

#### HETEROGENEOUS RESPONSES TO INFECTION AMONG HOUSE FINCHES: MECHANISTIC CAUSES AND TRANSMISSION CONSEQUENCES

No two individuals respond to infection in precisely the same way, a pattern with far-reaching consequences for pathogen spread and evolution. Revealing the mechanisms underlying individual variation in immunological and behavioral responses to infection will help improve our ability to predict wildlife disease dynamics. Here I discuss how heterogeneity in host responsiveness relates to transmission potential in an emerging infectious disease system: house finches (*Carpodacus mexicanus*) infected with *Mycoplasma gallisepticum*. This bacterial pathogen first jumped from poultry to house finches in the early 1990s, causing severe conjunctivitis, contributing to population declines, and spreading across most of the new host's range by 2010. Transmission among finches occurs largely via bird feeders, which not only attract large aggregations, but also serve as fomites. Experimental infections in captive birds suggest that variation in early inflammatory immune responses predict individual heterogeneity in pathology during the infectious period. I explore how such variation in pathology, as well as pathogen load and feeding behavior, relate to the amount of pathogen deposited on feeders and transmission to naive individuals. Finally, I place these results in the context of improving predictive models of disease spread in natural systems.

**PS1.49 James, Douglas,** (University of Arkansas, Fayetteville, United States); Smith, Kimberly; Neal, Joseph (University of Arkansas, Fayetteville, AR, United States); Hehr, John (Department of Geosciences, Fayetteville, AR, United States)

#### GULF HURRICANE BIRDS INLAND: SWEEP CLEAN VS. BLOWN THROUGH HYPOTHESES

In 2008, three hurricanes in the Gulf of Mexico brought marine, coastal, and other birds to Arkansas. Ten unusual species were found totaling 44 birds of which 15 Sooty Terns were the most numerous followed in numbers by 14 Laughing Gulls. The remaining 15 birds were scattered among 8 species. Hurricanes Dolly, Gustav, and Ike were involved. Only one extralimital bird arrived with Dolly, so Gustav followed by Ike is the main concern. Both made landfall in the same region less than a fortnight apart. Ike still had hurricane force winds across Arkansas, Gustav did not. This set the stage for testing our "swept clean" vs. "blown through" hypotheses concerning the distribution of birds by Gulf hurricanes. The "swept clean" hypothesis was supported. The same hypothesis was supported comparing previous paired Gulf hurricanes, Katrina followed by Rita. "Swept clean" indicates that the first of two tandem hurricanes transports inland the cargo of birds that were in position to be transported leaving none for the hurricane that followed.

**SAT11.6 James, Frances,** (Florida State University, Tallahassee, United States); Pourtless, John; Schenk, John (Florida State University, Tallahassee, United States)

#### IS THERE A CONTINUUM OF PHENOTYPES BETWEEN BIRDS AND DINOSAURS?

In 2011 Xu et al. published a startling paper in Nature that further blurred the distinction between birds and dinosaurs. They reported the results of a cladistic analysis of a standard matrix of coelurosaurian dinosaurs that included 11 new characters and scores of character states for Xiaotingia, their newly described fossil from China. Although the branches of their strict consensus tree had low statistical support, it suggested a clade consisting of Archaeopteryx, Xiaotingia and the current troodontid, Anchiornis. Because this clade, Archaeopterygidae, was the sister group of the Deinonychosauria (Dromaeosauridae and Troodontidae), rather than falling inside Aves (their Aviale), they proposed that Archaeopteryx was not a bird, but rather a dinosaur. We reanalyzed this matrix and confirmed that this result had negligible bootstrap support. When we examined the synapomorphies that the Xu et al. analysis had proposed for the Deinonychosauria and Aviale, we thought that 14 scores for Archaeopteryx for these characters were incorrect. A second reanalysis with our preferred scores put Archaeopteryx back into Aves. Apparently the results of Xu et al. are highly sensitive to interpretations of character states. Because there is so much independent evidence that Archaeopteryx is a bird, it is surprising that Xu et al. did not consider the alternative that not only Xiaotingia and Anchiornis but also other deinonychosaurs may be birds. If this is so, one must ask whether birds really are dinosaurs or whether some 'dinosaurs' are really misidentified birds.

**T1.6 James, Helen,** (National Museum of Natural History, Smithsonian Institution, Washington, United States); Spitzer, Megan; Wiley, Anne (Smithsonian Institution, Washington, DC, United States); Ostrom, Peggy (Michigan State University, East Lansing, MI, United States); Stafford, Thomas (Stafford Research Laboratories, Inc, Lafayette, CO, United States)

#### THE GEOGRAPHY AND CHRONOLOGY OF DECLINE IN BREEDING SEABIRDS IN THE MAIN HAWAIIAN ISLANDS

The decline of breeding seabird populations on oceanic islands can begin as soon as people first settle on the island. Archaeological and paleontological bones from islands consequently provide important baselines on the former breeding distributions and abundances of seabirds. We re-identified and compiled an anatomical inventory of over 18,000 seabird bones found in nearly 100 paleontological and archaeological sites, distributed across the six largest Hawaiian islands. Nineteen species are represented comprising the Diomedidae, Procellariidae, Hydrobatidae, Phaethontidae, Sulidae, Fregatidae, and Laridae. In strong contrast with the high number of extinctions recorded by bones of terrestrial birds in the same sites, only one of the seabirds has been described as an extinct species (*Pterodroma jugabilis*). There is tentative evidence for at least one additional extinction. The low extinction rate among seabirds may be attributed to life history traits including high vagility and longevity, ability to postpone breeding, and social attraction to successful colonies (which may apply in particular to first breeders). Despite this resilience, many seabird species are not now known to breed on islands or in regions where they occur as fossils, indicating that their breeding range, and their numbers, were probably greater in the past. We mapped the abundances and geographic distributions

of bones by species in a GIS context, to better understand breeding habitat and prior distributions before breeding ranges were altered in the human era. Bones of the Hawaiian Petrel (*Pterodroma sandwichensis*) are the most abundant in the database, composing about 70% of the total. For this species, we obtained over 150 radiocarbon dates, which establish a chronology of range contraction in relationship to the chronology of human-assisted biological invasions and other conservation threats.

**PS1.44 Jamieson, Sarah**, (Massey University, Palmerston North, New Zealand); Castro, Isabel (Massey University, Palmerston North, New Zealand); Jensen, Tom (San Diego Zoo Global, Escondido, CA, United States); Wilson, Alexandra (Massey University, Palmerston North, New Zealand); Durrant, Barbara (San Diego Zoo Global, Escondido, CA, United States)  
**FACTORS INFLUENCING BREEDING SUCCESS OF WILD NORTH ISLAND BROWN KIWI**

Kiwi are shy, nocturnal, flightless birds that are endemic to New Zealand. They are treasured by the Māori people and have become the national icon of New Zealand. Sadly, all five species of Kiwi are at risk of extinction. Adult and juvenile predation by introduced mammals is the leading cause of population decline; however, further hampering the recovery of Kiwi is their low hatching success and even lower recruitment rates. Unfortunately very little is known about the details of their breeding ecology. In 2010 we set out to fill this void by radio-tagging 45 adult North Island Brown Kiwi (*Apteryx mantelli*). Over the past two breeding seasons (2010/2011, 2011/2012) we have documented and closely monitored 43 nests. During our presentation we will describe the general breeding ecology of Kiwi (e.g., timing of breeding, clutch size, egg morphometrics, roles within social groups) and which environmental and behavioural attributes influence reproductive output (e.g., nest type, male experience, incubation schedules). It is our hope that the information gained during this project can be used to help with long-term management of North Island Brown Kiwi and the conservation of Kiwi throughout the country.

**S7.5 Jankowski, Jill**, (UBC, Vancouver, Canada); Allen, Julie (University of Florida, Gainesville, FL, United States)

**A PHYLOGENETIC PERSPECTIVE ON ELEVATIONAL GRADIENTS AS DRIVERS OF SPECIES TURNOVER AND DIVERSIFICATION IN ANDEAN BIRDS**

Species turnover is exceptionally high along Andean elevational gradients—individual species have narrow elevational ranges of a few hundred meters, and complete replacement of a given bird community can occur within 1000 meters moving up or downslope. This aspect of beta diversity makes a critical contribution to the immense regional diversity observed in Andean landscapes. Patterns of species turnover are often related to contemporary ecological drivers such as climate, vegetation, and species interactions. While such factors may reinforce elevational ranges, they offer limited insight into the role of evolutionary history in shaping observed patterns of species turnover. Here we apply a newly developed phylogenetic tree for all birds to provide an evolutionary perspective to patterns of species turnover and diversification in the Southeastern Peruvian Andes, which boasts a regional pool of over 1100 bird species. We quantify phylogenetic beta diversity along a 3000-m elevational gradient from the Amazonian lowlands to treeline to identify regions with a strong signal of phylogenetic turnover within the Andean bird fauna. We couple this analysis with an examination of speciation rates

over time and knowledge of Andean uplift events to better understand the historical role of Andean elevational gradients in generating observed diversity across diverse tropical bird families. Considering these analyses in combination allows us to potentially pinpoint common evolutionary mechanisms underlying community structure and turnover in these landscapes.

**S11.1 Jankowski, Mark**, (Lewis Clark State College, Lewiston, United States); Fair, Jeanne (Los Alamos National Laboratory, Los Alamos, Canada); Jen, Owen (Michigan State University, East Lansing, Canada)

**HETEROGENEOUS VIRAL SHEDDING IN BIRDS: POTENTIAL CAUSES AND CONSEQUENCES OF THIS CONSISTENT PHENOMENON**

A basic aim in both epidemiology and disease ecology is to determine how parasites transmit between hosts. Addressing this issue quite often leads to a determination of the relative competence of different host species known to participate in a given parasite transmission cycle. Although informative, it is also increasingly understood that host competence varies greatly within a species. We have found that this is certainly true of avian viruses. Using a meta-analysis of 23 separate laboratory studies involving 14 avian species and five viruses, we quantified the inequality of viral shedding by determining the cumulative distribution function, parameter estimates, and Gini coefficient for each study. The results of each of these metrics suggest a skewed distribution in which a minority of the birds in a group shed a majority of a group's virus. For example, the mean Gini coefficient of 0.700 indicates that the data followed the so-called Pareto Rule in which 20% of the bird subjects shed 80% of the group virus in a given study. This presentation will further detail the methods employed, what processes may drive such heterogeneity, as well as potential repercussions for disease transmission and control.

**PS1.94 Jansen, Erik**, (Texas Tech University, Lubbock, United States); Nagy, Laura (Tetra Tech EC Inc., Portland, OR, United States)

**METHOD FOR ESTIMATING RAPTOR FLIGHT HEIGHT TO CALCULATE COLLISION RISK PRIOR TO THE DEVELOPMENT OF A WIND ENERGY FACILITY.**

Commercial wind energy facilities lead the nation in renewable energy production with Texas as the primary contributor. Wind energy development poses a unique set of environmental concerns including indirect (e.g., displacement of species) and direct (e.g., mortality) impacts. Raptors are a specific concern because they are long lived, have a low reproductive rate and have been observed to be relatively common fatalities at operating wind facilities. Deaths and injuries are likely tied to flight behaviors that would lead birds within the rotor swept area thus increase the probability of collision with turbine blades. Data are often absent or poorly estimated in pre-construction assessments due to the inherent difficulty in accurately estimating flight height in the absence of wind turbines. The accurate estimate of raptor flight heights in the pre-development stage would allow the calculation of the mortality risk to raptors and contribute to making informed project siting decisions. Here we present a method that allows field biologists to estimate flight heights more consistently and accurately than previously used methods. We combine point-specific survey maps, digital laser rangefinder and clinometer with a height conversion table to group flight heights into collision risk categories. We apply this method during 25-minute surveys and use one minute interval (i.e., instantaneous) sampling. Compared to

conventional methods that solely use ocular estimates when a raptor is first detected and does not consider sequential observations; this method standardizes flight height estimates between surveyors and allows for more analytical techniques during data analyses to assist in siting wind energy projects.

**W11.9 Jedlicka, Julie**, (University of California Berkeley, EL CERRITO, United States);

#### MOLECULAR TOOLS REVEAL DIETS OF INSECTIVOROUS BIRDS FROM PREDATOR FECAL MATTER

Development of animal behavior and food web theories has been hindered by the difficulties of predicting and evaluating predator diet breadth and prey selection. I discuss the emerging, interdisciplinary field of 'molecular scatology' and describe a non-invasive application of molecular tools to detect arthropod prey in avian fecal matter to evaluate predator foraging. Mitochondrial cytochrome oxidase c subunit I genes were amplified from Western Bluebird (*Sialia mexicana*) fecal material and sequenced to identify arthropod prey. Overall, prey from seven different families and five different orders were identified. Earlier methodologies including transforming amplicons into chemically competent *Escherichia coli* cells will be compared to more recent approaches of next-generation sequencing of amplicon libraries. I will further discuss the ecological implications of these data and suggest areas of future research including coupling prey identification with availability in the field to build reference databases and determine prey selection and preferential foraging by predators. Consistent methodological advancement will enable molecular scatology to identify ecosystem services provided by predators, develop ecological theory, and inform conservation efforts.

**PS1.180 Jehl, Joseph**, (U. S. National Museum of Natural History, Annapolis, United States); Gebhard, Christina (Smithsonian Institution, Washington, United States); Schmidt, Brian (Smithsonian Institution, Washington, DC, United States)  
THE SPECTACULAR MIGRATION OF EARED GREBES THAT HAS NEVER BEEN SEEN: A GHOST OF THE PASSENGER PIGEON

The post-staging migration of Eared Grebes from fall staging areas at hypersaline lakes in North America to wintering grounds in Mexico is a spectacular event that has never been seen. The latest regular migration of any North American spans 4-5 weeks in November-January, the exact timing being determined by food availability. Radar studies at Great Salt Lake, UT, show grebes exploding away from the lake in one or two waves starting 45-60 min after sunset on 15 or so nights. As the staging population approximates 1.5 million, the number of birds in departing on any night can range into the tens or hundreds of thousands. Radar echos during major departures show a procession up to 40-50 miles long and 10-12 miles wide, sometimes followed by a second, with birds requiring as much as 2-3 hours to a single point. This may be the largest and most prolonged such single-species event since the demise of the Passenger Pigeon. The 12-hr flight to wintering areas is intended to be non-stop and typically originates under clear sky and low/no wind conditions. However, it is not without weather-related risk, and we document the size and consequences of a major downing event in December 2011.

**PS1.184 Jellen, Jennifer**, (Teton Raptor Center, Wilson, United States); Warren, Meghan; Jones, Jason; Smith, Roger (Teton Raptor Center, Wilson, WY, United States)

#### A GENETIC STUDY OF OSPREY (*PANDION HALIAETUS*) IN THE GREATER YELLOWSTONE ECOSYSTEM: CREATING NOVEL GENETIC MARKERS TO EXPLORE POLYANDRY, PEDIGREE, AND THE EFFECT OF FAMILIAL RELATIONSHIPS ON NEST USAGE

The osprey (*Pandion haliaetus*) is one of the most widely distributed species of raptor, with extant populations on every continent except for Antarctica. Despite this ubiquitous presence, very little is known about the genetic structure of osprey populations, a problem which is compounded by a lack of genetic markers that can be used to distinguish individual birds. We have undertaken an effort to identify microsatellite DNA markers specific to the North American osprey (*P. haliaetus carolinensis*), to collect non-invasive DNA samples from the molted feathers of wild birds in the southern portion of the Greater Yellowstone Ecosystem, and to genotype these individuals for the purpose of understanding polyandry, pedigree and the effect of familial relationships on nest fidelity among an established wild population.

**PS1.223 Jenkins, Brittany**, (University of Colorado, Boulder, United States); Vitousek, Maren; Safran, Rebecca (University of Colorado at Boulder, Boulder, United States)

#### HERITABILITY OF THE PHYSIOLOGICAL STRESS RESPONSE IN THE NORTH AMERICAN BARN SWALLOW *HIRUNDO RUSTICA ERYTHROGASTER*

Survival and reproductive success depend on the ability to respond appropriately to stressful events. In avian species, behavioral responses to stressors are strongly impacted by secretion of the glucocorticoid hormone corticosterone (CORT). When presented with a stressful situation, individuals increase CORT secretion which, in turn, affects a variety of physiological and behavioral changes aimed at increasing immediate survival. Lower levels of CORT are also released as part of a circadian rhythm that modulates energy mobilization and daily activity levels. Given that CORT mediates many important physiological processes, it has been implicated in influencing parental care and nestling provisioning rates, predator avoidance, and overall survival rates. Interindividual variability in both baseline and stress-induced CORT concentrations can be substantial, and recent evidence indicates that this variability is correlated with measures of fitness in several avian systems. However, we know little about how heritable CORT profiles are, which is vital for understanding whether and how CORT can respond to natural selection. The North American barn swallow *Hirundo rustica erythrogaster* is a migratory song bird that is exposed to extreme fluctuations in energetic demands and a variety of stressors during the breeding season, which may affect parental care, reproductive success, and survival between breeding seasons. Measurements of CORT can indicate an individual's physiological ability to cope with these various stressors. Our results will elucidate the heritability of both baseline and stress-induced CORT concentrations in *H. r. erythrogaster*. Discerning the heritable component of CORT will provide greater insight into whether these important aspects of physiological responses to stress are subject to evolutionary change by natural selection.

**S7.2 Jetz, Walter**, (NA, NA, Canada); Thomas, Gavin (Canada); Joy, Jeffery; Mooers, Arne (Simon Fraser University, Burnaby, BC, Canada)

#### THE DIVERSITY OF ALL BIRDS IN SPACE AND TIME

The patterns and processes underpinning the evolution and distribution of today's biodiversity are at the very heart of biology. Molecular time trees have advanced our understanding

of tempo and mode of diversification and identified remarkable adaptive radiations across the Tree of Life. However, due to incomplete phylogenetic and geographic sampling, the relative importance of such rapid radiations in shaping present global biodiversity patterns has remained unclear. Birds are a ubiquitous, charismatic and widely studied group displaying many unique adaptations. Here, we analyze and map the first complete dated phylogeny of all extant ca. 10,000 bird species. We find that birds have undergone a strong increase in diversification rate from ca. 40 MYA to present. This acceleration is due to a number of significant increases in rates across the tree. Geographically, the major differences in diversification rates are hemispheric rather than latitudinal, with bird assemblages in Asia, North America and Southern South America making up a disproportionate number of species from recent rapid radiations. Such stark geographic differences suggest the fields of macroevolution and macroecology will benefit from an increasingly geographic and taxonomically inclusive, global perspective.

**PS1.269 Job, Jacob**, (Western Michigan University, Portage, United States); Gill, Sharon (Western Michigan University, Kalamazoo, United States)

#### CAN YOU HEAR ME NOW?: CHIPPING SPARROWS (SPIZELLA PASSERINA) ALTER THEIR SONGS IN THE PRESENCE OF URBAN NOISE

Natural selection shapes communication signals over time to maximize transmission through specific landscapes, promoting efficient communication. When landscapes change faster than signals can evolve, the transmission of signals through the environment may be degraded and the effectiveness of communication may be compromised. Rapid urbanization, which is occurring worldwide at an unprecedented rate, removes natural landscapes and alters animal communication channels. This effect appears to be driven by large increases in anthropogenic noise. Anthropogenic noise may have important consequences for species that rely on vocal communication, and recent studies show that some songbirds alter spectral and temporal characteristics of their songs in the presence of elevated noise levels. Evidence of population level changes is critical when evaluating signal adaptation to rapid environmental change; however what is unclear is whether these changes reflect plasticity at the individual level. We examined vocal change along a noise gradient in a population of chipping sparrows (*Spizella passerina*) in southern Michigan, U.S.A. Chipping sparrow song consists of serially repeated notes that overlap with urban noise, suggesting a pressure to adjust songs in noisier habitats. We tested the hypothesis that chipping sparrows alter characteristics of their songs in the presence of elevated noise levels and that changes are the result of individual plasticity. Various measures of song output were correlated against ambient noise levels and preliminary results show population and individual level responses to ambient noise levels with shorter songs produced in noisier habitats.

**PS2.107 Johnson, Douglas**, (USGS Northern Prairie Wildlife Research Center, Saint Paul, United States);

#### STATISTICS FOR ORNITHOLOGISTS: WHAT'S NEW, WHAT'S NECESSARY?

As with any scientists, ornithologists are challenged to keep up with findings in their own discipline. It is unreasonable to expect them to maintain currency in statistics, which continually develops new ways of looking at data to learn from them. I offer a personal perspective on some of the modern statistical tools, identify relevant and useful ones, and suggest ways to

capitalize on new methodologies without having to immerse oneself in the statistics discipline.

**T16.1 Johnson, Erik**, (National Audubon Society, BATON ROUGE, United States); Wolfe, Jared (Louisiana State University, Baton Rouge, LA, United States)

#### AN INDEPENDENT ASSESSMENT OF OILING FREQUENCY IN BIRDS FOLLOWING THE BP DEEPWATER HORIZON OIL DISASTER

Northern Gulf of Mexico coastal habitats support millions of birds during at least one part of their life cycle. On 20 April 2010, the Deepwater Horizon oil rig exploded about 75 kilometers from the southeast coast of Louisiana, spewing an estimated 4.9 million barrels of crude oil into the northern Gulf of Mexico. Currents brought this crude to shore, impacting 2,580 km of shoreline and placing dozens of waterbird species at high risk of exposure. We drafted a citizen science monitoring protocol to assess the frequency and extent of oiling on coastal waterbirds from Louisiana to the Florida panhandle. We combined the dataset resulting from these citizen science surveys with additional observations submitted to eBird. Because of the public's limited access to the most heavily oil-impacted sites, and because visible oiling detection rates are less than 100%, our assessment of oiling frequency is conservative. Dozens of volunteers assessed nearly 90,000 birds in oil-impacted and non-impacted sites between May and November 2010. Among 33 waterbird species, including species of high conservation concern such as Least Tern, Wilson's Plover, and Reddish Egret, 993 individuals showed evidence of oiling. Spatial and temporal patterns of oiling rates corresponded with the spread of oil and subsequent capping of the well with the highest rates of oiling seen in southeastern Louisiana during July. In addition to providing an independent assessment of oiling frequencies during the Deepwater Horizon disaster, this study highlights how citizen scientists can mobilize quickly to collect valuable data at large spatial scales.

**SAT15.9 Johnson, Jeff A.**, (University of North Texas, Denton, United States); Burnham, Kurt (High Arctic Institute, Orion, IL, United States)

#### TIMING OF BREEDING COVARIES WITH PLUMAGE COLOR AMONG BREEDING GYRFALCONS IN CENTRAL-WEST GREENLAND

Melanic plumage color variation exists among Gyrfalcons (*Falco rusticolus*) throughout their arctic and sub-arctic circumpolar distribution, from white to silver to grey and almost black. While multiple color variants do exist within many populations, a few geographic regions (e.g., northern Greenland) possess a single color variant despite connectivity with neighboring areas, suggesting that local environments may influence plumage color variation. This is further supported by a nonsynonymous point substitution within the coding region of the melanocortin-1 receptor (MC1R) gene that is perfectly associated with the white/melanic phenotypes, showing strong genetic correlation following a Mendelian inheritance pattern with the white genotype recessive. Here we show that conditions exist in a Gyrfalcon population in central-west Greenland (66.5–67.5°N) where Gyrfalcon nests with white adult males had significantly earlier lay dates than grey males, and subsequently, fledged young earlier in the breeding season. In contrast, no significant difference was observed between female color and lay date. When white-white breeding pairs were compared to grey-grey pairs, lay date was significantly earlier at nests with white-white pairs and nests of grey-grey pairs had significantly fewer offspring. Although no evidence of

assortative pairing based on plumage color was observed, these data do suggest that directional selection possibly through crypsis and its influence on the timing of nest initiation when prey are limited may affect overall plumage color polymorphism in this population. In areas like north Greenland (>75°N) where white Gyrfalcons prevail, a shorter temporal breeding season in combination with factors such as genetic drift may influence plumage color frequency in this population despite connectivity with areas further south that possess silver and grey individuals. More work is needed to determine if similar patterns exist with respect to plumage color, lay date, and productivity in Gyrfalcon populations elsewhere throughout their circumpolar distribution.

**PS2.16 Johnson, L. Scott,** (Towson University, Towson, United States); Allen, Allison; Hebert, Rachel; Napolillo, Felicia (Towson University, Towson, MD, United States)

#### THE PROCESS OF FLEDGING IN THE MOUNTAIN BLUEBIRD (*SIALIA CURRUCOIDES*)

Fledging is a critical event in the breeding cycle but remains unstudied in almost all bird species, largely because it is difficult to predict when it will occur at a given nest. We studied fledging in the Mountain Bluebird using radio frequency identification. We attached passive integrated transponders to nestling legs. An antenna checked for the presence of a transponder signal (i.e., a nestling) at the nest box entrance every 3 s. Because nestlings sit in nest entrances for some time before fledging, the final time that a nestling's transponder was detected indicated the time the nestling fledged. Our results suggest that, at most nests, the first nestling to fledge leaves the nest within 3 h of sunrise and all remaining nestlings follow that day, usually within about 1 h. In contrast, if the first nestling to fledge leaves after mid-morning, most or all other nestlings usually wait until the following morning to fledge (suggesting that later fledgings may sometimes be inadvertent). Clutches in nests studied often hatched asynchronously setting up a size/competitive hierarchy within the brood. Thus, we also asked whether fledging typically begins when one of the older, larger, more competitive nestlings reaches certain state of development ("threshold size" hypothesis) or when a younger, smaller, less competitive nestling leaves the nest presumably to intercept parents returning with food ("nestling competition" hypothesis). We used as indices of a nestling's "competitive ability" both its size (primary feather length) and the proportion of time it got to sit in the nest entrance (which ensures receipt of the next parental food delivery) in the 48 h prior to the first fledging. We found that younger/smaller/less competitive nestlings rarely fledge first.

**PS1.157 Johnson, Patrick,** (The Ohio State University, Columbus, United States); Rodewald, Paul; Matthews, Steve (The Ohio State University, Columbus, OH, United States)

#### MIGRATORY STOPOVER OF LANDBIRDS WITHIN THE WESTERN LAKE ERIE BASIN: EXPLORING HOW LANDSCAPE FEATURES INFLUENCE MIGRANT ABUNDANCE TO INFORM CONSERVATION.

In the agriculturally dominated Western Lake Erie Basin, remnant forest patches are known to support immense numbers of migratory birds during spring and fall migration, especially in shoreline areas. Nonetheless, specific information on the distribution and habitat-relationships of migrants within the Western Lake Erie basin is badly needed to better understand habitat selection and develop well-informed strategies for conservation. Our overarching research question was how do densities of migrant species in forest patches vary with respect to: 1) vegetation composition and structure, 2) patch size and

isolation, 3) distance from the lake shore 4) distance from streams and creeks. We used a generalized random tessellation stratified approach to select forest sites that were located between 0-20km from the lakeshore along a 70km stretch of shoreline between Toledo and Sandusky, Ohio, USA. From mid-April through late May 2011 and 2012, we conducted over 1000 point counts at more than 100 forest sites (range of 6-12 survey visits to each site annually). Vegetation data were collected at each location and ArcGIS was used to measure patch area and isolation metrics and the distance to the shoreline. Point count data are being analyzed using a generalized N-mixture model for open populations within the unmarked package in the Program R. These methods allow for simultaneous estimates of abundance and detection probabilities for migrant species without the assumption of population closure between visits to a site. Preliminary results suggest migrant species exhibit varied responses to landscape and local scale habitat features

**T14.8 Johnston, Naira,** (University of Northern British Columbia, Prince George, Canada); Bradley, James; Otter, Ken (University of Northern British Columbia, Prince George, BC, Canada)

#### WIND-ENERGY DEVELOPMENT ALONG A GOLDEN EAGLE (*AQUILA CHYSAETOS*) MIGRATION ROUTE IN THE EASTERN ROCKY MOUNTAINS OF CANADA: HIGHER FLIGHT ALTITUDES POST-CONSTRUCTION PLACES EAGLES AT LOWER RISK OF TURBINE COLLISION.

The current development of wind energy projects in the eastern Rocky Mountain foothills of British Columbia, Canada, raises concerns because it overlaps with a Golden Eagle (*Aquila chrysaetos*) migration corridor. The Dokie Wind Energy Project is the first development in this area and stands as a model for other projects in the region because of consistent topography orientation and weather patterns. We visually tracked Golden Eagles over 3 fall migration seasons (2009-2011), 1 pre-construction and 2 post-construction, to document eagle flight behaviour. We estimated three-dimensional positions of the eagles in space as they migrated through our study site. Flight tracks were then incorporated into GIS to ascertain flight altitudes for eagles that flew over the ridge-top area, or turbine string. We found that eagle heights were higher post-construction compared to pre-construction. Overall, eagle heights were greatest under western cross-winds compared to eastern cross-winds, head-winds and tail-winds, were lower over breaks in the ridge-top topography compared with flat sections of the ridge, increased slightly with increasing wind speed, and were higher in the afternoon compared to the morning hours. No changes in the number of eagles that used the site were detected, suggesting that eagles see the turbines and increase their altitude to avoid the turbines during fall migration.

**PS2.154 Jones, Clark,** (The University of Georgia, Warnell School of Forestry and Natural Resources, Athens, GA, United States); Cooper, Robert (The University of Georgia, Warnell School of Forestry and Natural Resources, Athens, United States)

#### THE SPATIALLY VARYING EFFECT OF RED-COCKADED WOODPECKER MANAGEMENT ON DIVERSITY OF SPECIES OF CONCERN AT FT. BENNING, GA

Single-species management frequently influences non-target species that co-occur within the same habitat. In many cases,



the influence can be positive if those species share similar life histories and structural habitat requirements. Endangered species management is typically implemented as a single-species approach, but frequently other benefits to non-target species are also generated. Red-cockaded Woodpecker (*Picoides borealis*) management hinges on the use of prescribed fire and disturbance-dependent species of southern pinelands directly benefit from this management practice. However, subtle habitat differences of non-target species generate a variable response that does not always have a maximum benefit for all species. The objective of this study was to examine the spatially varying relationship between management for Red-cockaded Woodpeckers and the diversity of five species of concern in Georgia, USA. We found that proximity to a Red-cockaded Woodpecker cavity cluster had varying effects on the diversity of species concern at Ft. Benning, with some areas maintaining higher diversity at greater distances from cluster than others. By targeting restoration efforts in areas that have similar characteristics to those with strong relationships between diversity and Red-cockaded Woodpeckers, greater benefit to other avian species can be conferred.

**PS2.247 Jones, Jason**, (Vancouver Avian Research Centre, Vancouver, Canada);

#### THE IMPORTANCE OF OLD-FIELD HABITATS TO BIRDS IN A SUBURBAN-URBAN LANDSCAPE

The importance of old-field and early successional habitats for birds is becoming widely recognized throughout North America. For the past 3 years, the Vancouver Avian Research Centre has been monitoring birds (primarily using mist nets) utilizing old-field habitats in Colony Farm Regional Park in suburban Vancouver, British Columbia. Over this 3-year time span, we have captured 14,230 birds of 86 species in 21,897 mist-net hours. The importance of the sampled old-field habitat to locally breeding birds and migratory individuals is underscored by three main observations. First, during the late summer and into fall migration, the majority of captured birds are hatch-year birds (89.9%; 5611 of 6242 birds). These data highlight the importance of old-field habitats as nursery habitats for young birds. Second, molt patterns of adult birds captured during fall migration suggest that old-field habitats are important stopover locations for species that exhibit molt migration; for example, adult Swainson's Thrushes often show signs of active molt when captured during fall migration. Third, the regular capture during migration of species that do not utilize old-field habitats as breeding habitat (e.g., Dusky Flycatcher) suggests that these habitats represent important stopover and refueling locations during spring and fall migration for a wide variety of species. Large tracts of old-field habitats are a very rare landscape feature in the Greater Vancouver region. Our monitoring results strongly suggest that these old-field habitats represent a critical landscape feature, the continued protection of which will have lasting impacts on local and provincial bird populations.

**W15.6 Jones, Matthew**, (University of Wyoming, Laramie, United States);

#### IMMUNOGENETIC ADAPTATION AND REPRODUCTIVE ISOLATION ALONG ELEVATIONAL GRADIENTS IN RUFIOUS-COLLARED SPARROWS

Invasive pathogens are increasingly major drivers of extinction and population decline; thus, identifying genetic mechanisms of resistance to parasites in nature is critical to the formulation of effective conservation programs. The major histocompatibility complex (MHC) is a highly variable gene complex which initiates immune responses against foreign pathogens. Additionally, MHC genes may contribute to reproductive

isolation in populations that are differentially adapted to local parasite communities. While MHC heterozygosity is believed to be advantageous to defend against a wide variety of pathogens, excess allelic variation can lead to T-cell depletion and weaken the immune system. Thus, hybrids between populations with divergent MHC genotypes may have excess MHC variation, weakened immune systems, and high parasite infection rates, resulting in post-mating isolation. Using population samples of Rufous-collared Sparrows (*Zonotrichia capensis*) collected along replicated elevational transects, we investigated (1) elevational patterns of avian malarial infection rates and (2) local-adaptation of MHC to high and low elevation avian malarial communities. Highly variable MHC class I antigen binding regions and cytochrome b of two genera of avian malaria were sequenced in *Z. capensis*. Significantly different parasite infection rates were found at low (8%, n=49), middle (65%, n=65), and high (10%, n=70) elevations, in accordance with our predictions. Furthermore, strong associations were found between specific MHC alleles and resistance/susceptibility to avian malaria strains at high and low elevation. Ongoing work is investigating the presence of underdominance in MHC genotypes compared to neutral genome-wide introgression, which would suggest that MHC variation contributes to reproductive isolation along elevational gradients.

**W1.5 Jones, Megan**, (Florida State University, Tallahassee, United States); Boyle, Alice (University of British Columbia, Vancouver, BC, Canada)

#### COOPERATIVE MALE DISPLAY IN THE WHITE-RUFFED MANAKIN (*CORAPIPO ALTERA*)

The cooperative displays of lekking species have long been of interest to evolutionary biologists because they present an apparent paradox: why would some individuals forego mating opportunities while displaying with others at a detriment of their own fitness? This question has been intensively studied in tropical manakins (Pipridae), particularly in obligate or near-obligate cooperatively displaying *Chiroxiphia* manakins. Contrasting obligatory cooperative species with others having only individual displays can provide insight into the evolution of cooperation, but provides limited opportunities to examine the ecological, social, or genetic correlates of variation in cooperation. We provide the first comprehensive description of multi-male display behaviors by White-ruffed Manakins (*Corapipo altera*) based on observations from four breeding seasons. This species' displays were previously described as involving solitary males in dispersed leks with visiting males occasionally joining in for uncoordinated displays. However, descriptions were based on observations of few display sites or a short period of the breeding season. We document coordinated displays intermediate between that of individually displaying species (*Manacus* sp.) and near-obligate cooperative species (*Chiroxiphia* sp.). We quantified cooperative behavior using (i) an association index (based on the proportion of time two individuals associate with each other relative to their association with other individuals), and (ii) social network metrics. Males display in multi-male groups both in the presence of females and when females are absent. While some males do participate in stable cooperative dyads, other males were only observed displaying alone, never engaging in multi-male displays. Males that display in groups are not more closely related than expected for the population. These results lay the groundwork for future intraspecific tests of hypotheses explaining the evolution of cooperative behaviors.

**SAT6.6 Joos, Cara**, (University of Missouri, Columbia, United States);

#### FITNESS CONSEQUENCES OF TERRITORY SELECTION AND HABITAT QUALITY IN BELL'S VIREOS

Habitat quality is important for fitness of Neotropical migrant songbirds. While defining habitat quality is often difficult, linking fitness with habitat selection patterns may identify high quality habitat. Following the ideal despotic distribution hypothesis, territory settlement order reflects territory quality and therefor fitness of occupants. Further, if fitness is linked to habitat characteristics then settlement order also predicts habitat quality. Finally, we can assess if territory selection is optimal by asking if the same habitat characteristics predict both productivity and settlement patterns. We tested these hypotheses in a breeding population of individually color-banded Bell's Vireos (*Vireo bellii bellii*) in Missouri, USA over 3 seasons (2009-2011). Beginning prior to spring arrival we systematically searched study areas using playbacks to record territory settlement date and band status of occupants. Territories were visited every 1-2 days to map territory boundaries and monitor nests to record date of first egg laid and productivity (number fledged). Finally, vegetation structure was measured at the territory scale. Our results show that productivity declined with settlement day and, though less so, with lay day, however lay day was not correlated with settlement day. Productivity was also predicted by vegetation structure, however, when temporal and vegetation models were assess together, the vegetation model was more supported. Last, we found very weak support that productivity and settlement day were predicted by similar vegetation structure. Our findings support the ideal despotic distribution hypothesis as settlement order and habitat both predict productivity of Bell's Vireo territories in our system. Higher quality territories were selected earliest. Early settled territories had higher productivity but not necessarily due to earlier onset of breeding, instead habitat was the most supported predictor of productivity. Our results suggest that early arriving individuals have higher productivity because they obtain territories with higher quality habitat. Finally, our results provide information to habitat managers about specific habitat features that increase productivity of Bell's Vireos in Missouri.

**PS2.67 Jorgensen, Christopher**, (University of Nebraska-Lincoln, Nebraska Cooperative Fish and Wildlife Research Unit, Lincoln, United States); Powell, Larkin (University of Nebraska-Lincoln, Lincoln, NE, United States); Fontaine, Joseph (US geological Survey Nebraska Cooperative Fish and Wildlife Research Unit, University of Nebraska-Lincoln, Lincoln, NE, United States)

#### IF YOU BUILD IT WILL THEY COME?: MANAGING GRASSLAND BIRD POPULATIONS IN TOMORROW'S LANDSCAPES

Grassland bird populations are declining throughout North America and while habitat restoration efforts can be beneficial, management actions do not always demonstrate the desired outcome. Understanding why management actions fail is paramount; yet, past studies have focused on assessing habitat attributes at a single scale, and often fail to consider the importance of ecological mechanisms that act over multiple spatial scales. By looking at multiple spatial scales, we can use Bayesian hierarchical models to identify ecological characteristics driving grassland bird populations and how these factors interact with each other. Once these relationships are identified, we can construct predictive spatial models of relative abundance for a particular species or an entire community, helping identify suitable areas for allocating limited

management resources. We located survey sites across southern Nebraska and conducted a series of point counts to estimate avian populations while simultaneously estimating local vegetative cover and quantifying landscape effects using GIS. Results indicate woody cover has a strong influence on grassland bird species abundance, such that areas containing as little as 15 % woody cover in the landscape substantially reduces species abundance.

**S7.1 Joy, Jeffrey**, (NA, NA, Canada); Thomas, Gavin (Canada); Jetz, Walter (Yale University, New Haven, United States); Mooers, Arne (Simon Fraser University, Burnaby, BC, Canada)  
**CONSTRUCTING AND DATING THE EVOLUTIONARY TREE OF ALL BIRDS**

Evolutionary trees have become essential to nearly all aspects of biological science from molecular genetics to conservation. However, questions at a large taxonomic scale are nearly always hampered by incomplete phylogenies. The approximately 10,000 species of birds represents a charismatic radiation of considerable scientific and popular interest. Here, we present the construction and analysis of the first complete trees of birds. A distribution of complete bird trees was generated by first combining a distribution of backbone phylogenies that defined 129 monophyletic clades built with relaxed clock models and multiple fossil calibrations with distributions of 129 relaxed clock trees including all species assigned to each clade, and then by sampling across these distributions. Assignment of species without genetic data to clades and placement of such species within clades was done with reference to taxonomic treatments combined with birth-death models. We present the broad outlines of this tree, with special reference to the timing of major radiations.

**F1.2 Junda, James**, (Avian Conservation and Science Centre, Ste. Anne de Bellevue, Canada); Bird, David (Avian Science and Conservation Centre, Ste. Anne de Bellevue, PQ, Canada); Greene, Erick (University of Montana, Missoula, United States)  
**USE OF A ROTARY-WINGED REMOTELY PILOTED AERIAL SYSTEM (RPAS) TO DETERMINE NEST CONTENTS OF RAPTORIAL BIRDS**

Conducting surveys on raptor nests, particularly in precarious or inaccessible locations, can prove challenging. Ground-based surveys pose a risk to investigators by way of potentially aggressive parental responses and to the nest contents from the disturbance caused by the investigators. Today, manned aerial vehicles are still often the tool of choice to check the contents of raptor nests, e.g. eggs, young. However, the use of conventional aircraft is expensive and potentially unsafe and may be associated with a significant sampling bias. We propose that using a rotary-winged Remotely Piloted Aerial System (RPAS) will decrease the disturbance, risk and cost while simultaneously increasing accuracy over both the traditional techniques. It also may allow access to nests inaccessible by investigators on the ground or in a large manned aerial vehicle. However, not all raptor species may respond behaviorally to the RPAS in the same manner. In test flights undertaken in the last two years, Ospreys (*Pandion haliaetus*) nesting in Montana readily attacked such machines when they approached the nest. Also, a flight test on an abandoned Red-shouldered hawk (*Buteo lineatus*) nest in a forest with heavy canopy revealed that a RPAS equipped with GPS was difficult to maneuver through the branches due to signal disruption. Further testing of RPAS will continue in 2012 by conducting multiple flights at nests of a variety of raptor species in Quebec, Montana and Saskatchewan and documenting the behavioral responses of the parents. These

data will be used to evaluate this technique for accuracy, safety and effectiveness.

**W3.4 Jusino, Michelle**, (Virginia Tech, Blacksburg, United States); Lindner, Daniel; Banik, Mark (USDA FS NRS Center for Forest Mycology Research, Madison, WI, United States); Walters, Jeffrey (Virginia Tech, Blacksburg, VA, United States)  
DEMYSTIFYING THE RELATIONSHIP BETWEEN RED-COCKADED WOODPECKERS AND HEARTWOOD INHABITING FUNGI

Red-cockaded Woodpeckers (*Picoides borealis*) are primary cavity excavators in the longleaf pine ecosystem and solely excavate their cavities in the heartwood of live pine trees, a process that takes years to complete. Red-cockaded Woodpeckers may have a mutualistic relationship with heartwood infecting fungi. These fungi can decrease woodpecker cavity excavation time; the birds in turn may facilitate the dispersal and colonization of the fungi. We studied the rates of fungal presence and the fungal community composition in Red-cockaded Woodpecker initiated cavity starts (incomplete excavations) and fully excavated cavities. To specifically test if Red-cockaded Woodpeckers facilitate heartwood infection of longleaf pine trees by the transmission of fungi, we employed woodpecker accessible and inaccessible human-made cavity starts. These starts were drilled in 2009 and sampled twice a year for two years. The rate of fungal presence in fully excavated Red-cockaded Woodpecker cavities is 96% and 62% in woodpecker initiated starts. There is an initial fungal presence rate of 13% in human-made cavity starts and this rate changes through time (13% to 96% over two years). However, woodpecker accessibility does not affect the rate of fungal presence in human-made starts. In order to more fully elucidate the role Red-cockaded Woodpeckers play in fungal colonization, we also present results from a DNA-based study that explores the communities of fungi within the excavations that comprise our experiment. Current literature strongly suggests a relationship between these birds and one specific fungus, *Porodaedalea pini*. Our results indicate that many different fungi are prevalent in excavations and potentially important to Red-cockaded Woodpeckers.

**PS2.184 Justyn, Foth**, (Mississippi State University, Starkville, United States); Vilella, Francisco (USGS, Cooperative Fish and Wildlife Research Unit, Mississippi State, MS, United States)  
SHOREBIRD USE OF WETLANDS AND AQUACULTURE PONDS IN THE MISSISSIPPI ALLUVIAL VALLEY AND GULF COAST REGION

Historically the Mississippi Alluvial Valley (MAV) was covered by forested wetlands. In the last century, most of the MAV has been converted for agricultural, aquaculture, and other land uses which have provided new stop-over habitats for migrating shorebirds. Prior to anthropogenic modification, shorebirds likely migrated past the MAV to wetlands along the Gulf Coast. In 2010, the Deep-water horizon oil spill impacted coastal marshes of the northern Gulf of Mexico. In response, the Natural Resources Conservation Service implemented the Migratory Bird Habitat Initiative (MBHI) to provide migratory shorebirds with interior wetland habitat to help offset damage to coastal wetlands. Our objective is to estimate species composition and relative abundance of migrating shorebirds on MBHI associated wetlands in the MAV and Gulf Coast regions during fall migration. We present results from our first year pilot season, July–October 2011. Mean relative abundance of shorebirds using MBHI enrolled wetlands was > 8 times greater than wetlands not enrolled in MBHI. Shorebird migration

peaked in early September with approximately 43 birds/ha across all MBHI wetlands and 2 birds/ha for non-MBHI wetlands. Species richness also followed this trend and was > 3 times greater on MBHI wetlands when compared to non-MBHI wetlands. Continued research on shorebirds in the MAV and Gulf Coast will incorporate stable isotope analysis to assess connectivity and oil signatures in shorebird tissue and food sources. Our research will eventually provide conservation planners with tools to predict shorebird abundance and manage wetlands accordingly.

**SAT7.1 Kaiser, Sara A.**, (Cornell University, Ithaca, United States); Sillett, T. Scott (Migratory Bird Center, Smithsonian Conservation Biology Institute, Washington, DC, United States); Rodenhouse, Nicholas L. (Wellesley College, Wellesley, MA, United States); Holmes, Richard T. (Dartmouth College, Hanover, NH, United States); Webster, Michael S. (Cornell Lab of Ornithology, Cornell University, Ithaca, NY, United States)

SEX-SPECIFIC PARENTAL RESPONSES TO WEATHER-INDUCED VARIABILITY IN FOOD RESOURCES ACROSS A CLIMATE GRADIENT

In north temperate latitudes, climate change has altered the phenology of biological events and contributed to increased weather variability, affecting the quality of breeding habitat for migratory birds. Increasing variability in weather may impose selection pressures favoring individuals or species with greater flexibility in reproductive behaviors to exploit seasonal shifts in prey resources. If reproduction were mistimed to coincide with periods of adverse weather and reduced prey, birds would need to expend more energy and parental effort to compensate for lower foraging success and greater thermoregulatory demands to successfully reproduce. It is unclear, however, whether selection pressures acting on behavioral flexibility would be similar for both sexes. We investigated the direct and indirect effects of weather, caterpillar biomass and adult condition on sex-specific parental behavior in Black-throated Blue Warblers, *Setophaga caerulea*, breeding along a 2°C climate gradient spanning 600-m in elevation in the Hubbard Brook Experimental Forest, New Hampshire, USA. The total effect of weather on parental behavior was greater for males than females and the strength of the direct and indirect effects of weather depended on age-class and elevation. In general, males provisioned nestlings at lower rates and spent less time at the nest when temperatures were warmer. This coincided with periods of reduced caterpillar biomass, which required compensatory feeding by females regardless of their own body condition. Our results suggest that 1) climate warming may select for less parental investment by males and 2) that females may suffer fitness costs if reduced body condition from increased parental effort lead to higher mortality.

**W12.9 Kapetanakis, Yula**, (Cornell University, Ithaca, United States);

FILLING IN THE GAPS: USING NON-INVASIVE GENETIC MARK-RECAPTURE TO DEVELOP A COMPREHENSIVE DEMOGRAPHIC ASSESSMENT OF CRITICALLY ENDANGERED VULTURES IN CAMBODIA

Of the sixteen vulture species found in Eurasia and Africa, only four are classified by the IUCN as demographically stable. The remaining twelve species are vulnerable to, or have already undergone, extreme population declines. Yet the degree to which many old world vulture populations are declining, and the demographic impact of these declines, is still unknown. Nevertheless, accurate demographic data are essential for

addressing conservation issues. Of immediate concern are four vulture species that have undergone massive declines in south Asia from lethal exposure to diclofenac, a pharmaceutical drug used to treat livestock. Three of the impacted species (*Gyps bengalensis*, *G. tenuirostris* and *Sarcogyps calvus*) persist in small, isolated populations in southeast Asia and are now of high conservation priority. We used a non-invasive, genetic mark-recapture approach to estimate population parameters of vulture populations in Cambodia. From 2009-2011 we collected over 7,000 feather samples from feeding stations. By merging traditional mark-recapture and genetic techniques, DNA from feather samples provides otherwise difficult to attain demographic data. Feathers are identified to the species level by restriction enzyme assays and to the individual level via 10 polymorphic microsatellite markers. From this sample, we identified 170 individual birds, roughly equal to previously published population estimate for the entire country. Mark-recapture analysis suggests a nationwide population substantially larger than that previously estimated. Although small population size can lead to reduced genetic variability, estimated heterozygosity ranges between 0.69 to 0.77 for the three species.

**PS1.249 Karin, Benjamin**, (Museum of Vertebrate Zoology, University of California, Los Gatos, United States); Cicero, Carla; Bowie, Rauri (Museum of Vertebrate Zoology, University of California Berkeley, Berkeley, CA, United States); Benedict, Lauryn (School of Biological Sciences, University of Northern Colorado, Greeley, CO, United States)

#### SONG COMPARISON OF TWO AMPHISPIZA BELLI SUBSPECIES

This project focuses on analyzing vocal differences between Sage Sparrow (*Amphispiza belli*) subspecies in California. The goal of this study is to analyze songs of Sage Sparrows from populations representing two of the five named subspecies to assess whether patterns of vocal variation are concordant with the contradictory genetic and morphologic data previously done on these populations. Furthermore, the data will be used to test hypotheses about song divergence in relation to both the evolutionary history and ecology of the different populations. A number of variables measured on each song were used to quantify frequency and temporal characteristics of songs, and to compare songs between populations. Genetic and morphologic differences exist between coastal populations of *A. b. belli* and Mojave Desert populations of *A. b. canescens*. San Joaquin Valley populations of *A. b. canescens* are more similar genetically to *A. b. belli* than to other *A. b. canescens*, although phenotypically they resemble desert *A. b. canescens*. Ecological niche models show that populations in these ecoregions (Mojave Desert, San Joaquin Valley, Coast Ranges) occupy different bioclimates and respond idiosyncratically to temperature and precipitation. I have recorded over 1500 songs from 124 individuals from 6 sites in California. Analysis of song data from these sites show striking differences between Coast Range populations of *A. b. belli* and Mojave Desert *A. b. canescens*, and further analysis will determine which population is most similar to San Joaquin Valley populations of *A. b. canescens* that live between the other two populations. This project is aimed at clarifying the ambiguous subspecies relationship between *A. b. belli* and *A. b. canescens*, and could give evidence to rename San Joaquin Valley populations of *A. b. canescens* as *A. b. belli* in concordance with the genetic data. Additional comparison work (currently being done by Lauryn Benedict and myself) including the Great Basin subspecies, *A. b. nevadensis*, has potential implications to label one or more of these subspecies as a separate species.

**W2.1 Kathryn, Purcell**, (US Forest Service, Pacific Southwest Research Station, Fresno, United States); Sylvia, Mori (US Forest Service Pacific Southwest Research Station, Albany, CA, United States)

#### AVIAN POPULATION TRENDS AND PREDICTING RESPONSE TO CLIMATE CHANGE BASED ON 27 YEARS OF DATA FROM CALIFORNIA OAK WOODLANDS

Climate change may have profound effects on the distribution and abundance of birds. Using 27 years of point count data collected at 210 count stations in California oak woodlands, we examined relations among abundance, temperature and precipitation variables, and El Niño Southern Oscillation events to investigate population trends and predict species' responses to climate change. We used Poisson generalized additive models (GAM) using a logarithmic link with smoothing splines for count response as a first, exploratory approach to examine relations between avian abundance and the independent variables and to determine the functional shapes of the covariates within the Poisson regression model. GAM was also used to drop explanatory variables that appeared to have no relation to counts. We then used Poisson regression models from the family of generalized linear mixed models (GLM), employing the functional shapes for the explanatory variables suggested by the nonparametric spline functions to further explore relationships between avian abundance and the independent variables. Results of nonparametric and parametric Poisson regression models revealed that a majority of the species examined decreased in abundance following warmer than average summers. Response to precipitation varied among species, with some species increasing in or following wet years and others following dry years. Most species were more abundant in or following warm, wet El Niño years. Our results provide information on current trends in avian abundance in California oak woodlands, and also help predict how species might respond to locally changing climatic conditions. Understanding the possible biological consequences of climate change will provide guidance needed to help plan for such changes.

**SAT5.6 Katsnelson, Edith**, (Stanford University, Stanford, United States); Motro, Uzi (The Hebrew University of Jerusalem, Jerusalem, Israel); Feldman, Marcus (Stanford University, Stanford, United States); Lotem, Arnon (Tel Aviv University, Tel Aviv, Canada)

#### INDIVIDUAL-LEARNING ABILITY PREDICTS SOCIAL-FORAGING STRATEGY IN HOUSE SPARROWS (PASSER DOMESTICUS)

Social foragers can use either a 'producer' strategy, which involves searching for food, or a 'scrounger' strategy, which involves joining others' food discoveries. While producers rely on personal information and past experience, we may ask whether the tendency to forage as a producer is related to being a better learner. To answer this question, we hand-raised house sparrow (*Passer domesticus*) nestlings that upon independence were given an individual-learning task that required them to associate color signal and food presence. Following the testing phase, all fledglings were released into a shared aviary, and their social-foraging tendencies were measured. We found a significant positive correlation between individual's performance in the individual-learning task and subsequent tendency to use searching (producing) behavior. Individual-learning score was negatively correlated with initial fear of the test apparatus and with body weight. However, the correlation between individual learning and searching remained significant

after controlling for these variables. Since it was measured before the birds entered a social group, individual-learning ability could not be the outcome of being a producer. However, the two traits may be initially associated, or individual learning could facilitate producing behavior. To our knowledge, this is the first evidence that associates individual-learning abilities with social-foraging strategies in animal groups. (This work is published in Proceedings of the Royal Society B 2011 278, 582-589)

**T14.4 Katzner, Todd**, (West Virginia University, Morgantown, United States); Brandes, David (Lafayette College, Easton, PA, United States); Miller, Tricia (West Virginia University, Morgantown, Canada); Lanzone, Michael (Cellular Tracking Technologies, Somerset, PA, United States); Maisonneuve, Charles (Ministère des Ressources naturelles et de la Faune, Rimouski, PQ, Canada); Tremblay, Junior (Ministère des Ressources naturelles et de la Faune, Quebec City, PQ, Canada); Mulvihill, Bob (National Aviary, Pittsburgh, PA, United States); Merovich, George (West Virginia University, Morgantown, WV, United States)

#### TOPOGRAPHY DRIVES MIGRATORY FLIGHT ALTITUDE OF GOLDEN EAGLES: IMPLICATIONS FOR WIND ENERGY DEVELOPMENT

Wind power is a fast-growing industry with broad potential to impact volant wildlife. The consequences of wind turbines for flying birds and mammals are an issue of high importance. Understanding these consequences is critical to developing effective strategies and recommendations for siting turbines and for mitigating impacts to animals. We used altitudinal GPS telemetry data collected from golden eagles *Aquila chrysaetos* tracked to evaluate potential impacts on eagles and other raptors from wind turbines along migratory routes. Eagle movements during migration were classified as local (1-5km/hr) or migratory (>10km/hr) and were characterized based on the type of terrain over which each bird was flying and its distance from wind resources preferred for energy development. Birds engaged in local movements turned more frequently and flew at lower altitude than they did in active migration. This flight behavior potentially exposes them to greater risk from turbines than they experience when engaged in longer distance movements. Eagles flew at relatively lower altitude over steep slopes and cliffs (sites where orographic lift can develop) than over flats and gentle slopes (sites where thermal lift predominates). Eagles predominantly flew near to wind resources preferred by energy developers, and locally moving eagles flew closer to those wind resources with greater frequency than did eagles in active migration. Our research identifies generally how topography interacts with raptor migration behavior to drive human-wildlife conflict that results from wind energy development. At potential wind energy development sites, risk assessment needs to incorporate understanding of both local topography and its relationship to the varied types of movement behavior that wildlife can exhibit.

**T2.3 Kearns, Laura**, (The Ohio State University-School of Environment and Natural Resources, Columbus, United States); Rodewald, Amanda (The Ohio State University-School of Environment and Natural Resources, Columbus, United States)

#### DO PATTERNS OF NEST PREDATOR ACTIVITY PREDICT NEST LOCATIONS AND SURVIVAL IN URBANIZING LANDSCAPES?

Choice of nest location is one strategy that songbirds can use to reduce risk of nest predation. We hypothesized that birds would

avoid areas with high activity of nest predators, because nest survival would be negatively related to predator activity at local scales. We tested this hypothesis by examining the distribution and survival rates of Northern Cardinal (*Cardinalis cardinalis*) nests built during the breeding seasons of 2008-2010 in riparian forests in central Ohio across an urbanizing landscape. We intersected cardinal nest locations (N = 334) with utilization distributions of both mammalian and avian predators to determine the level of predator activity in the nest area. Consistent with our previous findings at landscape scales, daily survival rates of nests at local scales were not related to either avian or mammalian predator use (Bavian =  $-0.002 \pm 0.002$  SE,  $B_0 = 2.412 \pm 0.134$  SE,  $\omega_i = 0.144$ ; Bmammalian =  $-0.001 \pm 0.002$  SE,  $B_0 = 2.471 \pm 0.157$ ,  $\omega_i = 0.166$ ). Cardinals, however, built nests in areas with lower predator activity, and built in areas that were lower in mammalian activity than avian predator activity ( $38\% \pm 1.3$  SE vs.  $46\% \pm 1.3$  SE probability of predator use, respectively,  $t_{1,333} = -4.26$ ,  $p < 0.001$ ). Regardless of the amount of urbanization, there were no changes in where cardinals located nests (avian predator use:  $r = 0.05$ ,  $p = 0.33$ ; mammalian predator use:  $r = -0.03$ ,  $p = 0.95$ ). The lack of relationship between nest survival and nest location suggests that cardinals may choose nest-site locations due to other factors such as the availability of nesting habitat or proximity to foraging resources.

**PS1.252 Kelemen, Evan**, (Villanova University, Annandale, United States);

#### THE TWO-SONG REPERTOIRE OF CAROLINA CHICKADEES (POECILE CAROLINENSIS): POTENTIAL IMPLICATIONS FOR MATE CHOICE DURING HYBRIDIZATION

Song repertoires vary in function among songbirds, with considerable variation within some taxa. The Paridae (tits and chickadees) exemplify variation at the family level. Male Great Tits (*Parus major*), e.g., have large repertoires but their different songs are functionally similar, whereas songs of Tufted Titmice (*Parus bicolor*) are associated with distinct functions; in contrast, Black-capped Chickadees (*Poecile atricapillus*) produce a single geographically stereotyped song that varies in pitch only. Our study examined composition and structure of song repertoires of Carolina Chickadees (*P. carolinensis*), which have received comparatively little attention, sampled in southeastern Pennsylvania in 2010 and 2011. Two song types are common in our population. Designating high-frequency notes as H and low notes as L, songs separated into type A (HLHL) and type B (HLL) note patterns. Principle components analysis (PCA) of quantitative parameters of each song's first two notes unambiguously distinguished type A (n = 380 songs) and type B (n = 370) songs. PC1, based on frequency of the 1st and 2nd notes and frequency change between these notes, accounted for 50% of variation; PC2, with duration of the 1st and 2nd notes loaded heavily, accounted for 20% of variation. Both scores differed significantly between songs separated qualitatively based on note pattern into A and B types. Of songs sampled (n = 6711), 79% were type A and 21% were type B. Proportional presentation of A and B song types varied among males, but all males produced both types, except for a few males with small samples that were not known to sing type B. Songs within types varied through addition or subtraction of notes. Variants of type A (HL, HLHLHL, etc.) accounted for <math>1\%</math> of songs analyzed (n = 3186) whereas type B songs (n = 976) often included an additional low note (HLLL, 26%) or other variants (HL, HHLL, etc.; <math>5\%</math>). These results indicate that Carolina Chickadee repertoires are more complex than those of Black-capped Chickadees, a difference that may influence

hybridization between the two species in nearby populations in which many 'bilingual' males produce type A Carolina Chickadee songs (only) as well as Black-capped Chickadee song. Further investigation of the function of the two Carolina Chickadee song types may provide insight into the northward-moving Carolina × Black-capped chickadee hybrid zone.

**T4.1 Keller, Judith,** (University of Delaware, Newark, United States); Shriver, W Gregory (University of Delaware, Newark, DE, United States)

#### CAMPYLOBACTER JEJUNI, COLI, AND LARI PREVALENCE IN AGRICULTURALLY ASSOCIATED AND MIGRATORY WILD BIRDS

*Campylobacter jejuni* is responsible for the majority of bacterial foodborne gastroenteritis in the United States (Thomas, 1988; Abulreesh et al, 2006) Most *Campylobacter* food poisoning occurs due to the consumption of undercooked poultry meat; however little research has been conducted on other avian species that have the potential for transmitting this bacterium, especially in the US. This study evaluated *Campylobacter* prevalence in waterfowl, gulls, and shorebirds from Delaware, New Jersey, and Pennsylvania through culture and PCR-based methods. The overall prevalence of *Campylobacter* spp. for all wild birds in this study was 11.4%. Samples were heterogeneous in terms of prevalence at all levels, including order, family, genus, and species, ranging from 0 to 43.1%. *C. jejuni* was the most prevalent species of *Campylobacter* present, while *C. coli* and *C. lari* prevalence estimates were low (10.1%, 1.4%, 0.3%, respectively). Results from culturing methods indicate that 30% of Snow Geese and 6% of Canada Geese were positive for *Campylobacter* spp. (n=111, n=274, respectively). Of several Laridae species, 12% (n=127) were positive for *Campylobacter* spp., while Ruddy Turnstones had a prevalence of 43% (n=65), Sanderling 4% (n=26), and Semipalmated Sandpipers 26% (n=62). Characteristic human disease clonal complexes such as the ST-45 complex were isolated through MLST-PCR, but a significant amount of samples also had not yet had a ST assigned to them, suggesting some wild bird species-specific clonal complexes of *C. jejuni*. This was especially true for the shorebird species. Wild birds are sharing an increasing amount of habitat with humans as more of the landscape becomes fragmented and developed for human needs. Wild birds will remain an important aspect of public health due to their ability to carry emerging zoonotic pathogens or aiding in the dispersal of arthropod vectors (Reed et al, 2003). Although wild birds still have the potential to spread disease organisms such as *Campylobacter*, it is important to keep in mind that we as humans are also leaking pathogens into the environment that are in turn infecting wild bird populations. As basic information such as prevalence is still missing from a great majority of wild birds in the US, this study provides further insight into *Campylobacter* epidemiology, host preference, and strain characterization of *C. jejuni*.

**PS1.104 Keller, Rebecca,** (North Carolina State University, Raleigh, United States); Simons, Ted (USGS NC Cooperative Research Unit, Raleigh, NC, United States); Webster, Raymond (International Pacific Halibut Commission, Seattle, WA, United States); Franzreb, Kathleen (USDA-Forest Service, Knoxville, TN, United States)

#### CALCIUM LIMITATION IN HIGH ELEVATION BIRDS IN THE SOUTHERN APPALACHIANS

Calcium limitation is a primary concern for birds nesting in acidified landscapes, where birds may experience egg shell defects, decreased nesting success and decreased fitness. The

Southern Appalachians are exposed to some of the highest acidic deposition rates in North America, and birds nesting in the higher elevations where deposition is greatest may be at an increased risk. We examined the effects of calcium limitation on Dark-eyed Juncos (*Junco hyemalis*) using lead deposition in the organic horizon as a surrogate for acidic deposition. We created a geostatistical model of predicted deposition, accounting for spatial dependence and covariates. Analyzing eggs collected in 2006, we found a significant decrease of 0.11 mg calcium per egg per nest for every 1 mg/kg increase in deposition. Therefore, egg calcium decreased approximately 3-18% per nest as deposition increased from lowest to highest, respectively. Supplemental calcium added to treatment plots in 2007 and 2008 showed no effect on daily nest survival, clutch size or egg volume. Time, nest age, and elevation were significant parameters in our models explaining variation in nesting success, with increasing time and nest age having a negative effect during the incubation period, and elevation showing a positive effect during incubation and nestling periods. We found no support for an influence of deposition rate on clutch size, the timing of nesting, or nesting success. Thus, although acidic deposition may be affecting either the size and/or the thickness of junco eggs in the Southern Appalachians, we were unable to detect any population level effects.

**S6.1 Kellermann, Jherime,** (USA-National Phenology Network, Tucson, United States); van Riper III, Charles (USGS/SBSC/ Sonoran Desert Research Station, Tucson, AZ, United States)

#### PHENOLOGICAL SYNCHRONY, HABITAT BREADTH, AND RESPONSES TO CLIMATIC VARIATION OF BIRD MIGRATION IN THE MADREAN ARCHIPELAGO AND THE AMERICAN SOUTHWEST

Climatic conditions can have significant phenological effects that are not uniform across species or biogeographic regions. Spatiotemporal patterns of bird migration and phenological synchrony with ecological communities comprising stopover habitats are strongly affected by climate but are poorly understood in many regions, especially arid lands of the American southwest. The Madrean Archipelago of southeast Arizona is an ecologically diverse region providing vital "stepping stones" that link migration corridors of Mexico and the USA. We studied bird migration and leaf-out and flowering of tree species across 2200m elevational gradients in Arizona's "Sky Islands" during spring migration to assess timing and phenological synchrony of migration with vegetation at stopover sites, species-specific breadth of habitat use, and responses to interannual variation in regional climate at multiple scales. We surveyed bird abundance and plant phenology along 43 point-line transects across three mountain ranges and two river corridors eight times per year from March-May, 2009-2011. We analyzed a suite of bird species that do not breed in southeast Arizona. The winter of 2010 was significantly wetter and cooler, especially at high elevations with snow cover and low temperatures well into April. We found significant correlations of bird abundance with vegetation phenology across years, suggesting that some species can track and maintain phenological synchrony. Species exhibited a diverse range of habitat breadth and responses to climate. For example, in 2010 Ruby-crowned Kinglets (*Regulus calendula*), which used a broad range of stopover habitats in all years, displayed a significant habitat shift from montane conifer to lowland riparian forests by early-season migrants plus a 40% overall reduction in relative abundance. In contrast, Hermit Warblers (*Setophaga occidentalis*), which exclusively used upper-elevation conifer forests in all years experienced a 90%

reduction in relative abundance and no habitat shift. We used the eBird database (ebird.org) to examine potential larger scale responses to climate variation indicated by local abundance reductions. We found significant increases in detections (frequency and abundance) in counties of southern California in 2010, suggesting geographic shifts of migratory pathways in response to regional climate and that regional migrant abundance may be driven by climatic conditions at distant locations.

**F10.9 Kelly, Janice**, (Texas Tech University, Lubbock, United States); Schmidt, Kenneth (Texas Tech University, Lubbock, TX, United States)

#### POST-BREEDING PUBLIC INFORMATION IN A GROUND-NESTING SONGBIRD COMMUNITY

The territory a bird chooses to breed in can have large and direct effects on the bird's reproductive success. Birds can assess territory quality to make settlement decisions by using information obtained from social cues emitted by other organisms. Public information (PI) from performance-based cues reveals territory quality by advertising the current territory inhabitants' reproductive success. We designed a playback experiment to investigate PI use in the Veery (*Catharus fuscescens*) and its effect on community responses. We hypothesized that Veery fledgling vocalizations present during the post-breeding season are PI cues used by Veeries and other ground-nesting songbirds to select territories in subsequent breeding seasons. Moreover, we hypothesize that ground-nesters integrate multiple social cues sampled throughout the breeding season when selecting future breeding territories. To test these hypotheses, we played Veery fledgling vocalizations and silent controls at plots during the post-breeding season in 2009 and 2010, as well as chipmunk vocalizations at half of these plots during the pre-breeding season. Response data (nest distances to nearest plot, nest counts at each plot, and nest initiation dates at plots) were collected during the following breeding seasons. Our results show that Veeries as well as heterospecific ground- and canopy-nesters were more likely to occupy fledgling treatment plots compared to silent controls. However, no species or nesting guild appears to assess territory quality by integrating multiple social cues for territory selection. Our study demonstrates that post-breeding PI reaches conspecifics as well as heterospecific ground- and canopy-nesters selecting their own territories. This study is the first to test if songbirds integrate social information from multiple sources throughout the breeding season for territory selection.

**PS1.220 Kelly, Kevin**, (University of New Brunswick, Fredericton, Canada); Antony, Diamond (University of New Brunswick, Fredericton, NB, Canada); Rebecca, Holberton (University of Maine (Orono), Orono, ME, United States); Lynda, Leppert (Georgia Aquarium, Atlanta, United States)

#### IS THE COLOUR OF ATLANTIC PUFFIN BILLS AND FEET AN HONEST SIGNAL OF CONDITION?

Though auditory signals are most often associated with birds signalling their condition, visual cues can be just as important. Visual cues are often some sort of movement or display enhanced by brightly coloured plumage or soft parts. Atlantic Puffins are sexually monomorphic, colonially nesting seabirds whose intra-species signalling is poorly understood. Their bright orange bill and feet are much reduced during the non-breeding season so it seems likely they are used in signalling individual condition to other puffins. In this study we compared measures of physiological condition, such as corticosterone levels, blood leukocyte profiles, and plasma metabolites, to bill

and foot reflectance measures to establish whether colour in puffin soft parts was an honest signal of an individual's condition. In addition we used stable isotope analysis of blood samples to determine whether an individual's trophic position had any influence on soft part colouration that might enhance or contradict the signal of an individual's condition. Understanding how soft part colour correlates with individual condition and diet quality should provide a better understanding of signalling in Atlantic Puffins.

**T12.6 Kendrick, Sarah**, (University of Missouri-Columbia, Columbia, United States); Thompson III, Frank R. (USDA Forest Service, Columbia, MO, United States); Reidy, Jennifer (University of Missouri-Columbia, Columbia, MO, United States)

#### EASTERN WOOD-PEWEE BREEDING DEMOGRAPHY ACROSS A SAVANNA-WOODLAND-FOREST GRADIENT IN THE MISSOURI OZARKS

Better knowledge of bird response to restoration of savanna and woodland is needed to inform management of these communities. We studied the breeding demography of the Eastern Wood-Pewee (*Contopus virens*; hereafter Pewee) in the Missouri Ozarks because it breeds across a range of wooded habitats. Our objective was to determine temporal and habitat effects on breeding demography of the Pewee across savanna, woodland, and forest to better understand the effects of restoration efforts in the Midwest. We determined nest success, clutch size, fledge rate, and breeding densities of the Pewee across the vegetation gradient and tested for effects of year, stage, ordinal date, nest height, percent stocking, and percent forest in a 10-km radius. We conducted point counts using 10-minute unlimited radius counts and estimated detection probability and density of Pewees using distance models considering the effects of observer, type of detection, minutes since sunrise, vegetation type, day of year, and distance on detection probability. We monitored 310 nests at 13 study sites and conducted 906 point counts at 15 sites from 2009-2011. Year, ordinal date, nest height, and stocking had weak or no effects on nest survival. Nest stage had a strong effect on daily survival rate. Contrary to previous studies examining the effects of forest fragmentation in the landscape, period survival increased with decreasing forest cover in a 10-km radius. Daily survival rate was 0.977 (95% CI: 0.972, 0.981) overall. Average clutch size was 2.568 (95% CI: 2.456, 2.679; n=111) and average young fledged was 2.2 (95% CI: 2.034, 2.366; n=65). Only 1.25% of nests were parasitized by Brown-headed Cowbirds (*Molothrus ater*). Average feeding rate was 7.89 visits per hour (n=56) and frequency of parental visits was positively correlated with nestling age (p=0.049). We recorded 15 cases of double brooding and some successful nests were reused. Pewee densities were higher in woodland and forest compared to savanna. Increasing nest success with decreasing forest in a 10-km radius may indicate that Pewees are less susceptible to fragmentation effects like brood parasitism in Missouri. Thus, passerine nest survival may not always decrease with fragmentation and this relationship likely depends on dominant predators. Further research is needed to understand trade-offs of Pewee abundance and nest survival at different spatial scales.

**PS1.32 Kennedy, E. Dale**, (Albion College, Albion, United States); White, Douglas (Albion College, Albion, MI, United States)

#### RELATIVE CONTRIBUTIONS OF EARLY AND LATE NESTS TO BREEDING SUCCESS OF HOUSE WRENS

Seasonal reproductive success is a function of the number of broods per season and the productivity per brood. In small passerines, many birds may breed in one or a few seasons, and multiple breeding attempts in a single season are extremely important in overall lifetime breeding success. Here we report on 16 years of breeding data from a population of House Wrens (*Troglodytes aedon*) in Michigan. Between 1996 and 2011, we monitored 967 nests in boxes for onset of laying, laying order, hatching, and fledging. Overall, 675 nests (70%) were successful, defined as having at least one nestling fledge. Of these nests, 445 (46%) were designated as early (started by the first week in June) and 522 were late. Across years, the nesting success of early nests (300 of 445, 67%) and late nests (375 of 522, 72%) did not differ significantly ( $t=-1.13$ ,  $df=30$ ,  $P=0.27$ ), and success rates of early and late nests were only modestly correlated ( $r=0.375$ ,  $P=0.17$ ). Survival rates of fledglings may decline seasonally; however, only 111 of 3374 banded nestlings that fledged returned to our study site as adults, and 36% were from late broods. Overall, late broods appear to be as important as early broods in the reproductive success of this population of wrens.

**W11.5 Kennedy, Kyle**, (Black Hills State University, Spearfish, United States);  
EXAMINING THE MODES OF SELECTION MAINTAINING THE PHEUCTICUS GREAT PLAINS HYBRID ZONE USING GENOMIC CLINE ANALYSIS OF AFLP DATA

Hybrid zones provide natural laboratories to study how selection maintains species boundaries. Contact zones have traditionally been characterized using geographic cline analysis, a method taking allele frequencies and/or morphometric data and comparing them to a geographic locality. These geographic clines display the change in allele frequency across a hybrid zone and signify the location of allele exchange. While geographic clines are adequate at determining the location and the width of hybrid zones, they cannot determine the mode of selection that is maintaining them. New techniques employing genomic hybrid index construction and genomic cline analysis allows for the investigation of the mode of selection maintaining a hybrid zone through the identification of outlier loci. In this study, we analyze AFLP data with genomic cline analysis to identify loci under selection and the mode of selection acting on these loci in a hybrid zone between two Grosbeak (*Pheucticus*) species. The *Pheucticus* hybrid zone (*P. ludovicianus* x *P. melanocephalus*) located in the Great Plains has been examined for decades. Previous studies suggest the hybrid zone center has been fixed for the last forty years, but the width of the zone is decreasing, classifying it as a classic tension zone. The tension zone hypothesis is tested and loci under selection and contributing to reproductive isolation are identified.

**PS2.100 Kennedy, Kyle**, (Black Hills State University, Spearfish, United States);  
ESTIMATING HYBRID ZONE ORIGINS USING ECOLOGICAL NICHE MODELS.

Most contemporary hybrid zones are thought to be the result of secondary contact between species that diverged in allopatry. The size and shape of these hybrid zones is thus determined by the complex interplay between time since secondary contact, dispersal distance of the species involved, divergence in ecology between the parental species, and strength of selection against interspecific matings or offspring. Avian contact zones across the Great Plains are hypothesized to have originated quite recently, for some within the last hundred years and certainly within the Holocene. However, the observed width of many of

these zones is extremely narrow suggesting that dispersal into these areas is either infrequent or selection is stronger in these zones than has been recorded in most selection studies. Alternatively, it is possible that contact between species found in the Great Plains hybrid zones persisted through past environmental fluctuations and the species have been hybridizing for longer than originally hypothesized. This study uses ecological niche models (ENMs) to determine species distributions during the last glacial maximum of two hybridizing *Pheucticus* species (*P. melanocephalus* and *P. ludovicianus*) and examines the potential for the persistence of the contact zone during glacial periods. Species occurrence points for breeding *P. melanocephalus* and *P. ludovicianus* were collected from ORNIS. Additionally, 11 environmental layers for the present day and the Pleistocene were collected from WorldClim. Maxent was used to generate niche models for both species. The species distributions at the last glacial maximum show significant overlap suggesting the occurrence of a hybrid zone during the last glacial maximum. Implications for the strength of selection acting in this putative tension zone are discussed.

**T6.1 Kenyon, Haley L**, (UBC, Vancouver, Canada); Toews, David PL; Irwin, Darren E (UBC, Vancouver, BC, Canada)  
CAN SONG DISCRIMINATE BETWEEN MACGILLIVRAY'S AND MOURNING WARBLERS IN A NARROW HYBRID ZONE?

Reproductive isolation leads to speciation. In order to better understand which barriers to reproduction may be important in bringing about speciation we can study hybrid zones, where distinct taxa interbreed and reproductive isolation is incomplete. Here we investigate whether song is involved in the maintenance of a hybrid zone between MacGillivray's (*Geothlypis tolmiei*, formerly known as *Oporornis tolmiei*) and Mourning warblers (*G. philadelphia*) in northeastern British Columbia, Canada. We use recordings from both allopatric regions across these sister species' ranges and areas within the contact zone in conjunction with diagnostic mitochondrial and nuclear markers in order to determine whether song and genotype are associated. If song is a barrier to reproduction between MacGillivray's and Mourning warblers, then a bird's song should be indicative of its genotype. Using a discriminant function analysis we show that while song differs between these species in allopatry, there is only a weak and non-significant association between song and diagnostic genetic markers within the hybrid zone. This lack of association within the hybrid zone leads us to conclude that song is unlikely to play a strong role in reproductive isolation between these species. We suggest that this pattern of song convergence in sympatry could allow for continued hybridization and may have resulted from indiscriminant song learning within the hybrid zone. As a result, we advocate for future research examining heterospecific cultural transmission of song within areas of contact between closely related taxa.

**F13.11 Kern, Rebecca\*** (University of Delaware, Newark, United States); Shriver, Greg (University of Delaware, Newark, DE, United States)

THE EFFECTS OF PRESCRIBED FIRE AND HABITAT LOSS ON SEASIDE SPARROW POPULATION VIABILITY IN MARYLAND, USA

Tidal marshes in North America contain a unique assemblage of endemic species, including Seaside Sparrows (*Ammodramus maritimus*). In the Chesapeake Bay, Maryland, Seaside Sparrow density and fecundity are increased by prescribed winter burns; however, the Chesapeake Bay is predicted to lose significant



amounts of Seaside Sparrow habitat due to global sea level rise and marsh subsidence. The effects of prescribed burning and habitat loss on Seaside Sparrow population viability in Maryland are not known. To inform management and conservation decisions, we used population viability analysis to compare the relative effects of minimum and average burn scenarios, as well as low (15%) and high (33%) marsh loss scenarios, on Seaside Sparrow viability over 50 years at Blackwater National Wildlife Refuge. We found that prescribed burning increased the probability of Seaside Sparrow population persistence, but its effect was minimal compared to preserving habitat. Quasi-extinction of the population was two times more likely under the minimum burn scenario than under the average burn scenario, and 2.6 times more likely under the high marsh loss scenario than under the low marsh loss scenario. However, the likelihood of quasi-extinction was relatively low (0.1 – 0.2) under all scenarios except the high marsh loss scenario, in which the quasi-extinction probability was 0.5. The high marsh loss scenario also accelerated the extinction threat over time compared to the burn scenarios. Thus, slowing the rate of marsh loss will have a greater positive effect on population viability than increasing the frequency of prescribed fire.

**SAT17.6 Keyel, Alexander,** (Tufts University, Medford, United States); Bauer, Carolyn; Lattin, Christine; Romero, L. Micheal (Tufts University, Medford, MA, United States); Reed, J. Michael (Tufts University, Medford, United States)

#### TESTING THE ROLE OF PATCH OPENNESS AS A CAUSAL MECHANISM FOR APPARENT AREA SENSITIVITY IN A GRASSLAND SPECIALIST

Area sensitivity, species being disproportionately present on larger habitat patches, has been identified in many taxa. We propose that some apparently area-sensitive species are actually responding to how open a habitat patch is, rather than to patch size. We tested this hypothesis for Bobolinks (*Dolichonyx oryzivorus*) by comparing density and occupancy to a novel openness index, patch area, and edge effects. Bobolink density and occupancy showed significant relationships with openness, but logistic models based on an openness occupancy threshold had greater explanatory power. Thresholds remained approximately consistent from June through August, and shifted to be more open in September. Variance partitioning supported the openness index as unique and relevant. We found no relationships between measures of body condition (body mass, body size, circulating corticosterone levels) and either openness or area. Our findings have implications for studies of area sensitivity, especially with regards to inconsistencies reported within species: specifically, (1) whether or not a study finds a species to be area sensitive may depend on whether small, open sites were sampled, and (2) area regressions were sensitive to observed densities at the largest sites, suggesting that variation in these fields could lead to inconsistent area sensitivity responses. Responses to openness may be a consequence of habitat selection mediated by predator effects. Finally, openness measures may have applications for predicting effects of habitat management or development, such as adding wind turbines, in open habitat.

**S11.6 Kilpatrick, A. Marm,** (UCSC, Santa Cruz, United States); Jones, Matthew (New York State Department of Health, Slingerlands, United States); Daszak, Peter (Ecohealth Alliance, New York, United States); Kramer, Laura (New York State Department of Health, Slingerlands, United States); Marra, Peter (Smithsonian, Washington, United States)

#### BIODIVERSITY AND DISEASE RISK: DILUTION EFFECT OR SIMPLY HABITAT CHANGE?

There has been an explosion of interest in the possible role that biodiversity plays in the transmission of zoonotic diseases shared by humans and other animals. A mounting list of studies finding negative correlations between the diversity of host species and some measures of disease risk have been offered as evidence that species interactions and the hosts themselves play a direct role in variation in disease risk. However, in addition to an also growing list of studies showing an opposite trend, there are strong reasons to worry about the causal role of species rather than correlated environmental factors in decreasing disease risk. We examined detailed aspects of transmission ecology for a vector-borne pathogen, West Nile virus, across a land use gradient. In agreement with previous studies we found a negative relationship between host species diversity (and richness) and disease risk. However, additional data not collected/presented in other studies of this system, and in many other dilution effect studies, shows that the correlation with host diversity is likely to be spurious. Instead differences in habitat that cause the changes in host communities are instead responsible for modulating disease risk. Our results challenge a growing paradigm, and offer a path for moving the field forward to determine exactly when biodiversity provides an ecosystem service for human health.

**PS2.170 Kim, Daniel,** (Platte River Whooping Crane Maintenance Trust, Wood River, United States); Renfrew, Rosalind (Vermont Center for Ecostudies, Norwich, VT, United States); Fox, James (Migrate Technology Ltd, Cambridge, United Kingdom); Levey, Doug (National Science Foundation, Arlington, VA, United States); Murphy, Michael (Portland State University, Portland, OR, United States)

#### DIFFERENT BREEDING POPULATIONS OF EASTERN KINGBIRDS (*TYRANUS TYRANUS*) DISPLAY SIMILAR MIGRATORY PATHWAYS, BUT DISTINCT WINTERING AREAS.

The Eastern Kingbird (*Tyrannus tyrannus*) is a long-distance Neotropical migrant inhabiting grassland and open lands across North America. To elucidate migratory pathways and connectivity, we attached geolocators (GL) to birds from breeding populations in eastern Oregon (Malheur NWR; Malheur; n = 10) in 2009 and central Nebraska along the Platte River (Platte; n = 10) in 2010. In the following year we recovered three and six geolocators at the Malheur and Platte sites, respectively. Malheur birds proceeded east then south through the Great Plains, potentially crossing the Gulf of Mexico to the Yucatan before wintering in northern Peru/Colombia. Platte birds migrated close to the equinox, preventing estimates of fall migratory pathways around the Gulf of Mexico. All birds arrived on wintering areas by the third week in October and left between early February and late March. Malheur birds spent a mean residence time of 134 days in Peru, while Platte birds averaged 104 days residence in Bolivia, followed by a mean residence time of 26 days in Peru. Six of eight birds stopped over in Colombia (7 – 24 days, mean = 11.5 days) during spring migration. Seven birds re-entered the US in Texas and moved north or northwest to their respective breeding areas. Birds returned to the Platte site between 8 and 28 May and the Malheur site 28 May – 8 June. Additional study areas may display connectivity with regionally discrete eastern breeding populations displaying regionally discrete wintering areas in northern Argentina and Paraguay.

**SAT18.6 Kimball, Rebecca**, (University of Florida, Gainesville, United States); Braun, Edward; Wang, Ning (University of Florida, Gainesville, FL, United States)

#### INDEPENDENT CORROBORATION OF THE AVIAN TREE OF LIFE

Recent molecular phylogenies of birds have begun to resolve basal relationships among avian families and orders by using sequences from many different loci, such as the 19-locus study of Hackett et al. (2008). A question when using large datasets is whether high degrees of support can be obtained spuriously and support incorrect conclusions. To re-evaluate the relationship supported by Hackett et al. (2008), we collected data for 77 taxa that represent all major avian clades from 31 loci that were not used in that study. With this independent, 31-locus dataset we compared our results to that obtained using the 19 loci used in the prior study. This new dataset largely corroborated conclusions from Hackett et al. (2008) – strongly supported relationships from one dataset were generally well supported in the other. However, there were several differences between the two studies, with 10% of nodes receiving at least 50% bootstrap support in one of the studies not present in the other study. We identified sites in the datasets that supported one topology over the other. There were a limited number of these sites; while some were scattered across all loci, the majority of them clustered in a single locus. Exclusion of either these sites or the locus with an unexpectedly large number of these sites altered several well-supported relationships from Hackett et al. (2008). Since most nodes were in agreement between studies, we combined the two datasets into a 50-locus dataset, nearly doubling the amount of data relative to either the 19- or 31-locus datasets. However, no additional well-supported relationships were found when all 50 loci were analyzed, suggesting that additional resolution of the avian tree of life may only be possible with substantially greater amounts of data, if at all.

**PS2.31 Kimiatek, Alexi**, (Plymouth State University, Plymouth, United States); Reitsma, Leonard (Plymouth State University, Plymouth, NH, United States)

#### OLDER MALE CANADA WARBLERS HAVE MORE ROBUST PLUMAGE AND ARE MORE FIT

Sexual selection drives the evolution of secondary sexual characteristics used by females to assess potential mates. Plumage characteristics have been widely studied and have been shown to be honest signals of male quality. We investigated whether plumage variance may be related to age, arrival date, and fitness in male Canada warblers. A population of Canada warblers in central New Hampshire was monitored throughout the breeding season. Carotenoid-pigmented breast feathers were analyzed for feather brightness using reflectance spectrometry, and male melanin-pigmented bib size was measured. After-second-year males arrived to the study site earlier, had brighter breast feathers, larger bibs, greater breeding success and fledged more offspring than second-year males. Our data is consistent with a large body of research in showing the benefits of age on reproductive success.

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breast feathers, larger bibs, greater breeding success and fledged more offspring than second-year males. Our data is consistent with a large body of research in showing the benefits of age on reproductive success.

**PS1.60 King, David**, (Northern Research Station USFS, Amherst, United States); Chandler, Carlin (University of Massachusetts Amherst, 01003, United States); Rappole, John (Smithsonian Institute, Front Royal, VA, United States); Chandler, Richard (USGS Patuxent Wildlife Research Center, Laurel, MD, United States); Mehlman, David (The Nature Conservancy, Albuquerque, NM, United States)

#### ESTABLISHING QUANTITATIVE HABITAT TARGETS FOR NON-BREEDING GOLDEN-CHEEKED WARBLERS

The Golden-cheeked Warbler *Dendroica chrysoparia* is a federally endangered Neotropical migrant that inhabits montane pine-oak forests in Mexico and northern Central America during the non-breeding season. Although it is known that Golden-cheeked Warblers are closely associated with ‘encino’ oaks (evergreen or holm oak) such as *Quercus sapotifolia*, *Q. elliptica* and *Q. elongata*, which have shiny, narrow, elliptical, or oblong leaves, quantitative habitat targets are useful for effectively incorporating this information into conservation planning and forest management practices. We analyzed data on wintering Golden-cheeked Warblers collected during the non-breeding season in Honduras from 1996 to 1998 to identify quantitative targets for habitat conditions for this species. Data on warbler abundance were collected using line transect surveys located in montane pine-oak forests in a stratified-random fashion. Habitat data were collected at five 0.04 ha plots on these same transects and the averaged values used as predictors of Golden-cheeked Warbler abundance. We found that Golden-cheeked Warblers were strongly associated with the basal area of encino oaks and density of ‘roble’ oaks, such as *Q. segoviensis*, *Q. purullhana* and *Q. rugosa*, which have large, lobed leaves. Density of Golden-cheeked Warblers peaked at ~ 5.6 m<sup>2</sup> ha<sup>-1</sup> basal area of encino and ~7 roble oaks ha<sup>-1</sup>. These values can be used to identify quantitative habitat targets that can be directly incorporated into forest management practices to ensure that these activities maintain habitat conditions necessary for their use by Golden-cheeked Warblers.

**F7.1 King, Marisa**, (University of South Dakota, Vermillion, United States);

#### ACTIVATION OF THE IMMUNE SYSTEMS INCURS ENERGETIC COSTS BUT PRODUCES NO THERMOGENIC TRADEOFFS IN HOUSE SPARROWS (*PASSER DOMESTICUS*) UNDERGOING COLD STRESS.

Trade-offs between the immune system and other condition dependent life-history traits (reproduction, predator avoidance, and somatic growth) have been well documented in both avian and mammalian studies. However, to best of our knowledge, no work has been done examining trade-offs between immune activation and thermoregulation during cold exposure. Because of their high surface area-to-volume ratios, small birds incur high energetic costs associated with thermoregulation during cold exposure. Consequently, we predicted that the immune system and the thermoregulatory system would compete for energetic resources. To test this, we immunologically challenged adult House Sparrows (*Passer domesticus*) with 5 mg/kg of lipopolysaccharide (LPS) to induce an acute phase response (APR) and measured both the basal metabolic rate (BMR = Minimum metabolic rate required for maintenance; measured as the metabolic rate at thermoneutrality in resting, postabsorptive, nongrowing birds in the resting phase of the

daily cycle) and summit metabolic rate (MSUM = maximal metabolic rate achieved during cold exposure). We found that birds injected with LPS had significantly higher BMR and MSUM rates than birds injected with phosphate buffered saline (PBS), indicating that LPS treated birds were able to support both the cost of immune activation and that of thermoregulation. These results suggest that, in the absence of a pathogen, birds that experience short-term activation of the immune system have higher energetic costs during cold exposure, but they do not experience trade-offs between immune activation and cold tolerance performance.

**SAT15.6 Kingston, Sarah**, (Smithsonian / UMD, Suitland, United States); Parchman, Thomas (University of Wyoming, Laramie, WY, United States); Braun, Michael (Smithsonian Institution, Suitland, MD, United States)

#### HYBRIDIZATION, GENE FLOW, AND DIFFERENTIATION AMONG TOWHEES IN MEXICO: GENOME-WIDE SEQUENCE ANALYSIS

Both sides of an evolutionary coin, differentiation and gene flow, can be observed in the natural experimental setting of hybrid zones. Two species of towhee, *Pipilo maculatus* and *P. ocai*, interact across two well-documented hybrid gradients in central Mexico. Specimens of both species and their hybrids have been collected along these Teziutlán (~1200km, 11 locations, 167 total specimens) and Transvolcanic (~700km, 10 sites, 295 total specimens) gradients. We utilize a high-throughput genomic sequencing technique to collect close to 90k single nucleotide polymorphism sites for analysis. Bayesian modeling allows us to estimate population genetic parameters such as  $F_{ST}$  and assess variation in introgression across both hybrid transects. Outlier loci from the genomic background signal reveal portions of the genome undergoing either differential introgression or divergence (possibly related to maintenance of reproductive isolation). The ribbon-like habitat corridors in the Teziutlán gradient and island-like distribution of the Transvolcanic habitat allow us to compare differential introgression and gene flow across a semi-porous species membrane in two different spatial contexts.

**W14.12 Kirsch, Eileen**, (USGS, Upper Midwest Environmental Sciences Center, La Crosse, United States); Wellik, Mike (USGS, Upper Midwest Environmental Sciences Center, La Crosse, United States)

#### TREE SPECIES PREFERENCES OF FORAGING BIRDS DURING SPRING MIGRATION IN UPPER MISSISSIPPI RIVER FLOODPLAIN FORESTS

Floodplain forest tree species composition and structure is changing on the Upper Mississippi River (UMR) because of past management practices and altered river hydrology. Information on tree species birds use for foraging during spring migration can guide management to enhance species richness and forest structure. We were interested in determining if any tree species were being heavily selected by birds during spring migration and if tree size or phenology affected likelihood of selection. We characterized forest species composition and structure in five 40ha floodplain forest plots that represented the range of species diversity and structure typical of Pools 8 and 9 between La Crosse, WI, and New Albin, IA. We collected data on trees that birds used for foraging during spring 2010 and 2011. The most commonly observed species were American Redstart, Baltimore Oriole, Blue Grey Gnatcatcher, Warbling Vireo, and Yellow-rumped Warbler. Many species of transient neotropical and temperate migrants were observed but sample sizes were relatively small. Silver maple was by far the most dominant tree

species and was preferred by American Redstarts, Baltimore Orioles and Prothonotary Warblers but avoided by Yellow-rumped and Nashville Warblers. Oak species are in decline on the UMR but red oak was preferred by many transient migrant species. White oak is also in decline and whereas a few transient migrants preferred them, several species that breed in the area avoided them. Cottonwood also is in decline and was preferred only by Yellow-throated Vireo, but avoided by Warbling Vireo, American Redstart, Yellow-rumped and Chestnut-sided Warblers. Ash species on the UMR comprise 80% of the saplings but mature trees are threatened by spread of Emerald Ash borer. Ash species were preferred by five species including Northern Parula and avoided by Baltimore Orioles. American elm was preferred by five species including three transient migrants. Yellow-rumped Warblers, Warbling Vireos and Blue-gray Gnatcatchers also preferred larger than average individual American elms. Loss of large mature American elms to Dutch elm disease in the 1970s may have shifted foraging opportunities for these bird species.

**T1.5 Kirschel, Alex**, (University of Oxford, Oxford, United Kingdom);

#### THE EXTENT OF TRAIT SIMILARITY AT CONTACT ZONES INFLUENCES RANGE OVERLAP AND THE TRAJECTORY OF MULTIDIMENSIONAL CHARACTER DISPLACEMENT IN AFRICAN TINKERBIRDS (*POGONIULUS* SPP.)

The role of character displacement in evolutionary diversification is attracting renewed interest with several recent studies identifying patterns of displacement attributed to either ecological or reproductive processes. As well as the prediction of divergence between sympatric forms, character displacement may also account for divergence among populations of the same species in sympatry and allopatry or among populations at different contact zones. Together, these processes could help explain complex, trait-specific patterns of diversification. There is, however, very little evidence of divergence along different trajectories between interacting species among contact zones. Here we show how traits of two *Pogonius* tinkerbird species vary among contact zones across sub-Saharan Africa. Specifically, we find evidence for character displacement in song and morphology in Central and East Africa where the species coexist widely, with displacement in either species or both. In West Africa, however, greater similarity in plumage coloration could result in competitive or reproductive exclusion. With divergence along different trajectories among contact zones, allopatric populations of the same species might become reproductively isolated. Our findings suggest that interactions between species play an important role in explaining patterns of species diversification.

**PS1.119 Klassen, Jessica**, (Florida Atlantic University, Boca Raton, United States); Gawlik, Dale (Florida Atlantic University, Boca Raton, FL, United States)

#### PREY SWITCHING BY WADING BIRDS AS AN ALTERNATIVE FORAGING STRATEGY IN UNPREDICTABLE ENVIRONMENTS

Dynamic and unpredictable environments pose challenges to resident species. The ability to switch foraging strategies can benefit species when sudden environmental changes makes their primary prey difficult to find or energetically expensive to capture. We used wading birds as our model species to examine instances of prey switching. Our study took place in the Florida Everglades, USA, characterized by seasonally wet and dry cycles as well as unpredictable water level fluctuation within

seasons. We used throw traps to determine aquatic prey species density and biomass from 2005-2011 and compared those density estimates to number of nests of both fish- and crayfish-eating wading birds. In most years, the number of piscivore nests increased as fish biomass and density increased. This trend was strongest with small herons (snowy egrets *Egretta thula* and tricolored herons *Egretta tricolor*;  $R^2 = 0.82$ ), but also evident with great egrets (*Ardea alba*;  $R^2 = 0.46$ ). However, in 2009 the Everglades experienced a dramatic increase in great egret and small heron nesting concurrent with an increase in crayfish, but a decrease in fish. We hypothesize that piscivorous wading birds switched in 2009 to eating primarily crayfish. We explore this hypothesis with a wading bird food study during the 2012 nesting season.

**F11.9 Klucsarits, Jim**, (Alvernia University, Reading, United States); Rusbuldt, Joshua (Alvernia University, Stowe, PA, United States)

#### SPATIAL-TEMPORAL DISTRIBUTION OF NEST BOX USAGE AND PRODUCTIVITY FOR AMERICAN KESTRELS NESTING IN EASTERN PENNSYLVANIA

American Kestrels (*Falco sparverius*) have been rearing young in nest boxes on the farms and meadows in the vicinity of Hawk Mountain Sanctuary since the 1980s. Detailed records of box occupancy, success, and productivity have been collected for the past twenty years. Recent literature on the conservation status and population biology from nest box programs have suggested that kestrel numbers are declining across North America; with the Eastern Pennsylvanian population included. Despite a reduction of nest box usage and number of pairs between 2000 and 2005, these variables have since then begun to exhibit an upward trend. Drawing from the twenty-year database, we have spatially mapped out the temporal trends of the sites contained in the Hawk Mountain study area. Though occupancy and output were greater through the 1990s to the early part of the 21st century, a core subset of locations containing multiple pairs has remained stable and highly productive throughout. Using GIS tools, we observed how the distribution of nest box usage has changed and that a centralized pattern of multiple high use and productivity boxes appears over time. We graphically represent the highly used and productive “hot spot” nesting sites, as well as box use over five-year periods to attempt to understand the shifting population dynamics of kestrels nesting in our area. These data and potential patterns may provide clues as to why certain previously successful nesting sites have “gone cold” in recent years as well as directing conservationists towards new, potential sites to explore.

**PS1.69 Knight, Elly**, (Simon Fraser University, Vancouver, Canada); Mahony, Nancy (Environment Canada, Delta, BC, Canada); Green, David (Simon Fraser University, Burnaby, BC, Canada)

#### GRASSLAND SONGBIRD PRODUCTIVITY: DOES THE EDGE EFFECT ON NEST PREDATION VARY BETWEEN AGRICULTURAL TYPES?

Surveys indicate that grassland songbirds are declining more rapidly than other avian guilds including in the anthropogenically-fragmented landscape of the Okanagan-Similkameen, British Columbia. A common phenomenon in fragmented habitats is increased nest predation at habitat edges and many species avoid edge habitats, reducing their habitat availability. Previous edge effect studies have not discriminated amongst agricultural types despite differences in vegetation structure and supplemental food source for predators. Over two breeding seasons, we studied the impact of fragmentation by

orchards and vineyards on the reproductive success of Vesper Sparrows, abundance of nest predators, and avian community composition in the shrubsteppe of the Okanagan-Similkameen. Preliminary results from 2011 suggest an edge effect on nest predation is present in this habitat, with highest predation rates at orchard edges. Previously unconfirmed, nest camera work indicates snakes are the dominant passerine nest predator in this system and snake abundance was correlated with predation rate. Further, avian communities were different between edge and interior habitats with higher grassland obligate songbird abundance at habitat interior plots and vineyard edges. Our results identify potential contributing mechanisms of grassland songbird declines and will help land managers make decision about design and placement of grassland songbird habitat reserves.

**W6.4 Knowlton, Jessie L.**, (Michigan Technological University, Hilo, United States); Flaspohler, David J. (Michigan Technological University, Houghton, MI, United States); Kovach, Tony (University of Hawaii at Hilo, Hilo, United States)

#### INTERACTIVE EFFECTS OF INVASIVE RATS AND FOREST FRAGMENTATION ON DENSITY, NEST SURVIVAL, AND BEHAVIOR OF NATIVE HAWAIIAN BIRDS

Endemic island species are particularly vulnerable to habitat size reduction and biological invasion by non-native predators. Yet, how these two factors interact to jointly influence species persistence is not well understood. We used a unique system of replicated native forest fragments of varying size naturally created by recent lava flows on the Big Island of Hawai‘i to examine the effects of ubiquitous invasive rats (*Rattus rattus*) and forest fragment size on four species of native Hawaiian birds: ‘Oma‘o (*Myadestes obscurus*), Hawai‘i ‘Amakihi (*Hemignathus virens*), ‘Apapane (*Himatione sanguinea*), and ‘I‘iwi (*Vestiaria coccinea*). During the first year of a 5-year project, we began continuous operation of snap-trap grids within 14 study fragments to remove rats. Another 16 fragments served as controls with no rat removal. We then mist-netted and color-banded over 1600 birds, found and monitored more than 100 nests, conducted foraging behavior and feeding rate observations, and conducted bi-monthly point counts and quarterly color-band re-sighting surveys in each of the 34 study fragments over a two year period.

Data from years one and two suggest that nest survival of all species was related to the interaction between fragment size and rat presence. Species’ feeding rates were related to fragment size but not to rat presence, with most species showing lower feeding rates in small fragments. Only ‘I‘iwi densities were related to fragment size. Overall site fidelity between years one and two was high, with 65% of birds re-sighted only in the same fragment they were banded in, but site fidelity did vary by species with ‘Apapane showing the lowest site fidelity and ‘Oma‘o the highest. Site fidelity and species’ densities were not related to rat presence. These results suggest that both invasive rats and habitat reduction negatively impact the reproductive success of native Hawaiian birds. Habitat fragmentation also impacted the feeding rates of these birds, perhaps due to the need to be more vigilant for predators in smaller fragments. Finally, the high overall site fidelity suggests that some species may be reluctant to move across forest gaps. The long-term conservation of the highly imperiled Hawaiian forest bird fauna may in part depend on understanding the combined effects of habitat fragmentation and introduced predators.

**PS1.209 Knowlton, Jessie L.**, (Michigan Technological University, Hilo, United States); Fleischer, Robert (Smithsonian Conservation Biology Institute, Washington, United States); Flaspohler, David J. (Michigan Technological University, Houghton, MI, United States); Rotzel, Nancy (Canada)

FIRST CONFIRMED RECORD OF HYBRIDIZATION IN THE HAWAIIAN HONEYCREEPERS: `I`IWI (VESTIARIA COCCINEA) X `APAPANE (HIMATIONE SANGUINEA)

The adaptive radiation of the Hawaiian honeycreepers is the largest ever recorded for birds on an oceanic archipelago. Despite including more than 50 species in 21 genera, no hybridizations across honeycreeper species have ever been confirmed. Here we report genetic (nuclear and mtDNA sequences and microsatellites) and morphological analyses that verify the first hybrid between two Hawaiian honeycreeper species: the `i`iwi (*Vestiaria coccinea*) and `apapane (*Himatione sanguinea*). This hybridization is notable given that the parental species diverged ~1.6 mya and show large morphological and behavioral differences. Further, this discovery is important in light of the recent realization that hybridization plays an important role in speciation and genetic diversity not only in plants but also animals

**T4.5 Knutie, Sarah**, (University of Utah, Salt Lake City, United States); Herman, Jordan; DiBlasi, Emily; Clayton, Dale (University of Utah, Salt Lake City, UT, United States)

THE IMPACT OF INTRODUCED *PHILORNIS* NEST FLIES ON GALAPAGOS MOCKINGBIRDS

Introduced parasites can be detrimental to avian communities, particularly in island ecosystems. Generalist parasites can be exceptionally devastating because, assuming they are equally virulent in several bird species, they may drive uncommon species extinct while using more common bird species as reservoirs. Understanding the relative impact of parasites on different host species in a single region may therefore provide insight into how the parasite will affect the avian community in the future. In recent years, several introduced parasites and pathogens of birds have successfully colonized the Galapagos Islands. For example, *Philornis downsi* (Diptera: Muscidae), a nest fly with a parasitic larval stage, was recently introduced to the Galapagos Islands and has been destructive to the local bird community. The fly has been documented in nearly all nesting land birds in the Galapagos Islands. Fly larvae reduce the fitness of several Darwin's finch species, but work has not been done regarding the potential effects of *P. downsi* on other species. We studied the impact of *P. downsi* on the endemic Galapagos mockingbirds (*Mimus parvulus*). We predicted that mockingbirds, which are larger-bodied compared to Darwin's finches, are more tolerant against the effects of parasitism by *P. downsi* than finches. To test this prediction, *P. downsi* was experimentally manipulated in mockingbird nests using fumigation methods. Growth rate, hematocrit levels, and fledging success of nestlings were compared between experimental and control groups. Contrary to our prediction, *P. downsi* is also quite detrimental to mockingbirds.

**PS2.27 Kobelkowsky, Tania**, (Museo de Zoologia, Departamento de Biología Evolutiva, Facultad de Ciencias, Universidad Nacional Autónoma de México, Mexico City, Mexico);

BIOGEOGRAPHIC PATTERNS OF THE AVIFAUNA OF THE SIERRA MADRE OCCIDENTAL, MEXICO

The Sierra Madre Occidental (SMOc) is the largest and most continuous mountain range in Mexico, with an area of 289 000

km<sup>2</sup> (14.7% of the national territory). The pine-oak forests of the SMOc have been recognized as an area of high endemism and biodiversity; some species of birds, endemic to these forests in the SMOc and adjacent mountain ranges, are considered threatened or endangered: the Imperial Woodpecker, Thick-billed Parrot, and the Eared Trogon. With other Mexican montane areas, it has been recognized as an important transition zone between the Nearctic and Neotropic. This work pretends to reveal the elements of its makeup, and the affinities of its resident avifauna according to its richness and endemism patterns.

The information for the 1091 point occurrence localities was obtained from museum records of species contained in the Atlas de las aves de México and Global Biodiversity Information Facility (GBIF). To avoid bias due to incompleteness in the distributional data, we used niche-based distribution models of bird species, generated by the Genetic Algorithm for Rule-Set Prediction (GARP with Best Subsets – OpenModeller implementation) based on electronic climatic and topographic maps.

Maps of species richness were constructed by adding the distribution of each resident species. As a result we found that the western portion of the SMOc stands out for its considerably higher richness over the eastern portion.

The region was subdivided into 337 (0.38° x 0.38°) grid cells for a Parsimony Analysis of Endemicity (PAE) applied to the presence/absence matrix of 148 species of resident-terrestrial birds, and to the 55 species with a pine-oak and pine forest preference alone. The data matrix was analyzed with NONA through WinClada. A strict consensus cladogram shows a general separation into two groups: a northern -Sky Islands and northeast- and a southern resident avifauna. The analysis performed restricted to pine-oak and pine preference showed no fragmentation, indicating that this specific avifauna represents a natural unit.

Keywords: niche-based distribution models (ecological niche modeling), GARP, Parsimony Analysis of Endemicity.

**SAT5.1 Kobiela, Megan**, (College of William and Mary, Williamsburg, United States); Cristol, Daniel; Swaddle, John (College of William and Mary, Williamsburg, VA, United States)

DOES MERCURY CONTAMINATION AFFECT RISK-TAKING BEHAVIORS? TRADEOFFS BETWEEN EATING AND BEING EATEN

Methylmercury (MeHg) is a ubiquitous neurotoxin that is associated with reproductive failure, reduced cognitive ability, and increased mortality in aquatic ecosystems. It was recently discovered that MeHg can enter terrestrial food webs and affect passerine birds. Field studies have examined effects of MeHg on passerines, but captive dosing studies have been restricted to non-passerines. Therefore, research on behavioral effects of environmentally-relevant MeHg doses in songbirds is a conservation priority as this pollutant is widespread, poorly regulated, and little is known about sub-lethal effects that could be devastating for populations. To help close this knowledge gap, I examined how MeHg affects captive zebra finches' (*Taeniopygia guttata*) tradeoff between starvation and predation risk using a sub-lethal dose likely to be found at a contaminated site. Managing this tradeoff is essential to fitness because a bird that is too occupied with foraging is likely to be eaten whereas a bird avoiding all predation risk will likely starve. Because many

physiological abilities and cognitive assessments of risk are involved, a neurotoxin like MeHg may cause suboptimal tradeoffs. I quantified the birds' response to risk by measuring regulation of body mass, rate and duration of vigilance, time spent away from protective cover, and latency to forage after a disturbance. Dosed and undosed birds were placed in an experimental arena and were video-recorded on each of three consecutive mornings. Perceived level of predation risk was elevated by increasing the distance between food and cover on the second morning and by the addition of a taxidermic hawk mount on the third morning. Preliminary results show that MeHg-exposed birds lost significantly more mass in response to the hawk than control birds. Reducing mass indicates that the MeHg birds may be reacting more strongly to the hawk, increasing their starvation risk, and theoretically decreasing their predation risk. This is contrary to studies in other taxa where mercury contamination was associated with an increased risk of being eaten, but those studies did not distinguish reduced escape ability from poor decision making. This is the first mechanistic study of how this pervasive pollutant may be altering optimal decision making and survival in wild songbirds.

**PS2.38 Koczur, Lianne**, (Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, United States); Munters, Alexandra; Green, Clay (Texas State University, San Marcos, TX, United States); Ballard, Bart (Caesar Kleberg Wildlife Research Institute, Texas A&M University-Kingsville, Kingsville, TX, United States); Heath, Susan (Gulf Coast Bird Observatory, Lake Jackson, TX, United States)

#### NEST SUCCESS AND CHICK SURVIVAL OF AMERICAN OYSTERCATCHERS IN TEXAS

An overall small population size, low productivity, and decreasing habitat warranted the listing of the American Oystercatcher (*Haematopus palliatus*) as a Species of High Concern in the U.S. Shorebird Conservation Plan. While a significant amount of research has focused on Atlantic and Eastern Gulf Coast populations, little is known about the Western Gulf Coast population. The objectives of this study are to determine reproductive success of American Oystercatchers along the Gulf Coast of Texas and to identify causes of nest failure and chick mortality. In 2011, 47 nests were monitored weekly until nest or chick fate was determined. Nest success was 0.60 (SE = 0.07). Thirty six chicks successfully fledged and overall productivity was 0.78. Nests on small islands not connected to the mainland had the highest productivity successfully fledging on average 1 chick/pair. These small islands also produced 77% (28) of total fledglings. Major causes of nest failure and chick mortality were overwash and predation. Monitoring will continue during 2012 and 2013. Examination of reproductive success and the parameters affecting productivity of the Texas population will be important in implementing conservation efforts in this region.

**PS1.65 Koford, Rolf**, (U.S. Geological Survey, Ames, United States); Jain, Aaftab (Natural Resource Ecology and Management Department, Ames, United States); Guy, Zenner; Hancock, Al (Iowa Department of Natural Resources, Clear Lake, IA, United States)

#### CANADA GOOSE FORAGING NEAR AN IOWA WIND FARM

We examined Canada Goose (*Branta canadensis*) foraging activity and vigilance behavior near an 89-tower wind resource area (WRA) in north-central Iowa in fall 2003 and 2004. In close proximity to the WRA were three wildlife management

areas that are heavily used by migrating waterfowl in the fall. Geese primarily roosted on a lake in one of these management areas and foraged on waste grain in a designated area surrounding the lake that is closed to Canada Goose hunting. To assess whether the presence of a wind tower in a field influenced whether geese foraged in that field, we recorded approximately 1.2 million (2003) and 0.9 million (2004) goose-use days in the closed area. We used negative binomial models to examine factors that might affect how many geese were in a recently harvested field. We found that the use of fields by geese was affected by distance from the primary roost lake, crop type, and days since crop harvest. The presence of wind towers had little or no effect. We monitored vigilance behavior to determine if it differed between flocks foraging in WRA fields and fields outside the WRA and found no significant difference in vigilance. Thus we found no evidence that either foraging or vigilance behavior was affected by the presence of the wind towers.

**F13.1 Koper, Nicola**, (University of Manitoba, Winnipeg, Canada); Walker, David (University of Manitoba, Winnipeg, MB, Canada); Sliwinski, Maggi; Pipher, Emily; Ranellucci, Cristina; Rodgers, Jennifer; Leston, Lionel (University of Manitoba, Winnipeg, Canada)

#### EFFECTS OF MANAGEMENT ACROSS CANADA ON SPRAGUE'S PIPITS AND CHESTNUT-COLLARED LONGSPURS, TWO THREATENED GRASSLAND SONGBIRDS

Most North American prairies are fragmented by roads, croplands, reservoirs, and other anthropogenic features. Within prairies, habitats may be degraded by inappropriate grazing, trails, and oil and gas infrastructure. We used nonlinear regression, mixed-effects models, logistic exposure analysis and information theory to compare effects of (1) habitat fragmentation and edges, (2) livestock grazing, and (3) shallow gas development on relative abundances and nesting success of Sprague's pipits and chestnut-collared longspurs. Studies were conducted between 2000 and 2011 in southern Alberta, Saskatchewan and Manitoba. Grazing and energy development had relatively few effects on either species. We found no effects of timing of grazing on either species. Both species generally responded positively to the presence of grazing, although Sprague's pipit relative abundance declined slightly as stocking rates increased. We found no effects of the presence of shallow gas infrastructure on relative abundance of either species, but chestnut-collared nesting success declined with density of shallow gas infrastructure. Both Sprague's pipits and chestnut-collared longspurs avoided grassland habitats near water and cropland edges, although their densities did not decrease near roads. Population densities near water and cropland declined by 25% or more up to a distance of 350 – 2000 m from edges. The consequence of this habitat avoidance was dramatic; fewer than 1% of the grassland patches in southern Alberta contain any habitat far enough away from edge that they could support the relative abundances of Sprague's pipit populations that we would expect in the absence of edge avoidance. The weight of evidence suggests that cattle grazing is generally compatible with conservation of these species under good range management practices. Shallow gas development also had relatively few negative effects, but further research is needed to understand effects on nesting success. Taken together, these results suggest that the greatest threat to the conservation of Sprague's pipits and chestnut-collared longspurs is conversion of prairies to other land uses, and that effects of habitat loss are exacerbated by behavioural avoidance of grasslands adjacent to habitat edges.

**PS2.61 Korte, Allison**, (Boise State University, Boise, United States); Dufty, Alfred (Boise State University, Boise, ID, United States)

#### AVIAN SPECIES RICHNESS AND ABUNDANCE ALONG AN URBANIZED RIVER CORRIDOR.

Riparian corridors serve multiple, sometimes conflicting, purposes: they contain valuable habitat for avian breeding, migration, and dispersal activities and this attracts urban development along their banks because it brings wildlife closer to city-dwellers.

To maintain the riparian corridor, the city of Boise, ID mandated a 70-ft buffer between all buildings and the Boise River, which runs through the city. However, with increasing population there are added anthropogenic pressures.

We examined if urbanization was associated with decreased avian richness and abundance along the Boise River during the breeding season. We also surveyed a suite of vegetation and habitat variables to determine the level of tolerance to anthropogenic habitat disturbance of the avian species living in the riparian corridor.

Over 80 species were identified and separated into guilds. Using an AICc model we found that habitat differences along the urban corridor did affect species richness and abundance. For instance, birds in the cavity-nesting guild were best described by the presence of live grass, suggesting a need to preserve open habitat. We also analyzed several individual species. For example, the top model for the Yellow Warbler was characterized by the presence of riparian habitat and people, suggesting that this species is tolerant of people, as long as riparian habitat is maintained.

This study improves our basic understanding of the effects of urban development on avian species along riparian corridors. Additionally, it will help in developing local conservation plans to preserve the attractiveness of riparian areas while minimizing the impacts on the avian community.

**F7.2 Kouwenberg, Amy-Lee,\*** (Memorial University of Newfoundland, St. John's, Canada); Hipfner, Mark (Environment Canada, Delta, BC, Canada); McKay, Donald; Storey, Anne (Memorial University of Newfoundland, St. John's, NF, Canada)

#### CORTICOSTERONE AND STABLE ISOTOPES IN FEATHERS IDENTIFY CARRY-OVER EFFECTS IN ATLANTIC PUFFINS

Carry-over effects may provide new insight into poorly-understood traits such as egg size, a key life-history trait that varies greatly among individuals with no satisfactory explanation. We measured corticosterone levels and  $\delta^{15}\text{N}$  stable isotopes (trophic level) in feathers grown several months before egg-laying to test the hypothesis that carry-over effects influence egg mass in Atlantic puffins (*Fratercula arctica*). CORT levels in blood fluctuate in response to physiological stressors, and the CORT circulating in the blood is incorporated into growing feathers. We found that egg mass increased with both  $\delta^{15}\text{N}$  (trophic level) and CORT levels in feathers, both of which can be categorized as carry-over effects. Our results suggest that the ability of female birds to meet the nutritional costs of egg production can depend, at least in part, on whether they can mount a sufficient CORT response to promote increased foraging effort during the pre-breeding season.

**PS1.19 Krakauer, Alan**, (University of California Davis, Davis, United States); Blundell, Melissa; Scanlan, Tawny; Wechsler, Michelle; McCloskey, Emily; Yu, Jennifer; Patricelli, Gail (University of California Davis, Davis, United States)

#### LATERAL BIAS IN INTER- AND INTRA-SEXUAL BEHAVIORS BY LEKKING MALE GREATER SAGE-GROUSE

Whether due to differential capabilities of sensory organs or to lateral specialization in the brain, many animals react differently to stimuli encountered on the left versus right side of their body. While these lateral biases may be widespread, little is known about their importance in the wild. We studied the relationship between relative orientation and both intrasexual agonistic behaviors and courtship displays in lekking sage-grouse (*Centrocercus urophasianus*), a species in which many behaviors are produced in conspicuously lateral orientation relative to the male or female target. We found little evidence for lateral bias in agonistic interactions, nor any relationship between lateral bias in aggressive behaviors and male mating success. In contrast, we found complex patterns of variability related to lateral bias in courtship. Lateral bias was found on average only in males that did not mate, and bias differed depending on the distance between the male and female. These results affirm that the presence of lateralized behaviors may depend upon many factors including the behavior in question, the social context, and variability among actors.

**T10.1 Kramer, Patrick**, (York University, Toronto, Canada); Tarof, Scott (Earth Rangers, Woodbridge, ON, Canada); Stutchbury, Bridget (York University, Toronto, ON, Canada)

#### BENEFITS OF EXTRA-PAIR MATE CHOICE: ARE EXTRA-PAIR YOUNG MORE FIT THAN WITHIN-PAIR YOUNG?

Approximately 75% of socially monogamous passerines pursue extrapair mating with the frequency of extrapair paternity varying among and within taxonomic groups. One mechanism of mate choice, the good genes hypothesis, states that mate choice should seek the high-quality males to improve the overall genetic quality of offspring. The purple martin (*Progne subis*) is a Neotropical migratory swallow that is a colonial, secondary-cavity nester known to have an extra-pair mating system. To test the good genes hypothesis, we collected nesting data, determined social parentage and blood sampled adults and young for subsequent parentage analysis using microsatellite markers. We then monitored the reproductive success, survival and recruitment of within-pair and extra-pair young over subsequent years. We used Program MARK to model survival of three cohorts over five years. We found that second-year (SY) males have higher rates of cuckoldry than do after-second-year (ASY) males, consistent with an earlier study. Males tended to be cuckolded by older males. In our population extra-pair offspring had a higher survival probability than did within-pair offspring but only in their second year; the converse was true for first year survival. We argue that our data support the good genes hypothesis of mate choice by showing a context-specific adaptive advantage to extra-pair mating behaviour.

**F10.10 Krebs, Bethany**, (University of Illinois at Urbana-Champaign, Urbana, United States); Newman, Christina; Anderson, Tavis (University of Wisconsin Madison, Madison, WI, United States); Brawn, Jeff (University of Illinois at Urbana-Champaign, Urbana, United States)

#### SPATIO-TEMPORAL PATTERNS IN COMMUNAL ROOSTING BEHAVIOR OF AMERICAN ROBINS (TURDUS MIGRATORIUS) IN AN URBAN SETTING

Despite numerous potential hypotheses, a definitive explanation for avian communal roosting behavior has yet to be identified. Proposed benefits to individual birds for participating in communal roosts include information transfer, dilution of predation risk or improved overnight thermoregulation. Seasonal communal roosts of American Robins (*Turdus migratorius*) have been observed in the literature as far back as the 19th century; however, the formation and use of communal roosts by this species has not been extensively studied – especially in urban landscapes. We used radio transmitters to track movements and roosting patterns of 121 American Robins in suburban Chicago during the summers of 2009-2011. Seven communal roosts of American Robins were identified and monitored in our study area, ranging in size from 200 to 22,000 birds. Our monitoring efforts determined that there is a strong temporal component to the size and location of communal roost use by American Robins. Small roosts appear to form during the early stages of the breeding cycle and then dissipate with the onset of fledgling care when parents begin to roost near their offspring. In cases of fledgling mortality, the adult bird caring for that juvenile stops roosting in or near the breeding territory and may join a nearby communal roost or begin preparing for a second brood. This supports previous observations of brood division in American Robins. Upon independence of fledglings, we observed adult birds converging into several very large roosts and abandoning smaller roost sites used early in the season. We also observed some evidence that ‘networks’ of roosts may exist; some roosts were very interconnected and others showed little connectivity.

**PS2.139 Krebs, Elsie,** (Environment Canada, Delta, Canada); Mahony, Nancy (Environment Canada, Delta, BC, Canada)

#### CAN POPULATION TRENDS IN BREEDING BIRDS BE PREDICTED BY LOCAL OR REGIONAL CHANGES IN BREEDING HABITAT?

More than a third of species of songbirds appear to be declining across Canada. Understanding the scale at which the factors underlying these declines are operating is critical if we are to prioritize and design conservation actions. Estimates of population trends for many species are based on roadside counts from Breeding Bird Surveys (BBS). Because BBS does not track habitat change, declining trends could be due to real population change or biased by differential change in roadside habitats. For example, previous studies in Eastern North America have found that changes due to urbanization and agriculture are found disproportionately along roads, leading to less forested habitat than away from roads. We assess this potential bias in BBS by examining how changes in bird presence and abundance are impacted by changes in habitat at the local (BBS) and regional scales. To do this we sampled changes across 37 Breeding Bird Survey routes in British Columbia using recent and historical data on habitat and point counts. We will evaluate these results across species categorized by habitat guilds and for species with apparent declining and increasing trends and assess the extent to which these trends can be explained by the local or regional availability of breeding habitat.

**F4.1 Kresnik, Ross,** (York University, Brampton, Canada); Stutchbury, Bridget (York University, Toronto, ON, Canada)  
ARRIVAL ECOLOGY AND BEHAVIOR OF WINTERING OVENBIRDS (*SEIURUS AUROCAPILLA*): UNDERSTANDING TERRITORY ACQUISITION AND SPACE USE STRATEGIES

For several migratory birds the ability to acquire and hold a territory is of fundamental importance throughout the annual cycle. Although several studies have delineated which factors

influence territory acquisition on the breeding grounds, few have explored how dominance patterns are established on the wintering grounds. We radio-tracked Ovenbirds (*Seiurus aurocapilla*) during the early wintering period in southern Belize to determine 1) which factors (i.e. malarial infection, social dominance, migratory origin, arrival date, energetic condition) influenced fall territory acquisition and 2) if diurnal activity, social behaviour, resource access and survival differed with spatial use strategy. Age was the primary factor influencing territoriality with 92.9% of after hatch year (AHY) birds and 65.2% of hatch year (HY) birds possessing fixed territories. Territory owners possessed heavier  $\delta$ Dbreeding values than non-territorial birds. The interaction among age and territorial status suggested that HY non-territorial birds had slightly lighter  $\delta$ Db values than HY territorial birds. Non-territorial Ovenbirds baseline CORT titres were significantly higher than territorial birds. Our analysis suggests that HY birds of Northern breeding origin were less likely to occupy territory possibly due to greater migratory distance to the wintering grounds, resulting in poorer energetic condition. Ovenbirds possessed fixed home ranges 77.5% of the time with the remaining individuals exhibiting a nomadic wandering strategy. Floater's movements could be divided into long and short distances which greatly influenced home range size. The foraging success of wanderers was also found to be statistically lower when compared with sedentary birds. Wanderers reduced success was likely caused by unfamiliarity of foraging habitat given that territory defence from conspecifics was low. Short distance wandering may have been adopted to cope with unfamiliarity of habitat and appeared to be a more successful strategy allowing one floater in this study to acquire territory. Survival was 100% during the study period. Since insect resources typically decline during the dry season and territory defence intensifies, the early part of the wintering period may give wandering Ovenbirds the time needed to seek and secure non-breeding territory.

**W2.3 Kreuser, Jodi,\*** (Michigan State University, East Lansing, United States); Porter, William (Michigan State University, East Lansing, United States)

#### EVALUATING THE RELATIONSHIP BETWEEN CLIMATE CHANGE, RANGE SHIFTS, AND DIFFERENTIAL GUILD RESPONSES OF MICHIGAN BREEDING BIRDS

Shifting climate patterns and extreme weather events induced by climate change affect plant and animal species across a range of ecosystems, and result in numerous consequences including landcover changes, habitat loss, and disrupted trophic and phenological interactions. In North America there are few large-scale, quantitative analyses using multi-species data to evaluate the influence of climate change on range shifts. To provide compelling support associating climate change with distributional shifts, studies are needed that quantify systematic range shifts in regions less confounded by geography, while using similar data, scale, and approaches. We evaluated Michigan breeding bird atlas data (1983-1988 and 2002-2009) to test for significant poleward shifts in avian communities and differential responses between migratory and foraging guilds. In addition to using an information-theoretic framework for geographic analyses, we employed multi-season occupancy modeling to evaluate temporal differences in occupancy, detection probabilities, and effort bias relative to climate and guild covariates. We found systematic range shifts for bird species with diverse life histories, which suggests that a fundamental ecological change drives that pattern, and the repeated pattern of shifts in different geographic regions provides strong support that ranges shift in response to climate change. Among species that demonstrated range shifts, we



observed a differential response between distinct foraging and migratory guilds, which further illustrated a nuanced pattern among insectivorous and Neotropical migrant species. Our results may help inform research and conservation strategies and elucidate the ecological responses behind climate-induced range shifts.

**T10.4 Kus, Barbara**, (USGS Western Ecological Research Center, San Diego, United States); Howell, Scarlett (USGS Western Ecological Research Center, San Diego, NF, United States); Wood, Dustin (USGS Western Ecological Research Center, San Diego, CA, United States)

#### FEMALE-BIASED SEX RATIO AND FACULTATIVE POLYGYNY IN A DECLINING POPULATION OF THE ENDANGERED SOUTHWESTERN WILLOW FLYCATCHER

Demographic changes in populations, such as skewed sex ratios, are of concern to conservationists, especially in small populations where stochastic and other events can produce declines that may lead to extirpation. We documented a decline in one of the few remaining populations of Southwestern Willow Flycatcher in southern California, which dropped from 43 to 16 adults between 2004 and 2010. Declines were unequal between sexes, and adult sex-ratios were female-biased in 5 of 7 years. During this time, the incidence of polygyny in this facultatively polygynous species increased, with males pairing with 2-4 females simultaneously. The proportion of paired males that were polygynous ranged from 0-80% between 2000 and 2010, and varied significantly with the ratio of females to males in the adult population ( $P=0.003$ ). We investigated the role that nestling sex ratio might be playing in contributing to the female-biased adult sex ratio by using genetic techniques to determine sex from blood samples collected from 160 nestlings in 72 nests from 2002-2009 ( $n = 4-17$  nests per year, representing 67-100% of nests with nestlings each year). Binomial tests for departure from an even sex ratio showed that nestling sex ratio was female-biased in 5 of 8 years, and significantly so in 3 years. Sex ratio did not differ as a function of nest order (first versus subsequent nests;  $t = -0.43$ ,  $P=0.67$ ) nor of mating status of parents (polygynous versus monogamous;  $t=0.40$ ,  $P=0.69$ ). It thus appears that a skewed nestling sex ratio has contributed along with other factors to a female-biased adult population, which in turn has influenced the mating system. While a high degree of polygyny may reduce the genetic diversity of this population and thereby create additional threats, we propose that the capacity for polygyny, which generally occurs at low levels in Southwestern Willow Flycatchers, has allowed this population to persist through a decline that might otherwise have resulted in extirpation.

**T12.4 Kwon, Eunbi**, (Kansas State University, Manhattan, KS, United States); Lank, David B. (Simon Fraser University, Burnaby, BC, Canada); Sandercock, Brett K. (Kansas State University, Manhattan, United States)

#### CHANGES IN BREEDING PHENOLOGY AND REPRODUCTIVE SUCCESS OF LONG-DISTANCE MIGRATORY SHOREBIRDS: COMPARATIVE STUDY OVER TWO DECADES

Changes in breeding phenology are often the first indicator of biological response to modern climate change. Birds migrating long distances to the breeding ground are especially vulnerable to environmental changes, because their high energetic requirements and long-distance movements make the phenological synchrony among trophic levels critical for breeding success and survival through migration. The greatest

climatic change for the next century is expected in the Arctic and significant advancement of the peak of invertebrate prey abundance has been already reported. In this field study, we examined shifts in the breeding phenology of two arctic breeding shorebirds, Western Sandpiper (*Calidris mauri*, hereafter WESA;  $N=289$  nests) and Semipalmated Sandpiper (*Calidris pusilla*, hereafter SESA;  $N=253$  nests), by comparing long-term changes in the breeding performance of nesting birds during 1993-1996 and 2010-2011 near Nome, Alaska. During 1993-1996, the mean date of clutch initiation (DCI) ranged between 21st – 27th of May for WESA and 26th – 30th of May for SESA. In 2010 and 2011, the mean DCI was 29th and 30th of May for WESA and SESA respectively. In both species, the clutch initiation and hatching were negatively correlated with the daily mean temperature (regression coefficients were  $-1.87$  and  $-1.09$  for WESA and SESA). Greater nesting success was predicted by lower nest density for WESA, and by lower mean temperature of previous breeding season for SESA. Long-term monitoring on their breeding performance in relation to the environmental change will aid our understanding of the underlying mechanism for the population decline in long-distance migrants.

**PS1.72 Kyle, Keiller**, (Audubon California, Sacramento, United States); Kelsey, Rodd (Audubon California, Sacramento, CA, United States)

#### INCORPORATING PEST CONTROL BY BIRDS INTO AGRICULTURAL LANDSCAPES: THE ECOSYSTEM SERVICE VALUE OF BIRD-FRIENDLY FARM MANAGEMENT

Agricultural cropland is often considered a largely hostile landscape for wildlife; however, many bird species in the Central Valley of California and elsewhere not only use but often rely on farmland and crops for foraging and nesting. Audubon California, through its Bird Friendly Farming Initiative, is working to incorporate natural habitats and manage crops on farms to increase the abundance and diversity of birds in working landscapes. It is therefore important that we develop a better understanding of the potential benefits or costs to farmers of these practices. One service that birds provide that has not been fully explored is natural pest suppression by insectivores and raptors. With rapidly increasing regulations of chemical pesticides, especially in California, natural pest control options will be highly valued and useful. In this review of existing literature and studies we estimate the pest control benefit that insectivorous birds can provide to farmers and make the case that an increased abundance of birds on farms could result in a substantial reduction in chemical pesticide application. Bird-centric pest management is successfully being implemented on shade-grown coffee farms throughout the tropics, and we conclude that this avian ecosystem service is currently underappreciated and underutilized in temperate farming practices.

**T3.3 La Puma, David**, (University of Delaware, Madison, United States); Buler, Jeffrey (University of Delaware, Newark, DE, United States); Dawson, Deanna K. (USGS Patuxent Wildlife Research Center, Laurel, MD, United States); Jones, Tim (United States Fish and Wildlife Service, Laurel, MD, United States)

#### WEATHER RADAR IDENTIFIES IMPORTANCE OF BOTTOMLAND FORESTS AND COASTAL MOSAIC FOR MIGRATING LANDBIRDS IN SOUTHEASTERN U.S.

The migration period is a critical time for migratory landbirds within their annual cycle. In light of ongoing land-use changes,

there is a need to identify and prioritize important stopover habitat for landbird conservation. The Southeastern U.S. provides stopover habitat for millions of these birds migrating to and from tropical wintering grounds. Because migration occurs over a short window of time, is highly spatially variable, and involves a constantly changing cast of birds, quantifying stopover habitat use by traditional survey methods is extremely difficult and often problematic. Doppler weather surveillance radars provide a unique tool to comprehensively study stopover habitat use over broad geographic areas at relatively fine resolution, as they detect birds departing daytime stopover sites at dusk and provide measures of bird density aloft. We used data collected during fall 2008-2009 and spring 2009-2010 by six WSR-88D/NEXRAD stations in the South Atlantic Coastal Plain to identify and map bird stopover density. We then used a combination of physical and compositional landscape metrics to model consistently high-use stopover habitat. Percent cover of hardwood forest and average canopy height performed well at predicting high-use stopover habitat across seasons. Distance to the coast was positively associated with stopover density except during fall when coastal habitats were used as launching points for birds heading to the Caribbean and the American Tropics.

**S1.10 La Sorte, Frank**, (Cornell Lab of Ornithology, Ithaca, United States); Fink, Daniel; Hochachka, Wesley; Iloff, Marshall; Kelling, Steve (Cornell Lab of Ornithology, Ithaca, United States)

#### MIGRATION DYNAMICS OF NORTH AMERICAN BIRDS

The study of avian migratory dynamics has had a long history in ecology. These studies typically involve the examination of a small number of birds that are intensively studied over short time intervals (telemetry) or many birds poorly sampled over longer time intervals (band returns). Extrapolating findings from these studies across populations or species has not been fully validated. We describe the use of a continental-extent citizen-science database of bird observations, eBird, to describe population-level migration dynamics for 93 North American bird species. We used daily observation recorded from 2007 to 2011 to estimate the speed and variability of Spring and Fall migration trajectories and the degree of overlap in seasonal migration routes. Daily patterns of occurrence for each species were summarized using weighted centroids and daily variability in occurrence using weighted SD. Each species' migration trajectory was modeled using generalized additive models applied to the weighted centroids. We contrasted observed dynamics across species with a set of independent predictors: body mass, migration distance, foraging guild, flight mode, and wing-aspect ratio. We selected the best combination of predictors using a bootstrap AIC stepwise procedure. Across species, migration speed and variability were similar in the Spring and Fall with more species following a clockwise migration trajectory. Smaller bodied, long distance migrants had higher migration speeds and less variable longitudinal patterns of occupancy during both migration periods. Smaller bodied, long distance migrants were also more likely to have clockwise migration trajectories. Our findings suggest migration strategies for small bodied, long distance migrants are more rigorously defined across space and time, with trajectories that appear to be more in line with seasonal climatic patterns. Narrower margins of error associated with successful migration for these species could explain these stronger associations. However, constrained migration strategies that are currently successful could be a hindrance under global change, especially when changing climatic conditions no longer favor current migration routes.

**PS2.115 LaBarbera, Katie**, (Museum of Vertebrate Zoology, Berkeley, United States);

#### EFFECTS OF ELEVATION ON DARK-EYED JUNCOS IN THE SIERRA NEVADA

Birds are expected to adapt to optimize their fitness within their habitat. Differing selection pressures in different habitats may drive divergence of populations in those habitats. Dark-eyed Juncos breed across a wide elevational range, and juncos breeding at high elevations may face shorter breeding seasons, greater climatic variability, and considerably different habitat from those breeding at low elevations. My dissertation research focuses on how juncos differ across elevations in their life history strategies and whether differences in optimal strategies have selected for reduced gene flow among versus within elevations. Preliminary results from the 2012 field season will be presented, including life history traits, morphological and plumage characteristics, and song. Future work will expand on this, including analyzing study skins collected in the region from up to a century ago to examine how juncos have responded to recent climate change.

**PS2.222 Ladin, Zach**, (University of Delaware, Newark, United States); Shriver, W. Greg; Roth, Roland (Department of Entomology and Wildlife Ecology, Newark, DE, United States)

#### LONG-TERM PEDIGREE REVEALS RARE INBREEDING EVENT IN WOOD THRUSH

We investigated long-term demographic trends of a breeding population of wood thrush (*Hylocichla mustelina*) within a small urban forest fragment using pedigree analysis. Pedigree analysis can be useful in determining how variation in demographic parameters can influence long-term population dynamics. We analyzed 37 years of demographic data on breeding wood thrush collected annually between 1974 – 2011 in a small (16 ha.) forest fragment in Newark, Delaware using the program Pedigraph v2.4 to determine temporal trends in coefficients of relatedness, and explore how variation in demographic parameters (e.g. immigration rates, return rates, and recruitment) may contribute to population trends. Over the 37-year period, wood thrush were captured annually and color banded and were comprised of adult males (N=392), adult females (N=386), and hatch-year birds (N=1,868). The annual mean percent of all returning individuals (mean±SE) was 66.3±2.1%, with higher return rates in males (71.72±2.4%) compared to females (64.5±2.6%). However, the percent of returning fledglings (4.9±0.7%) was much lower compared to adults. The population has a low mean inbreeding coefficient (0.0012), which makes sense given an annual mean percent of immigrants (33.7±2.1%). However, we detected an example of inbreeding between a male (band #: 98160624) and daughter (band #: 98160670) that successfully bred in 1989 and 1990 producing 10 fledglings. We describe this unique inbreeding event and discuss the implications for population-level responses to long-term demographic patterns.

**PS2.88 Lahkar, Kulojyoti**, (Wildlife Conservation and Study Centre, Guwahati, India); Risebrough, Robert W. (The Bodega Bay Institute, California, United States)

#### ISSUES CURRENTLY AFFECTING GYPS VULTURE POPULATIONS IN ASSAM, INDIA

The populations of three species of Gyps vultures have been declined disastrously in south Asia in recent years as a result of contamination of livestock carcasses with diclofenac and possibly to a lesser extent other NSAIDs (non-steroidal anti-inflammatory drug) with similar properties. To know the status and to initiate a long term conservation process for two critically

endangered vultures (*G. tenuirostris* and *G. bengalensis*), a survey was initiated in 2003 and thereafter surveying and monitoring regularly to know about the factors which are currently affecting their survival. These include destruction of nests and cutting and thinning of nesting trees; egg collection for medicinal purposes, hunting chicks and adult birds for meat; being killed accidentally by vehicles and trains while feeding on carcasses on roads and railway tracks and, in 2010 – 2011, the deliberate poisoning of carcasses with insecticides to kill carnivores. Three-year running averages of the number of nestings of both species suggest a decline in the order of 50% over the seven year period, with a particularly sharp drop recorded in 2010 – 2011. In order to ensure the long-term conservation of vultures in wild in Assam, we propose: awareness campaigns among local communities to protect nests, nestlings and nesting trees; to use safer drugs in veterinary medicine instead of diclofenac and other NSAIDs with similar properties, and to avoid the poisoning of carcasses likely to be consumed by vultures.

**PS1.33 Lai, Jonas**, (American Museum of Natural History, New York, United States); Rivadeneira, Jorge (Napo Wildlife Center, New York, United States); Zyskowski, Kristof (Yale Peabody Museum, New Haven, CT, United States)

#### FIRST DESCRIPTION OF THE NEST OF LONG-BILLED WOODCREEPER, *NASICA LONGIROSTRIS*

On 13, November, 2011, we encountered a nest of Long-billed Woodcreeper, *Nasica longirostris*. The nest was located in an open-topped cavity of a dead Moriche palm, *Mauritia flexuosa*, which is part of a small stand of Moriche palm located on the bank of the Añangu river, in Yasuni National Park, Napo Province, Ecuador. Two individuals were observed perched above the nest cavity, the nest cavity was photographed, and one individual was video-recorded carrying nest materials and engaging in nest construction. Nest materials consisted of pieces of bark covered in a fruticose lichen. In general, the architecture of the nest is consistent with nests of other genera of *Dendrocolaptinae*.

**PS2.142 Lain, Emily J.**, (University of Southern Mississippi, Hattiesburg, United States); Moore, Frank (University of Southern Mississippi, Hattiesburg, MS, United States); Barrow, Wylie C. (U.S. Geological Survey, National Wetlands Research Center, Lafayette, LA, United States); Diehl, Robb (U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, MT, United States)

#### HURRICANE DISTURBANCE EFFECTS ON THE HABITAT RELATIONS OF NEARCTIC-NEOTROPICAL MIGRANTS DURING SPRING STOPOVER

Anthropogenic change, hurricanes, and other natural disturbances have reduced the amount of forest cover along the Gulf of Mexico, which may affect the stopover biology of migratory birds. In southwestern Louisiana, coastal chenier forests provide the first possible landfall for birds returning north in spring. This region was severely impacted by two recent hurricanes, Rita in 2005 and Ike in 2008. We assess the impact of these storms on migrants at two levels: (1) species assemblage structure and (2) stopover biology, including fuel deposition rates, of individual migrants. Species were classified into foraging guilds based on the vertical height and foraging substrate where birds were typically observed in cheniens during spring migration. Capture rate by guild was compared between pre-storm (1993-2005) and post-storm years (2006-2011). Stopover duration and fuel deposition rate were compared pre- and post-storm for focal species from each guild. Frequency of

live foliage-gleaning canopy foragers decreased post-storm compared to pre-storm; whereas canopy airspace foragers increased. Arthropod-foraging understory species decreased with each storm yet frugivorous understory species increased. Arthropod and seed-eating ground species increased post-storm but leaf-litter ground-foraging species decreased. Although storms impacted stopover habitat, organismal response did not differ in line with guild-specific storm-response expectations, and in most cases species assemblage structure did not change significantly between pre- and post-storm periods. Even in a disturbed landscape migrants appear flexible in their use of habitat and foraging behavior, which may not be surprising in light of the variety of habitats and food resources intercontinental migrants encounter during migration.

**T13.10 Lait, Linda**, (Memorial University, St. John's, Canada); Burg, Theresa (University of Lethbridge, Lethbridge, AB, Canada)

#### FROM COAST TO COAST: THE POPULATION GENETIC STRUCTURE OF THE BOREAL CHICKADEE

The population genetic structure of species in northern North America is a direct result of how they survived the last glacial maximum. With much of the land covered by large ice sheets, plants and animals survived in ice-free regions known as refugia. The majority of birds persisted in refugia south of the ice sheets, although studies are increasingly pointing to Beringia and smaller coastal refugia as playing a larger role than previously thought. The objective of this study was to evaluate how the population genetic structure of the boreal chickadee (*Poecile hudsonicus*) was affected by the most recent glaciations. Unlike many North American songbirds, the boreal chickadee is a year-round resident found almost exclusively in previously glaciated regions, with the current distribution including a number of putative glacial refugia. A combination of mitochondrial DNA sequences ( $N = 277$ ) and nuclear microsatellite genotype data ( $N = 258$ ) were employed across 14 populations covering most of the chickadees' range. The mtDNA data supported clear differences between the eastern and western populations, with the central populations containing a subset of haplotypes from both groups. The microsatellite data supported a slightly different pattern – the separation of Newfoundland from the mainland populations. The patterns of genetic diversity seen (high in Alaska, Atlantic Canada and the central populations), and the separation of the eastern and western populations, support the use of multiple glacial refugia, one in Beringia and one in the east.

**PS2.6 Lam, Christina**, (Rocky Point Bird Observatory, Victoria, Canada);

#### NESTING BEHAVIOUR OF RESIDENT ANNA'S HUMMINGBIRDS (*CALYPTA ANNA*) IN SOUTHERN VANCOUVER ISLAND, BRITISH COLUMBIA

Anna's Hummingbirds are a recent addition to British Columbia's fauna, only emerging from California in the mid 1930s. Since their initial range expansion, Anna's have flourished in the wake of urban encroachment, being one of very few avian species to benefit from human interference. Anna's have now become year-round residents in some areas of southwest BC. Their range now overlaps with the southern breeding grounds of the Rufous Hummingbird (*Selasphorus rufus*), which migrates to Washington State, British Columbia, and coastal Alaska from wintering sites in Mexico and Gulf States of the US. However, since the 1960's, the Rufous population has undergone a 63% decline and are now a species of continental concern. While the exact cause for this dramatic decrease is uncertain, one factor may be competition with the

Anna's. Preliminary observations show that resident Anna's are reproductively active most of the year. This study examines the nesting behaviour of female Anna's Hummingbirds before, after and during the Rufous breeding season (late March through July). Data were collected from direct observations as well as from high definition video, which allows for intimate accounting of nesting and rearing behaviour while minimizing human interference. The sites chosen for observation vary in resources, moderating effects of the ocean, recent or established presence of breeding Anna's, and presence of breeding Rufous. This study aims to provide insight into whether or not Anna's nesting behaviours alter significantly at different times of the year, and whether specific types of nesting habitat are lost to the Rufous population once resident Anna's become established.

**SAT2.6 LaManna, Joseph,\*** (Montana Cooperative Wildlife Research Unit, Missoula, United States); George, Luke (Humboldt State University, Arcata, CA, United States); Saracco, James; Nott, Philip; DeSante, David (Institute for Bird Populations, Point Reyes Station, CA, United States)

#### SPRING MIGRATION PRECIPITATION INFLUENCES ANNUAL SURVIVAL OF MIGRATORY SONGBIRDS

The El Niño-Southern Oscillation (ENSO) has been shown to influence demographic rates of birds at local and regional scales. Our objective was to examine mechanisms for the observed effect of ENSO on avian survival. North American precipitation is heavily influenced by ENSO, so we conducted a Cormack-Jolly-Seber (CJS) analysis of the effects of ENSO-related precipitation on Swainson's Thrush and MacGillivray's Warbler survival throughout their annual cycles. Four regional precipitation anomalies, including one ENSO-associated anomaly in spring on the migrating route and another in winter on the wintering grounds, were included in the analysis to examine alternative hypotheses. We predicted that a model incorporating one of the two ENSO-related precipitation anomalies would best predict the species' annual survival. Our analysis provided strong support for an effect of dry season precipitation on the spring migration route on annual survival of both species. This positive effect of spring precipitation on annual survival was consistent across birds breeding along the entire west coast of the USA. In contrast, we found little support for effects of winter range precipitation on survival of these western Neotropical migrants. El Niño-associated increases in winter and spring dry-season precipitation in the water-limited tropical deciduous forests of western Mexico likely lead to increased food availability during northern migration. Several analyses of migratory songbirds in eastern North America have suggested that variation in annual survival is driven by conditions on the wintering grounds rather than conditions during migration. Western North American migrants appear to use a different migratory strategy and may be more vulnerable to conditions during migration. Because many western Neotropical migrants migrate through the same region as our focal species, it is possible that other such species are similarly influenced by ENSO-related spring migration precipitation in western Mexico. If, as some climate models predict, annual variation in ENSO-related precipitation increases, our focal species and other western migrants may suffer greater variation in annual survival. Furthermore, the implication from our study that population dynamics of western migratory bird species may oscillate synchronously and depend on ENSO-driven precipitation during spring migration is a novel hypothesis that deserves further investigation.

**PS1.38 Lamle, Alexandria,** (Cameron University, Lawton, United States); Landoll, Diane (University of Oklahoma,

Norman, OK, United States); White, Jared; Husak, Michael (Cameron University, Lawton, OK, United States)

#### NEST STRUCTURE AND COMPOSITION OF SCISSOR-TAILED FLYCATCHERS ACROSS A LANDSCAPE GRADIENT

Nest structure and composition affect development of eggs and young, and thus contribute directly to parent fitness and population dynamics. Despite this, there are few detailed analyses of nests for savannah birds, and many of the existing studies predate the widespread availability of synthetic materials (e.g. plastic and nylon). The Scissor-tailed flycatcher (*Tyrannus forficatus*) is a common savannah species of the North American south-central plains. Two previous studies have considered their nest construction, but combined included a total of only 39 nests, all of which were from south-central Texas. The objective of our study was to examine a larger sample of nests from southwestern Oklahoma, USA across a variety of open habitats. During 2009 and 2010, measurements were taken in the field of 129 nests for internal and external width, length, and depth. Eighty nests were collected and their composition determined visually (indirect measure of volume) and by weight. Contents were divided into multiple sub-categories of plant, animal, and synthetic material. Dimensions were comparable to previously published values. The majority of nest content visually and by weight ( $\geq 75\%$ ) was plant material followed by animal and synthetic material. Forbs comprised most of the plant material, the majority of animal material was fur/hair, and the most common synthetic material was plastic. Synthetic material was higher than observed in previous studies. A comparison of nests from natural, modified, and urban habitats will be discussed, as will variation between successful (fledged  $\geq 1$  young) and unsuccessful nests.

**PS2.112 Lamont, Myles,** (University of the Fraser Valley, Abbotsford, Canada); Arndt, Allan (University of the Fraser Valley, Abbotsford, BC, Canada); Rodrigues, Antonia (Simon Fraser University, Burnaby, BC, Canada)

#### DEFYING ALLOPATRY: A COMPARISON OF BOTH NEW AND OLD WORLD POPULATIONS OF THE WHITE-FACED WHISTLING DUCK

The White-faced Whistling Duck is part of a basal genus of waterfowl in the family Anatidae. Despite having widespread populations on both the African and South American continents, it displays no phenotypic differences between these two populations, causing taxonomists to classify it as a single species. To date, no work has been carried out to determine if this classification represents an accurate depiction on a genetic level. Few cases exist of a species being separated by very large distances, yet display no visual differentiation unless some sort of continual gene flow occurs; with no known migration between continents recorded, this phenotypic stasis can only be explained based upon phylogenetic comparisons between these two separate populations. Mitochondrial DNA was amplified using primers from the ND2 gene region. Preliminary results suggest that some minor genetic variation between continents exists, however is much smaller than what would be expected based upon the distance and time these two populations have been separated. By comparing the genomic make up of these two populations, it may be possible to determine which population was the founder as well as potentially indicate the relative evolutionary time since these two populations separated; perhaps providing insight into whether an unknown migration is occurring or if this species has somehow resisted genetic drift and defied the evolutionary process under which all organisms are believed to be held.

**T11.10 Lanctot, Richard**, (US Fish and Wildlife Service, Anchorage, United States); Hill, Brooke; Gates, River (U.S. Fish and Wildlife Service, Anchorage, AK, United States); Cunningham, Jenny (University of Columbia-Missouri, Columbia, MO, United States); Doll, Andy (University of Colorado Denver, Denver, CO, United States); Taylor, Audrey (Windbird Resources, Conway, WA, United States)

WHAT HAPPENS WHEN YOU REMOVE AN APEX PREDATOR FROM AN ARCTIC ECOSYSTEM? FINDINGS FROM A 9-YEAR STUDY AT BARROW, ALASKA.

Removal or addition of apex predators may have profound effects on an ecosystem, resulting in loss of some species, enhancements of others, and changes in trophic interactions. In Arctic and Subarctic environments, Arctic Fox (*Alopex lagopus*) have been shown to have dramatic effects on waterbird populations through loss in productivity (i.e., lower nest success and hatchling survival). However, other factors such as the availability of alternative prey (i.e., lemming) and waterbird species composition and density are likely to be important. We investigated these relationships by documenting changes in the shorebird community (i.e., species composition and density, breeding initiation and success) and other environmental variables that occurred at Barrow, Alaska, between 2003 and 2004, when no fox control was in place, and 2005 – 2011 when fox were removed to benefit nesting eiders. Shorebird species composition and nest density increased following fox removal (e.g., average # of nests went from 59.3 to 114.7 per km<sup>2</sup>), and apparent hatching success increased from 32 to 69%. These changes occurred despite large differences among years in numbers of lemmings, weasels, and avian predators. More abundant and frequent lemming peaks also appear to be driving changes observed in vegetation communities, which ultimately may influence carbon sequestering by tundra plants.

**PS1.156 Landoll, Diane**,\* (University of Oklahoma, Norman, United States);

ANNUAL AND ENVIRONMENTAL VARIATION IN EXTRA-PAIR PATERNITY IN A SOCIALLY MONOGAMOUS SAVANNAH NESTING PASSERINE

Social monogamy rarely reflects the actual state of passerine mating systems. Rates of extra-pair paternity (EPP) may be related to morphological characteristics, habitat structure, nesting density, timing of reproduction/nesting synchrony, and weather conditions. Our goal was to investigate the affect of each of these on EPP rates in the sexually dimorphic, savannah-nesting Scissor-tailed Flycatcher (*Tyrannus forficatus*). By investigating multiple correlates of EPP, we hope to gain insight to the causes and consequences of variation in EPP rates and the opportunity for sexual selection through extra-pair copulation and fertilization.

We used DNA isolated from blood samples of birds captured at the nest to conduct paternity analyses. Morphological measurements were taken at the time of capture. These included weight, culmen, and right and left tarsus, wing chord, and tail length for all adults. We used eight fluorescently labeled microsatellite primers to identify cases of EPP or to confirm paternity for social males. We measured % ground covered by a suite of habitat variables in 57m<sup>2</sup> plots surround each nest. We also recorded nesting dates, minimum and maximum daily temperature, and rainfall to investigate the relationships of nesting date/synchrony, temperature, and rainfall with EPP. We investigated the effect of these variables on EPP and the proportion of EPY in nests in four years.

We found high EPP rates in Scissor-tailed Flycatchers. In all years combined, 64% contained extra-pair young (EPY) and

44% of nestlings were extra-pair. The relationship between EPP and morphology varied yearly. Males that retained paternity in their nests had more symmetrical tails than cuckolded males, as did females that had extra-pair mates. Cuckolded male tail length was negatively related to the proportion of EPY in their nests. Extra-pair males were heavier than social males they cuckolded. EPP was higher in wilderness areas than urban areas, potentially due to greater vigilance and mate guarding in urban areas, which had a higher nesting density. Increased rainfall in the month leading to clutch initiation negatively influenced the proportion of EPY in nests, but in the three months leading to clutch initiation was positively related to EPY. EPP has a complex relationship with a suite of ecological variables, and is highly variable depending on environmental conditions. Investigating multiple correlates of EPP simultaneously will help us garner a more complete picture of reproductive and social dynamics in the majority of passerines.

**PS2.110 Lane, Oksana**, (Biodiversity Research Institute, Gorham, United States); Arendt, Wayne (USDA Forest Service, International Institute of Tropical Forestry, Luquillo, PR, United States); Torrez, Marvin (USDA Forest Service, International Institute of Tropical Forestry, Managua, Nicaragua, United States); Evers, David (Biodiversity Research Institute, Gorham, ME, United States)

HEAVY METAL EXPOSURE IN RESIDENT BIRDS AND NEOTROPICAL MIGRANTS IN SELECTED SITES IN CENTRAL AMERICA.

Mercury and other heavy metal exposure in wintering neotropical migrants and resident birds in Central and South America is largely unknown. In 2007-2012 we nonlethally collected blood and feather samples from resident and migrant birds from different habitats in Belize, Costa Rica, Nicaragua and Panama to determine if mercury and other heavy metals exposure is of concern at these sites. Of over 60 species captured mercury exposure varied and was in general low at sampled sites in Costa Rica and in Panama, but elevated in several species in Belize and Nicaragua. The American Pygmy Kingfisher (*Chloroceryle aenea*) had the highest concentrations of mercury in feathers, ranging from 2.8 -5.7 ppm in Panama, 7.8 ppm in Belize, and 11 ppm in Caño Palma Research Station in Costa Rica. Feather mercury concentrations over 5 ppm are considered elevated for songbirds, and over 40 ppm in large piscivorous birds (loons). Species that foraged in aquatic habitats (streams, mangroves) such as Northern Waterthrush (*Seiurus noveboracensis*), Spotted Sandpiper (*Actitis macularius*) and kingfishers tended to have higher mercury, aluminum and copper feather concentrations than other species.

**SAT1.1 Langin, Katie**,\* (Colorado State University, Fort Collins, United States); Sillett, Scott (Smithsonian Migratory Bird Center, Washington, DC, United States); Funk, Chris (Colorado State University, Fort Collins, CO, United States); Morrison, Scott (The Nature Conservancy, San Francisco, CA, United States); Ghalambor, Cameron (Colorado State University, Fort Collins, CO, United States)

DIVERGENCE WITH GENE FLOW: LOCAL ADAPTATION IN BILL MORPHOLOGY WITHIN A SINGLE-ISLAND ENDEMIC, THE ISLAND SCRUB-JAY

The spatial scale of adaptive differentiation and the mechanisms that drive it has been at the forefront of evolutionary debate since Darwin. Because birds can fly, dispersal and gene flow between populations has traditionally been thought to be high, leading to constraints on local adaptation and divergence. Yet,

increasingly evidence is accumulating that divergent selection can promote adaptive divergence between adjacent bird populations even in the presence of gene flow. We tested for local adaptation in the Island Scrub-Jay (*Aphelocoma insularis*), a species currently confined to 250 km<sup>2</sup> Santa Cruz Island. Previous work on mainland *Aphelocoma* has documented local adaptation in bill morphology associated with divergent feeding requirements in oak and pine habitats. Our data are consistent with those patterns and have revealed habitat-related variation in bill morphology at remarkably small spatial scales: jays in all three of the island's pine stands have longer bills than jays in the matrix of oak habitat. We have also detected spatial genetic structure at neutral genetic markers (microsatellite loci), but those patterns are largely driven by isolation by distance, not isolation by habitat. Thus, gene flow does not appear to be restricted across the oak-pine habitat boundary. Taken together, our results provide a rare example of small-scale morphological divergence across the geographic range of a bird species with no pronounced physical barriers to dispersal.

**S3.2 Langston, Rowena**, (The Royal Society for the Protection of Birds, SANDY, United Kingdom);  
**BIRDS AND OFFSHORE WIND FARMS: A UK PERSPECTIVE**

Renewable energy is an important component of a low carbon future for energy generation. Wind energy is the most advanced renewable energy source and is a global industry onshore and, increasingly, offshore. The UK is leading the charge for deployment of offshore wind farms, with 5 GW installed, under construction or consented, and many more in planning. As with any form of energy generation, wind energy also has potential environmental costs which have to be balanced against benefits. The environmental impacts on birds derive from: collision mortality; displacement arising from disturbance; habitat loss or change leading to alteration of food availability; barrier effects leading to deviation of long-distance migratory flights or disruption of local flights between egg nesting and foraging areas. Not all species of birds, or individuals within a species, are equally susceptible to negative interactions with wind turbines, and neither are the population consequences of impacts equivalent. Most concerning are bird species of conservation importance that exhibit behaviours that risk population decline. In particular, cumulative impacts arising from multiple wind farms, or wind farms in combination with other developments, are of concern. Increasing our understanding of impacts is essential to delivering possible solutions and this paper summarises current knowledge for birds and identifies key information gaps, with recommendations for addressing these, drawing on UK experience.

**SAT1.4 Lank, David**, (Simon Fraser University, Burnaby, Canada); Farrell, Lindsay (Simon Fraser University, Burnaby, BC, Canada); McRae, Susan (Department of Biology and North Carolina Center for Biodiversity, Greenville, NC, United States)  
**GENES PRODUCING 'FEMALE MIMIC' MALES ALSO SHRINK FEMALE RUFFS (PHILOMACHUS PUGNAX), AND MAY ALTER SEX RATIOS**

Ruff are lek-breeding shorebirds long known for individual variation in color and pattern of elaborate breeding plumages, and a behavioral dimorphism between territorial and non-territorial male morphs, which correlates with plumage color. Six years ago, Dutch researchers documented the existence of third rare small male morph, termed 'faeders', which lack ornamental plumage, putative 'female mimics' (Jukama and Piersma 2006: *Biol Lett* 161-164). Subsequent observations of captive faeders confirm that these birds also lack courtship

behaviour at leks. Pedigree data showed that the development into this morph is controlled by a strong genetic factor, a mendelian dominant 'faeder allele'. Here we report the apparent influence of this putative faeder allele on female size and, possibly, sex allocation. Approximately half of the female offspring of cryptic males are tiny, forming a separate small mode in the size distribution, parallel to that differentiating the size of faeders from ornamented males. On close inspection, this mode can be seen in published data from wild females captured in Finland and Germany. The faeder allele may also distort sex ratios. Sex ratios of migrant wild juvenile ruffs, which would include only ca. 1-2% faeder offspring, are strongly female biased (35-40% male, Jaatinen et al. 2010 *Ornis Fennica* 87:125-134). We hand-rear offspring in our captive population. Those surviving to fledging fathered by ornamented males, and with mothers lacking the faeder allele, are similarly female biased (42:58 M:F, n=639), whereas fledglings fathered by cryptic males are have an even ratio (50:50, n=84; parentage by offspring sex:  $\chi^2 = 2.12$ , p=0.15). Any difference in faeder offspring sex ratio would suggest a change in sex allocation by females mating with faeders, implying that the average fitness of small males exceeds that of small females. Consistent with this possibility, our small females have delayed their age of first egg-laying relative to other females.

**PS1.199 Lankau, Hedwig**, (University of Alberta, Edmonton, Canada); Bayne, Erin (University of Alberta, Edmonton, AB, Canada); Machtans, Craig (Environment Canada, Yellowknife, NW, Canada)

**OVENBIRD (SEIURUS AUROCAPILLA) RESPONSE TO REGENERATING SEISMIC LINES**

The Ovenbird (*Seiurus aurocapilla*) is a warbler known to be sensitive to newly created seismic lines. Seismic lines, long linear clearings made by oil and gas exploration, are rapidly dissecting the boreal forest of western Canada. We investigated potential mechanisms causing Ovenbirds to exclude seismic lines from their territories. We mapped the territories of 52 male Ovenbirds in the Liard River valley in the Northwest Territories, Canada. We recorded the number of neighbours, the vegetation conditions on the seismic lines, and noted whether the birds included or excluded the line. The best model to explain Ovenbird response to seismic lines included the number of neighbouring conspecifics, the amount of bare ground, and canopy closure. The probability of line exclusion was greatest for birds with more neighbours, regardless of line vegetation conditions. We conclude that lines are used as landmarks to demarcate territorial boundaries, especially in areas where territorial males have more neighbours. In addition, Ovenbirds exclude recently cut seismic lines from their territories due to lack of protective cover and food resources on lines. Food and predation risk issues are mitigated once leaf litter depth and understory cover are restored to near forest interior values, which occurs within 40 years after lines are cut. Landmark effects are longer lasting because canopy height and tree density take more than 40 years to recover to forest interior levels.

**S6.9 Lany, Nina**, (Dartmouth College, Hanover, United States); Ayres, Matthew P. (Dartmouth College, Hanover, NH, United States); Stange, Erik E. (Norwegian Institute for Nature Research, Lillehammer, Norway); Sillett, T. Scott (Smithsonian Migratory Bird Center, Washington, DC, United States); Rodenhouse, Nicholas L. (Wellesley College, Wellesley, MA, United States); Holmes, Richard T. (Dartmouth College, Hanover, NH, United States)

SPRING LEAF PHENOLOGY, INSECT AVAILABILITY,  
AND THE TIMING OF BREEDING BY A MIGRATORY  
SONGBIRD IN A NORTH AMERICAN TEMPERATE  
FOREST

Climate patterns vary strikingly among years and the phenology of biological events shows correspondingly high inter-annual variation. Natural selection should favor organisms that time their life cycle to maximally exploit resources and many populations display adaptive plasticity in their phenology to adjust to climatic variation. We explore the mechanisms by which the timing of breeding of black-throated blue warblers (*Setophaga caerulescens*) in a northern hardwood forest responds to climatic variation, and compared the effects of the timing of breeding on reproductive output to the effects of other known demographic drivers. The arrival of black-throated blue warblers was weakly matched to spring leafout dates, indicating modest plasticity in the timing of migration. Birds became more closely synchronized to local phenology in their initiation of clutches. Clutch initiation dates were strongly related to leafout dates, but not to the timing of a peak in food availability. Food abundance during the egg formation period explained 15% of the variation in clutch initiation dates after accounting for the effects of spring phenology, presumably because birds must gain a threshold level of stored resources before laying begins. The probability of nest survival, food abundance, the interaction of the two, and conspecific density each explained 35%, 11%, 7%, and 7%, respectively, of the variation in average annual reproductive success. The average phenological plasticity displayed by the population resulted in the highest reproductive output, and the consequences of being too early or too late accounted for 4% of the variation in reproductive success. Thus, adaptive plasticity maintains a phenological match in this system, at least within the historic range of variation.

**SAT5.4 Lanzone, Micheal**, (Cellular Tracking Technologies, LLC, Somerset, United States); Miller, Tricia; Turk, Phil (West Virginia University, Morgantown, WV, United States); Brandes, David (Lafayette College, Easton, PA, United States); Halverson, Casey (Cellular Tracking Technologies, Somerset, PA, United States); Maisonneuve, Charles (Ministère des Ressources naturelles et de la Faune, Rimouski, PQ, Canada); Tremblay, Junior (Ministère des Ressources naturelles et de la Faune, Québec, PQ, Canada); Cooper, Jeff (Virginia Department of Game and Inland Fisheries, Fredericksburg, VA, United States); O'Malley, Kieran (WVDNR, Romney, Canada); Brooks, Robert (The Pennsylvania State University, University Park, PA, United States); Katzner, Todd (West Virginia University, Morgantown, WV, United States)

FLIGHT RESPONSES BY A MIGRATORY SOARING  
RAPTOR TO CHANGING METEOROLOGICAL  
CONDITIONS

Soaring birds that undertake long-distance migration attempt to develop strategies to minimize the energetic costs of endurance flight. This is relevant because condition upon completion of migration has direct consequences for fecundity, fitness and thus, demography. Therefore, strong evolutionary pressures are expected for energy minimization tactics linked to weather and topography. Importantly, the minute-by-minute mechanisms birds use to subsidize migration in variable weather are largely unknown, in large part because of the technological limitations in studying detailed long-distance bird flight. Here we show golden eagle (*Aquila chrysaetos*) migratory response to changing meteorological conditions as monitored by high-resolution telemetry. In contrast to expectations, responses to

meteorological variability were highly stereotyped across individuals. Eagles reacted to increased wind speed by using more orographic lift and less thermal lift. Concomitantly, as use of thermals decreased, variation in flight speed and altitude also decreased. These results demonstrate how soaring migrant birds minimize energetic expenditures and show the context for avian decisions and choices of specific instantaneous flight mechanisms.

**S11.8 LaPointe, Dennis**, (U.S. Geological Survey, Hawaii National Park, United States); Atkinson, Carter (U.S. Geological Survey, Hawaii National Park, HI, United States); Samuel, Michael (U.S. Geological Survey, Madison, WI, United States)  
MOSQUITO-BORNE AVIAN DISEASE IN HAWAIIAN  
FOREST BIRDS: INDIVIDUAL TO LANDSCAPE EFFECTS.

Avian malaria *Plasmodium relictum* and Avipoxvirus have contributed to the extinction and population decline of endemic Hawaiian forest birds following the introduction of the mosquito, *Culex quinquefasciatus*, early in the 19th century. Hawaiian honeycreepers have suffered the most losses with half the known species now extinct. Mortality from avian malaria ranges among species from 17 – 90 % and prevalence of chronically-infected individuals may exceed 90 % in some forest communities. Vector demography and pathogen transmission are driven largely by climate resulting in altitudinal zones of year-round, endemic transmission; epizootic, seasonal transmission and transmission-free refugia. Modeling of long-term, capture-recapture data indicate that some species' population may experience > 50% annual mortality among hatch-year birds and > 25% among adults during epizootic years. Disease transmission and other stressors like drought and predation can create sinks where populations are only sustained by the immigration of birds from higher, transmission-free elevations. These introduced diseases and non-native passerines have greatly altered Hawaiian forest bird communities but there is little evidence that the relatively malaria-resistant, non-native species substantially alter transmission rates. Non-native birds, while abundant, appear to be more successful at defending against mosquito blood feeding than Hawaiian honeycreepers and thereby limit a potential dilution effect. Conversely, evolving tolerance to malaria in some honeycreepers can enhance transmission in the community. At the landscape level, forest fragmentation by residential development, agriculture, and ranching, as well as, forest degradation by feral pigs has greatly facilitated disease transmission primarily through the creation of larval mosquito habitat. Changes in land use practices, climate, vector diversity and natural selection ensures that this introduced avian disease remains dynamic and an obstacle to the preservation and restoration of Hawaii's avifauna.

**PS1.257 Lara, Carlos E.**, (Universidad Nacional de Colombia, Medellin, Columbia); Cuervo, Andres M. (Louisiana State University, Baton Rouge, United States); Valderrama, Sandra (University of Waikato, Hamilton, New Zealand); Cadena, Carlos Daniel (Universidad de Los Andes, Bogota, Columbia)  
A NEW SPECIES OF WREN (TROGLODYTIDAE) FROM A  
DRY INTER-ANDEAN VALLEY OF COLOMBIA

We discovered a wren in the dry Cauca River Canyon, an inter-Andean valley, northwestern Colombia. External phenotype indicated affinities with the genus *Thryophilus*, which is composed by *T.nicefori*, and *T.rufalbus*. We conducted a comparative study of this group to describe the new population, and shed light on species limits among members of the *T.rufalbus-nicefori* complex. We found that individuals of this new population have distinctive plumage, morphology,

vocalizations and genetic type. Although similar in plumage coloration to *T.rufalbus*, the individuals discovered have distinctive paler upperparts as well as more cinnamon-brown rather than bright or dark rufous; fine blackish barring on wings, and tail is similar to *T.nicefori* which, in contrast, have much heavier and blacker barring on wings and tail, as well as darker and colder brown above with faint black barring on the dorsum and upper tail-coverts. Differences in morphology with other taxa included smaller body mass and wing length in comparison with *T.rufalbus* and *T.nicefori*. Relative to other *Thryophilus*, the new wren's songs have a richer repertoire of syllable types, shorter trills, lower number of trill syllables, and higher spectral frequencies. Sequence divergence (cyt-b) with *T.nicefori*, *T.r.minlosi* and *T.r.cumanensis* averaged 3.8%, 3.6% and 2.7%, respectively. We conclude that the new population is an unnamed taxon that merits species rank. It is a fully diagnosable lineage with respect to other wrens, based on joint evidence from plumage pattern, morphometrics, vocalizations, and genetic variation. In addition, our results suggest that the *T.rufalbus-nicefori* complex as currently defined might comprise multiple species

**W2.6 LaRoche, Dominic**, (University of Arizona USGS Cooperative Research Unit, Tucson, United States); Conway, Courtney (University of Idaho, USGS Cooperative Fish and Wildlife Research Unit, Moscow, United States); Swann, Don (National Park Service, Tucson, United States); Kirkpatrick, Chris (University of Arizona USGS Cooperative Fish and Wildlife Research Unit, Tucson, United States)

#### THE FUTURE OF SOUTHWESTERN RIPARIAN BIRDS IN A CHANGING CLIMATE; CHANGES IN SPECIES COMPOSITION DUE TO DECLINES IN AVAILABLE WATER AND RIPARIAN VEGETATION.

Most climate projection models predict reduced water availability in southwestern North America within the next 100 years and a shift to a more arid climate. The reductions in available water from a changing environment, coupled with increasing water needs of growing human populations, will pose a substantial threat to desert riparian woodlands in future years. Riparian woodlands in the desert southwest provide habitat for many species of wintering, breeding, and migratory birds. It has been estimated that over 50% of breeding bird species in the southwest U.S. are dependent upon riparian woodlands even though these areas account for <1% of the landscape. Water, in the form of both ground water and surface water, is critical for maintaining healthy riparian woodlands. We conducted a 29-site study of riparian woodlands in southeastern Arizona from 2006-2011 to determine how a riparian bird community responds to decreased surface water, ground water, and degraded riparian vegetation. We surveyed birds and monitored nests while simultaneously measuring riparian vegetation, surface water, and ground water to track the changes in these variables resulting from either drought or groundwater withdrawal. We documented a shift from riparian obligate species to species which typically breed in the surrounding upland in sites with reduced water availability. We documented declines in nesting attempts associated with the reduced water availability for three species of riparian birds. The presence of surface water was the most important predictor for 9 bird species and overall species richness. Other species responded to drought-induced changes in vegetation. Reductions in available water for desert riparian woodlands associated with climate change and ground water withdrawal pose a substantial risk for many riparian obligate bird species.

**SAT17.2 Latta, Steven**, (National Aviary, Pittsburgh, United States);

#### IS THERE A CARRY-OVER EFFECT FROM THE BREEDING GROUNDS TO THE WINTERING GROUNDS?

The quality of the over-wintering habitat occupied by an individual has been shown to affect territory quality in the subsequent breeding season and the number of fledglings produced, and to contribute to determining the direction and distance traveled by birds during their first spring migration. These seasonal interactions can play an important role in avian demographics and individual fitness. However, a similar carry-over effect from the breeding grounds to the wintering grounds has never been shown. We investigated carry-over effects in the stream-obligate Louisiana Waterthrush (*Parkesia motacilla*). We have previously shown that this waterthrush is an excellent indicator of water quality and riparian system health, and so may be a very good model Neotropical migratory bird to investigate the occurrence of seasonal interactions. We used levels of the corticosteroid stress hormone occurring in feathers to test the hypothesis that birds originating from high quality, low stress breeding habitats will arrive earlier and secure higher quality territories on the wintering grounds compared with birds originating from low quality, high stress breeding habitats. We also investigate how over-wintering territory quality affects site persistence and survival in this species. We present these results and discuss their importance to the ecology of Neotropical migratory birds.

**SAT3.5 Laughlin, Andrew**, (Tulane University, New Orleans, United States); Sheldon, Daniel (Oregon State University, Corvallis, OR, United States); Winkler, David (Cornell University, Ithaca, NY, United States); Taylor, Caz (Tulane University, New Orleans, LA, United States)

#### RADAR AND RADIOS REVEAL ROOST SITES AND BETWEEN-ROOST MOVEMENTS OF WINTERING TREE SWALLOWS (*TACHYCINETA BICOLOR*)

Though large roosts of blackbirds, robins, and swallows are a common and charismatic phenomenon during migration and winter, few studies of roost phenology, location, and interactions between roosts have been conducted.

Tree Swallows form very large nocturnal roosts during migration and winter. We used Doppler weather radar to establish the locations, habitat, and durations of winter Tree Swallow roosts in southeastern Louisiana. We attached radio transmitters to 29 birds at one roost and surveyed several surrounding roosts for 8 weeks to measure the daily rate of movement between roosts by individual birds.

In late October, we located six large (~ million +) Tree Swallow roosts using radar, five of which were in sugarcane fields. After the sugarcane harvest in December, we located three smaller Tree Swallow roosts in wetland habitats. Most of the swallows appear to have left this area after the harvest, suggesting that this area of the Gulf Coast serves as a long stopover habitat for millions of Tree Swallows, only some of which remain in the area for the rest of the winter.

Before the sugarcane harvest, the roosts stayed in the same general area at each location, but the swallows did not necessarily use the same roost each night. We 're-sighted' 23 of the original birds at least twice over this survey period, and all roosts that we surveyed with telemetry provided at least one signal from our birds with radios. In all, we calculated that birds moved from one roost to another at a rate of 40%, and remained in the same roost 60% of the time. One bird was 're-sighted' in 5 different roosts, including a wetlands roost 75 km from the roost



where it was originally caught, 55 days after initial radio attachment.

**F11.6 Lawonn, James**, (Oregon State University, Corvallis, United States); Roby, Daniel (USGS-Oregon Cooperative Fish and Wildlife Research Unit, Department of Fisheries and Wildlife, Oregon State University, Corvallis, United States); Piatt, John (USGS-Alaska Science Center, Anchorage, United States); Corcoran, Robin (U.S. Fish and Wildlife Service, Kodiak National Wildlife Refuge, Kodiak, United States); Pyle, Bill (U.S. Fish and Wildlife Service, Kodiak National Wildlife Refuge, Kodiak, United States)

#### SEARCHING FOR A SHADOW'S SHADOW: KITTLITZ'S MURRELETS NESTING IN UNGLACIATED ALPINE HABITAT ON KODIAK ISLAND, ALASKA

Kittlitz's murrelet (*Brachyramphus brevirostris*) is a rare and mysterious seabird that nests in remote mountainous terrain in coastal areas of Alaska and the Russian Far East. It is a species of conservation concern, and is currently a priority species for listing under the U.S. Endangered Species Act. Owing to the remoteness of its breeding habitats and its solitary nesting habits, fewer than 25 nests for the species had been described prior to 2005. To fill significant gaps in our knowledge of the species' breeding ecology, we studied Kittlitz's murrelets nesting on scree slopes in unglaciated alpine habitats in Kodiak National Wildlife Refuge, Alaska. We discovered 53 active Kittlitz's murrelet nests during 2008-2011, and placed remote cameras near 33 nests to elucidate aspects of parental care, chick diet and growth, and factors limiting nest success. Nests were situated on steep slopes with little vegetation, and most nests were at least 200 m from the nearest active nest. Five nest sites were reused in successive years, and inter-annual nest locations appeared clumped on the landscape, suggesting fidelity to nesting territories. Of all active nests, only 28 (53%) produced hatchlings and only nine (17%) produced fledglings, confirming low nesting success. Chick diet was composed almost exclusively of high-lipid forage fish species, pointing to the intense energetic demands of simultaneous rapid growth and thermoregulation in harsh alpine environments. Young fledged 22 to 27 days post-hatch, suggesting intense selection pressure to fledge early. Red fox depredation and chick mortality on the nest for unknown reasons accounted for approximately 86% of all failed nests. These results enable the U.S. Fish and Wildlife Service and other land management agencies in Alaska to identify potential nesting habitats and factors limiting reproductive success for this poorly-known candidate species.

**PS1.253 LaZerte, Stefanie**, (University of Northern BC, Prince George, Canada); Otter, Ken (University of Northern BC, Prince George, BC, Canada)

#### VOCAL ADJUSTMENT BY BLACK-CAPPED AND MOUNTAIN CHICKADEES IN URBAN AND NOISY HABITATS

The transmission of bird song in a given habitat is determined by the acoustic environment of that habitat, which is in turn influenced by ambient noise and physical structures. Because song plays such an important role in avian territoriality and reproduction, song transmission should be optimized to the local habitat (acoustic adaptation hypothesis). However, human activity often results in novel, altered environments, including increased noise from cars or people, and changes to the physical structure of the landscape through urbanization. Some birds can adapt to these novel environments by individually adjusting their songs to transmit more efficiently, but not all species may be capable of this vocal adjustment. Pilot studies suggest that

black-capped chickadees in urban environments adjust their singing behaviour in relation to noise. Therefore, we looked for evidence of long and short term vocal adjustment in black-capped and mountain chickadees (*Poecile atricapillus*, *P. gambeli*). Long-term vocal adjustment was examined by recording and comparing songs from noisy or quiet, and urban or rural individuals in different populations across British Columbia, Canada. Short-term vocal adjustment was determined by observing the responses of these individuals to experimental noise playback during the chorus. We will present data on the differences in signalling strategies under urban constraints between the two chickadees species. We will use this data to determine the extent of vocal adjustment and therefore, which species are most vulnerable to urbanization.

**PS2.9 Leal-Sandoval, Alfredo**, (Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México. Unidad Académica Mazatlán, Mazatlán, México); Castillo-Guerrero, Alfredo; Fernandez, Guillermo (Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México. Unidad Académica Mazatlán, Mazatlán, México); Mellink, Eric (Centro de Investigación Científica y de Educación Superior de Ensenada, Ensenada, México)

#### PARENTAL CARE AND TRANSITION TO THE INDEPENDENCE IN THE BLUE-FOOTED BOOBY (*SULA NEBOUXII*)

We characterize the parental care received by young Blue-footed Boobies (*Sula nebouxii*) at pre and post-fledging period during their transition to independence. We recorded patterns of parental care and chick behavior at focal nest at Isla el Rancho, Sinaloa, during the 2006 breeding season. The hatching date and chick hierarchy were used as indicators of parental care. To determine if parental care was related to the duration of post-fledging period, we analyzed the chick and fledging body mass, fledging date, presence of parents at nest, duration of the transition to the independence and food begging rate. We found that the parental care affect the conditions of the young at the beginning and duration of the transition to the independence. The maximum body mass reached by chicks was affected by hatching date (males) and chick hierarchy (females), and body mass decreased with hatching date. The young that hatched earlier had more pre-fledging care and fledge at elder age than those hatched later in the season. The duration of post-fledging parental care and the transition to the independence was longer in the late hatchers. This pattern can be explained by chick that hatched earlier were in better body condition, developed their motor skills as consequence of more parental care. This suggests that parental care establish the conditions for a shorter transition to independence.

**W17.3 LeBeau, Chad**, (Western EcoSystems Technology, Inc, Cheyenne, United States); Beck, Jeffrey (University of Wyoming, Laramie, WY, United States); Johnson, Gregory; Nielson, Ryan (Western EcoSystems Technology, Inc, Cheyenne, WY, United States); Holloran, Matt (Wyoming Wildlife Consultants, LLC, Fort Collins, CO, United States)

#### SHORT-TERM IMPACTS TO GREATER SAGE-GROUSE FROM WIND ENERGY DEVELOPMENT

Wind energy development is increasing in rangeland habitats, which has raised concerns relative to impacts to avian species including the Greater Sage-Grouse (*Centrocercus urophasianus*; hereafter sage-grouse). Little information exists about the impacts of wind energy development on sage-grouse; however, wind energy infrastructure is likely to directly and indirectly

impact sage-grouse movements because they avoid tall structures and human activities. Changing movements may equate to different habitat selection patterns, which are predicted to lead to reduced population fitness. The purpose of our study was to document habitat occurrence and fitness parameters associated with sage-grouse inhabiting areas in close proximity to wind turbines. In April 2009 and 2010, we captured 116 female sage-grouse near Medicine Bow, Wyoming and have monitored these grouse for 2 years to evaluate nest, brood, and female survival, and habitat occurrence. We used logistic regression to develop resource selection functions to estimate habitat occurrence. We used Cox proportional hazards regression to model nest, brood and female survival. The proximity to wind turbines did not influence nest site or brood-rearing occurrence but the relative probability of summer occurrence increased in habitats closer to wind turbines. Female survival was not influenced by wind turbines but nest and brood survival were both negatively affected by proximity to wind turbines. This is the first study to evaluate short-term effects of wind energy infrastructure--specifically wind turbines--on sage-grouse fitness parameters and habitat selection.

**PS1.10 LeClair, Dayna,\*** (University of Guelph, Guelph, Canada); Hussell, David (Ministry of Natural Resources, Simcoe, ON, Canada); Mitchell, Greg; Norris, Ryan (University of Guelph, Guelph, ON, Canada)

#### EXAMINING EFFECTS OF FOOD AND TEMPERATURE DURING DIFFERENT STAGES OF THE BREEDING PERIOD ON THE REPRODUCTIVE SUCCESS OF A MIGRATORY BIRD

Food abundance and temperature during the breeding season has been shown to influence reproductive performance at multiple stages of the breeding cycle. However, the relative contribution of food and temperature at each stage towards reproductive success has yet to be examined. Using an unprecedented 35-year dataset for two breeding populations experiencing consistent inter-annual variability in food availability and temperature and a hierarchical path model, we examined the direct effects of food and temperature on stage specific reproductive performance, as well as the indirect effects of food and temperature at each stage on overall reproductive success. We found that the relative effects of temperature and food on reproductive success varied between populations. For one population that experienced high food availability throughout the breeding period, food availability during laying had a large positive effect on the number of offspring fledged through its effect on clutch size. For the other population that experienced cooler temperatures throughout the breeding period and an annual peak in food availability during the nestling stage, temperature during the pre-laying and nestling stages had large negative effects on reproductive success through their direct effect on nestling survival. For the latter population, we also found that reproductive success decreased over the 35-year monitoring period, likely because of a negative effect of increasing temperature on food availability. Taken together, our results suggest that, in cases of high food abundance, food can outweigh any constraints imposed by temperature. Our results provide critical and unique insights into the life history of songbirds and provide a means to predict how future changes in food abundance via variation in temperature will influence populations.

**PS1.146 Lee, Myungbok,** (University of Georgia, Athens, United States); Carroll, John (University of Georgia, Athens, GA, United States)

#### ASSESSING SCALE DEPENDENCIES IN AVIAN SPECIES IN A PINE FOREST, AGRICULTURE AND URBAN MATRIX

In southeastern USA, planted pine forests are increasingly embedded in a complex matrix of urban development and/or extensive agriculture. Although majority of the planted pine forests are primarily managed for timber harvest, there are growing interests in management plans to conserve avian species in these habitats. However, most management has focused on local or stand scale. Little attention has given to landscape-scale habitat characteristics. We investigated the relationship between occupancy of 14 avian species and two spatial scales: local-scale and landscape-scale. During May-August 2010 and 2011, we conducted bird survey and vegetation sampling at 128 loblolly pine stands in the Sand Hill of Georgia. To generate landscape variables, we digitized aerial photographs in ArcGIS and used FRAGSTATS. We performed principle component analysis at each scale and used 3 principle-component scores of each scale for analysis. We developed 6 occupancy models with two-levels of detection and three-levels of occupancy in Program MARK. We used information theoretical approach to identify the best supported models. Of 14 species, occupancy of 7 species was more associated with local variables, 6 species with landscape variables, and 1 species with neither of local nor landscape variables. Local-scale variables were most important for forest interior species, whereas landscape-scale variables were more crucial for forest edge species or pine-grassland species. Although avian response to local-or landscape-scale variables were species-specific, our results showed that landscape-scale habitat features can be important in conservation management plans of some avian species, particularly, forest edge or pine-grassland species.

**PS2.144 Lehmicke, Anna Joy,** (University of Georgia, Athens, United States); Leggett, Alison (University of Georgia, Athens, United States); Woodrey, Mark (Grand Bay National Estuarine Research Reserve, Moss Point, United States); Cooper, Robert (University of Georgia, Athens, United States)

#### LANDSCAPE FACTORS AFFECTING DENSITY OF CLAPPER RAILS AND SEASIDE SPARROWS IN THE GRAND BAY NATIONAL ESTUARINE RESEARCH RESERVE

Tidal salt marshes are highly productive ecosystems and are important both ecologically and economically. Since it is often difficult to monitor the overall health of an entire ecosystem, managers and researchers may rely on one or a suite of indicator species as proxies for ecosystem health. Protecting and restoring appropriate habitat for these species is contingent upon understanding the habitat features they utilize. The objective of this analysis was to create a density model for each of two species, Clapper Rails (*Rallus longirostris*) and Seaside Sparrows (*Ammodramus maritimus*) that have been proposed as "indicator species" in the tidal marsh system of the Grand Bay National Estuarine Research Reserve, Jackson County, Mississippi. During 2010 and 2011, we conducted point count surveys to assess the influence of various landscape metrics on densities of Clapper Rails and Seaside Sparrows at random sampling locations within the estuarine boundary. Candidate models were based on a priori hypotheses determined by observed species distribution and known life history requirements. The results for Seaside Sparrows suggest an influence of predator abundance and elevation, both of which may be related to the chance of nest success. Clapper Rail results indicate that there is no clear driver behind Clapper Rail density, suggesting that they may have more general habitat

requirements than Seaside Sparrows. Future analyses may want to consider variables that vary annually or consider patterns of density at a larger scale.

**W13.1 Leonard, Marty L.** (Dalhousie University, Halifax, Canada); **Horn, Andrew G** (Department of Biology, Dalhousie University, Halifax, NS, Canada)

#### AMBIENT NOISE DISRUPTS NESTLING BEGGING RESPONSES IN TREE SWALLOWS

Much of the work done on the impacts of noise on communication has focused on its impacts on song in adult birds. The increasing intensity, duration and geographical spread of anthropogenic noise, however, makes it important to determine if noise disrupts other reproductive behaviors, such as parent-offspring interactions. Nestling birds are particularly prone to errors, sometimes failing to beg when parents arrive with food (committing missed detections) or begging in response to stimuli other than a parent's arrival (committing false alarms). Here we performed playback experiments to test whether increased noise caused increases in both types of error by nestling tree swallows, *Tachycineta bicolor*. Our results show that nestlings exposed to noise are indeed more likely to miss the parent's arrival, but we could not detect any increase in false alarms. Noise affects signaling by nestlings in several ways, suggesting that disruption of parent-offspring interactions may be one mechanism underlying the lowered reproductive success in noise that has recently been reported for several songbird species.

**S9.4 Leppold, Adrienne**, (University of Maine, Orono, United States); **Hobson, Keith** (Environment Canada, Saskatoon, SK, Canada); **Holberton, Rebecca** (University of Maine, Orono, ME, United States)

#### CHARACTERIZING SPATIAL AND TEMPORAL PATTERNS OF LANDBIRD MIGRANTS IN A COMPLEX FLYWAY SYSTEM, THE GULF OF MAINE REGION

The Gulf of Maine region is a major flyway for several million migrants travelling to and from the boreal and Arctic breeding grounds. Although the region faces increasing threats from overfishing, coastal development, and rapid growth in land-based and offshore energy projects, little is known about the temporal and spatial patterns of migration movements and which populations are making them. Since 2010, we have been using multiple methods (passive acoustic survey, visual surveys, banding, stable isotopes) to characterize patterns of landbird migration in the region. Several measures of energetic condition (including blood sampling for plasma metabolites) were used to determine how well individuals are doing en route as they navigate the region's complex topography. Stable hydrogen isotope ( $\delta^2\text{H}$ ) analysis of flight feathers and a Bayesian assignment framework were used to depict origins of individuals and populations on the precipitation-based passerine feather  $\delta^2\text{H}$  isoscape for North America. This approach was used to contrast catchment areas of adults and immature birds moving through our site. As expected, over 80% of the birds were boreal forest or Arctic-breeders, but many of these have breeding origins much further west than might otherwise be expected. Nocturnal flight call rates were higher inland compared to coastal and offshore areas. Within-night patterns suggest that some sites are used as departure areas while others as initial stopover sites. The use of multiple methods revealed the dynamic nature of migration through this complex region.

**W11.10 Lerner, Heather**, (Smithsonian Conservation Biology Institute, Washington, United States); **Lock, Justin**

(Smithsonian Conservation Biology Institute, Washington, United States); **Fleischer, Robert** (Smithsonian Conservation Biology Institute, Washington, United States)

#### NEXT GENERATION SEQUENCING FOR POPULATION AND PHYLOGENETIC STUDIES: REFERENCE FREE MITOCHONDRIAL GENOME SEQUENCING ACROSS THE AVIAN TREE OF LIFE

Studies of non-model organisms have benefitted substantially from the advent of next generation sequencing technologies. However, the lack of reference genomes, the cost of generating such data, and the upfront expenses associated with next generation sequencing projects have been a major obstacle for population, barcoding and phylogenetic studies. We have developed and tested a novel and highly cost-effective technique for targeted resequencing of the complete mitochondrial genome across the diversity of the avian clade. We designed ~17 000 short oligonucleotide probes to capture and enrich the complete mitochondrial genome for any avian species from genomic DNA. The probe library was designed to include priming sites on the 5' and 3' ends of each molecule such that the probe library itself can be amplified for repeated use. Thus, this design eliminates the cost of additional commercial probe synthesis. Using the probe library, we were able to enrich, and then sequence on the 454 FLX+ platform, the complete mitochondrial genome of representative species from eight avian orders. A total of 14 million bases were sequenced, 66.03 % (SD = 14.45) of which could be mapped back to the appropriate mitochondrial genome. This comparatively high rate of on-target sequence demonstrates both the versatility and specificity of this new technique for use in broad studies of genetic diversity, phylogenetics and population biology. This novel technique for highly cost-effective and reference-free mitochondrial genome sequencing will greatly lessen the upfront costs of next generation projects while still providing researchers with the power and depth of sequencing made possible by high throughput sequencing technologies.

**PS1.265 Lesak, Adrian**, (Dept. of Forest and Wildlife Ecology, UW-Madison, Madison, United States); **Pidgeon, Anna**; **Radeloff, Volker** (Dept. of Forest and Wildlife Ecology, UW-Madison, Madison, WI, United States)

#### VERY LOW HOUSING DENSITY NEGATIVELY AFFECTS FOREST SONGBIRD NESTING SUCCESS

Anthropogenic alteration of landscapes such as land cover change, urban, and exurban housing growth has many effects on breeding forest songbirds but it is unclear at what threshold of change these effects can be detected. We focused on the low end of the rural housing density spectrum to ascertain whether sparse development in a forest-agricultural matrix affects nest success of songbirds in the Baraboo Hills of southern Wisconsin, USA. On 26 10-ha plots, we monitored the nests of four species (Acadian Flycatcher, Ovenbird, Wood Thrush, and Rose-breasted Grosbeak) from mid-May through July 2005-2007. Within 1-km buffers surrounding each plot, housing density was derived from digitized structures on aerial orthophotos and landscape structure was characterized using the 2001 NLCD. Multivariate models of nest success were tested using logistic exposure on a subset of variables that were significantly associated with nest success in univariate models. Acadian Flycatchers and Ovenbirds showed steep declines in nest success when housing density was included in the final model. The addition of only a few dwellings per square kilometer caused declines in daily survival rate of up to 15%, which is significant when extrapolated over the entire nesting cycle of these birds. Wood Thrush and Rose-breasted Grosbeak nesting success was

unaffected by housing variables but increased with patch size and density of forest and cropland. It appears that for some area-sensitive forest interior songbirds, even low levels of residential development in the vicinity of their nesting habitat can drastically reduce their reproductive output and adds another dimension to consider when implementing conservation measures for these species.

**T14.10 Leston, Lionel,** (Natural Resources Institute, Winnipeg, Canada); Koper, Nicola (Natural Resources Institute, Winnipeg, MB, Canada)

#### DOES SHALLOW GAS WELL DEVELOPMENT ADVERSELY AFFECT DAILY NEST SURVIVAL OF CHESTNUT-COLLARED LONGSPURS (*Calcarius ornatus*) AND OTHER PRAIRIE SONGBIRDS?

Increasing shallow gas well development in the prairies is suspected of adversely affecting prairie songbird nest success. Nest predators and invasive plants like crested wheatgrass may spread from roads into native prairies or spot prairie songbird nests while perched on infrastructure, reducing habitat attractiveness and quality for songbirds. In 2010-2011, we sought to determine if and how shallow gas well development significantly affected prairie songbird nest survival. Nests were located systematically by rope-dragging or incidentally during point counts and subsequent nest checks. Sites ( $n=38$ ) were 1-square-mile native pastures with varying amounts of energy infrastructure in southern Alberta. Nest success was analyzed via logistic exposure modeling. In general, daily survival probability of all nests excluding Chestnut-collared longspurs (*Calcarius ornatus*) ( $n=138$ ) was best predicted by a model in which daily nest survival increased with increasing distance (100-m increments) from newer wells and decreased with distance from older wells (distance effect size = 0.213, well age effect size = 0.068, interaction effect size = -0.018, all  $p < 0.050$ ). Daily survival of Chestnut-collared longspur nests ( $n=141$ ) declined with increasing well density (effect size = -0.057,  $p = 0.025$ ), but not with distance to the nearest well or road. Our results suggest that current levels of shallow gas well development in Alberta may impact pasturelands as habitats for declining prairie songbirds, but more study is needed to determine why overall nest survival increases near older wells and how well density but not well or road distance influences longspur nest survival.

**F13.10 Levandoski, Gregory,** (Rocky Mountain Bird Observatory, Fort Collins, United States); Macias-Duarte, Alberto; Panjabi, Arvind (Rocky Mountain Bird Observatory, Fort Collins, CO, United States)

#### INFLUENCES OF HABITAT CHARACTERISTICS ON WINTER SURVIVAL OF VESPER SPARROW (*Poocetes gramineus*) IN THE CHIHUAHUAN DESERT OF MEXICO

Grassland bird populations have experienced significant declines over the last four decades in North America. Possible explanations for this decline include a decrease in winter survival due to changes in habitat quality. To test this theory, we estimated winter survival of Vesper Sparrow (*Poocetes gramineus*) in the Chihuahuan Desert grasslands of northwestern Chihuahua, Mexico. During the winters of 2009 and 2010, we placed radio transmitters on 102 individuals and monitored them daily. We collected data on vegetation structure and composition at each of the 2,651 sites where radio-tagged birds were recorded. To estimate daily survival rate and to determine the effect of habitat structure on survival, we utilized a parametric survival analysis. We estimated a daily survival

probability of 98.9% (95% CI  $98.7 \leq x \leq 99.1\%$ ) for both years, which suggests an over-winter survival rate of 20.2% (95% CI  $10.2 \leq x \leq 32.5\%$ ). Our parametric survival analysis suggests that habitat structure can predict winter survival. High average grass and shrub heights were positively related to winter survival of Vesper Sparrow. Based on model-averaged estimates of regression coefficients across our 224 best models, we estimated that survival time increased by a factor of 4.09 (95% CI  $1.19 \leq x \leq 14.04$ ) for every 10 cm increase in grass height and increased by a factor of 1.48 (95% CI  $1.01 \leq x \leq 2.19$ ) for every 10 cm increase in shrub height. Our results suggest that poor grassland conditions could be an important cause in grassland bird population declines. These results underscore the need, and indicate the potential, of restoring grassland health to reverse persistent declining trends in grassland bird populations.

**PS2.166 Li, Jianqiang,** (Alabama A&M University, Normal, United States);

#### EXTRA-PAIR PATERNITY IN TWO AEGITHALOS TITS: PATTERNS AND INDICATIONS

The explanation for the variation of extra-pair paternity continues attracting research interest in the area of avian breeding system. Using two sympatric populations of cooperative breeding black-throated tits, *Aegithalos concinnus*, and silver-throated tits, *A. glaucogularis* as a system, we tested whether the pattern of extra-pair paternity level of the two species was consistent to the predictions according to their nesting distance, male incubation attendance and population sex ratio. Results suggest that the two species had low level of extra-pair paternity with 5.7% of the black-throated tit offspring ( $n=383$ ) in 17.2% of the broods ( $n=64$ ) and 6.8% of the silver-throated tit offspring ( $n=412$ ) in 33.3% of the broods ( $n=63$ ) being sired by extra-pair mates. The higher proportion of broods with extra-pair paternity in the silver-throated tits was consistent to the prediction by their male incubation attendance, but not the nesting distance and population sex ratio. We then investigated the pattern of extra-pair paternity in relation to each species' cooperative breeding system and found that a low proportion of cooperative breeding nests contained offspring sired by the helpers (black-throated tit, 8.3% of 12 nests and silver-throated tit, 23.5% of 17 nests). Overall, two main indications might be derived from these results: 1) phylogeny still seems to be the major determinants of the difference of extra-pair paternity level between related species; and 2) the existence of helpers during the breeding of black-throated tits and silver-throated tits is unlikely to be driven by direct reproductive stake.

**SAT9.2 Li, Xinhai,** (Institute of Zoology, Chinese Academy of Sciences, Beijing, China);

#### CLIMATE CHANGE VULNERABILITY OF 63 GALLIFORMES SPECIES IN CHINA

There are 63 Galliformes species occurring in China, including 23 endemic species. Some species are declining, and had been listed in the IUCN Red List, including four endangered (EN) species and 14 vulnerable (VU) species. Galliformes species are mostly sedentary species with high site fidelity and low dispersal ability, so that they might be vulnerable to climate change. We assessed the climate change vulnerability of the 63 species using two models, Random Forest (RF) and Generalized Additive Model (GAM). RF is an efficient machine learning method, suitable for treating many environmental variables and complicated relationships. GAM is good for fitting nonlinear effects, and it is easier for model interpretation. We estimated the current (1991-2010) ranges and predicted the future (2081-2100) ranges of these species using six climate variables based

on Regional Climate Model version 3 (RegCM3) and the A1B emission scenario. The two models were consistent for most species. The results indicated that 29 species (including 13 endemic species) would have range shifts over 50%. Galliformes at higher elevation face greater range shifts. Northward shifts would be more than other directions. In summary, the most vulnerable species mainly occur in the Qinghai-Tibetan Plateau, the Hengduan Ranges, and Southern China. The vulnerable species and their habitats should be specially concerned in the future action plans dealing with climate change.

**T14.3 Lie Dahl, Espen,** (Norwegian Institute for Nature Research, Tiller, Norway); Torgeir, Nygård; Bevanger, Kjetil (Norwegian Institute for Nature Research, Trondheim, Norway); Røskaft, Eivind; Bård Gunnar, Stokke (Norwegian University of Science and Technology, Trondheim, Norway)

#### POPULATION EFFECTS FROM A WIND POWER PLANT ON THE WHITE-TAILED EAGLE (*Haliaeetus albicilla*)

We studied a white-tailed eagle population of ca 50 pairs at the Smøla wind-power plant in coastal Norway before and after a 68-turbine wind power plant was built. During 2005-10, 39 white-tailed eagles were found killed by turbine collisions, more than half of them adults. Population parameters were monitored during the pre- and post-construction periods. Survival rates were calculated using Kaplan-Meier statistics, using survival of GPS tagged individuals for younger age-classes and DNA profiles for adult birds. DNA profiles of adult collision victims were matched against a database of feathers collected at nests from territory-holding birds to verify their origin. Collision mortality lowered the adult survival rates in the study population from 0.955 to 0.93, i.e. it contributed to one third of the total mortality. Juvenile survival was reduced by nine percent during first year of life due to turbine strikes (from 0.92 to 0.83). Older juveniles were not affected. These data, together with reproductive rates, were used to model the white-tailed eagle population in the study area to predict the future viability of the local population. DNA profiles from moulted feathers collected over a six year period also gave new insights into the use, shape and extent of the eagles' territories, and ultimately led to a reduction of the original estimate of the study population size on Smøla by ca 25 %.

**S9.2 Lightfoot, Holly,** (Acadia University, Wolfville, Canada); Thurber, Bethany; Taylor, Philip D. (Acadia University, Wolfville, NS, Canada)

#### PATTERNS OF FALL SONGBIRD MIGRATION AROUND THE BAY OF FUNDY AND GULF OF MAINE

During fall migration, millions of birds migrate south along the Atlantic coast of North America. Previous research suggests that weather and time of night influences migratory intensity and direction, and the nature of these effects varies with location. We examined geographic variation in responses of migrating songbirds at two ecological barriers, the Gulf of Maine and the Bay of Fundy. Migrants in SW Nova Scotia may cross the Gulf of Maine directly, circumvent it by crossing the Bay of Fundy, or partially circumvent it by selecting an intermediate route. Individuals arriving along the north shore of the Bay of Fundy may cross the Bay to SW Nova Scotia, or travel west-southwest along the coast. The proportion of individuals choosing each strategy should depend on weather and time of night. Four modified marine surveillance radars were situated at strategic locations across SW Nova Scotia and around the Bay of Fundy to assess variability in these patterns. Over two years there were

11 nights (4 in 2007; 7 in 2010) where data were collected at multiple sites during moderate to heavy migration from mid-September through early October. We examined how simple metrics of migration (density, orientation, strength of orientation) varied with time of night and weather, and the extent to which the movement patterns described above were represented on different nights. The results show complex variation within and among nights and among locations. First, greater numbers of migrants congregate on the south shore of the Bay of Fundy compared to the numbers observed in SW Nova Scotia. Second, on some nights, large proportions of these migrants head N-NW, crossing from the south side of the Bay of Fundy to the north side. Last, large numbers of migrants move SW along the north shore of the Bay of Fundy rather than crossing the Gulf of Maine. These results suggest that crossing strategy is likely highly individual and may be species specific and illustrates the dynamic and complex nature of migration in this region.

**PS1.148 Lin, Fang-Yee,** (Dept. of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, United States); Lee, Pei-Fen (Institute of Ecology and Evolutionary Biology, National Taiwan University, Taipei, TW, Taiwan); Stauffer, Dean F. (Dept. of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA, United States)

#### ARE FRAGMENTS ALWAYS ISLANDS? INFLUENCE OF HABITAT SPECIALIZATION ON MACROECOLOGICAL PATTERNS OF FOREST BIRDS IN FRAGMENTED LANDSCAPES, TAIWAN

It has been well documented that the effects of area and isolation on organisms in fragmented landscapes are the functions of ecological traits of the species concerned. Understanding how characteristics of organisms influence the macroecological patterns in a given fragmented landscape is critical to promote conservation effectiveness. The aim of this study is to examine the influence of habitat specialization on effects of area and isolation on forest-dependent birds in fragmented lowland-forest landscapes in Taiwan. The species-area relationship (SAR) and the similarity-distance pattern for forest specialists and generalists were evaluated, respectively. Area and pairwise geographic distance of forest islands were estimated in the ArcMap 9.3. Bird data was derived from Breeding Bird Survey Taiwan and species were assigned into forest specialists and generalists by their forest dependency. Pairwise Sørensen similarities of avian community composition were calculated in the R environment.

There was significantly positive SAR for all forest bird species and forest specialists. The z-value, slope of the SAR, of forest specialists was 0.401, even higher than expected from published values for oceanic islands system ( $z=0.25-0.33$ ). Only forest specialists showed significant similarity-distance pattern (Mantel  $r=-0.379$ ,  $p=0.042$ ), that is, the similarity of community composition decreased with increasing the geographic distance. Our results indicated that forest specialists are more susceptible to area and isolation effects than forest generalists in a given fragmented landscape. The forest islands embedded within the non-forest matrix possibly function like real islands for forest specialists because of their unfavourability of the non-forest matrix as well as reluctance to disperse through the hostile matrix. On the contrary, the patch-matrix boundary and the role connectivity play in shaping diversity and community composition for forest generalists are less obvious. Our results suggest that that it is a top priority to protect forest specialist birds for avian biodiversity conservation in fragmented lowland-forest landscapes in Taiwan. Landscape connectivity should be incorporated into the current framework of forestry

management, essentially being primarily focused on maintenance of local forest quality, in Taiwan.

**PS2.14 Lindstrom, John**, (Southern Illinois University, Carbondale, United States); Eichholz, Michael (Southern Illinois University, Carbondale, IL, United States)

#### EFFECT OF COVER TYPE ON BIRD BEHAVIOR DURING SPRING MIGRATION

Wetland habitat quality is often assessed by estimating bird use, assuming greater bird use is indicative of higher habitat quality. Because food availability is thought to be the most limiting factor outside the breeding grounds for most birds, habitats with greater food densities are thought to be of higher quality. However, because bird distribution may be influenced more by factors other than food density, bird distribution may not necessarily be a good indicator of wetland quality. An alternative indicator of wetland quality could be behavior. Foraging theory predicts birds should increase feeding intensity when foraging in habitats with greater food densities. We tested the efficacy of using foraging behavior as an indicator of habitat quality by comparing waterfowl abundance and behavior among 3 habitat types with differing levels of food availability (actively managed moist soil units, naturally occurring wetlands, and inundated agricultural fields). These inundated fields are located near the river, flood regularly, and are primarily planted as a 25% food plot containing Japanese millet and Buckwheat for use by waterfowl. We surveyed each wetland once per week in one of three time intervals (morning, midday, and evening). Dabbling ducks spent 59% of time feeding when averaged across all wetland varieties. Actively managed moist soil units had the highest proportion of time feeding with 61% of all observations, followed by the flooded agricultural fields (57%) and natural swamplands (39%). We suggest bird behavior may be a better assessment of habitat quality for spring migratory avifauna.

**F9.1 Linkhart, Brian**, (Colorado College, Colorado Springs, United States); yanco, scott (clearpath environmental, denver, United States)

#### MIGRATION PATH AND WINTERING AREA OF FLAMMULATED OWLS BREEDING IN COLORADO

The Flammulated Owl (*Otus flammeolus*) breeds in mature, montane forests of western U.S. and Canada, and is thought to migrate a greater distance than any other North American strigiform. While the owl's winter destination is believed to be southern Mexico and Central America, this has never been conclusively demonstrated, as individuals located in these regions during the winter possibly were non-migratory residents. We attempted to determine the winter destination and migratory pathway of Flammulated Owls breeding in central Colorado by equipping males with geolocators in 2009 (n = 7) and 2010 (n = 11). We did not recover any of the geolocators from 2009 on breeding grounds in 2010, but in 2011 we recovered four geolocators, including one from a male who had carried a geocator since 2009. All four males departed from their breeding grounds by the 2nd to 3rd week of October, and required one to two weeks to navigate to wintering grounds in southern Mexico, a distance of approximately 2500 km. While on their wintering grounds, male movements over much of this time appeared to concentrate in relatively localized areas. Males remained on wintering grounds until early April, and returned to breeding grounds by early to mid May. At least one male appeared to follow the Sierra Madre Oriental along the eastern portion of Mexico to and from wintering grounds, and on the migration north he appeared to spend 2-3 weeks in northern New Mexico and southern Colorado before arriving on his

breeding territory. While these data require larger samples from owls throughout the range to more fully understand temporal and spatial patterns of migration, they establish a basis for beginning to understand conservation implications of habitat use along the migration pathway and on wintering grounds.

**PS1.205 Lipshutz, Sara**, (Smithsonian Tropical Research Institute, NA, Panama);

#### HYBRIDIZING JACANAS: A POLYANDROUS PERSPECTIVE

Studies of avian hybridization have demonstrated the importance of sexual selection in heterospecific mating, but evidence thus far has been limited to socially monogamous and polygynous mating systems. Our on-going work confirms hybridization between the closely related, simultaneously polyandrous Northern Jacana (*Jacana spinosa*) and Wattled Jacana (*Jacana jacana*) where their ranges overlap in southwestern Panama (unpubl. data). We characterized a hybrid zone along the Pacific coast of southwestern Panama with coincident phenotypic and genetic (mtDNA) centers. However, the cline width estimated for mtDNA was substantially narrower than the phenotypic cline width (32 vs 130 km). Our finding of limited mitochondrial DNA introgression was surprising given the shallow mtDNA divergence between the two parental species (1.4%), especially as both parental species show no evidence of isolation by distance over hundreds or even thousands of kilometers. We also found evidence for unidirectional introgression of *J. spinosa* mtDNA into the hybrid zone, suggesting heterospecific mating was more common between *J. spinosa* females and *J. jacana* males (or their F1 offspring) than other pairings. We hypothesize that heterospecific intrasexual selection best explains this pattern. In sex-role-reversed jacanas, female competition leads to a mating advantage – namely the ability to defend and maintain a breeding territory and access to mates. Traits relating to aggression, such as body mass, are under strong sexual selection; females are significantly larger than males, and *J. spinosa* females may be up to 15% heavier than *J. jacana* females. Thus, we have begun examining interspecific aggression and mating within three mixed populations in the contact zone to better characterize the role sexual selection plays in the hybridization of these polyandrous species.

**SAT14.9 Lituma, Christopher M.**, (The University of Tennessee, Knoxville, United States); Buehler, David A. (The University of Tennessee, Knoxville, TN, United States)

#### SPATIALLY BALANCED MONITORING FOR PRIORITY GRASSLAND BIRDS IN THE CENTRAL HARDWOODS BCR

Grassland and other early successional birds are declining more than any other avian group in North America. Seven of eleven priority species that occur in the Central Hardwoods Bird Conservation Region (CHBCR) have declined >1.5% per year from 1966-2009. The North American Breeding Bird Survey (BBS) is inadequate for monitoring priority grassland bird populations at scales finer than bird conservation regions for many priority species. As a result, conservation planning is difficult when baseline population metrics cannot be estimated and used to establish conditions to measure progress against. We implemented a spatially-balanced roadside monitoring protocol by randomly locating five 15-km roadside-based routes with 5-min unlimited distance point counts (30 counts/route), along secondary roads within grassland, agricultural, and scrub-shrub cover types in conservation priority counties (n = 37) in the CHBCR from 2008-2011. We also conducted off-road point counts to assess roadside bias. We used Huggins closed capture

module in program MARK with spatial and temporal covariates to model roadside detection probabilities. We used occupancy estimation in program MARK to model off-road detection probabilities and occupancy, and included spatial, temporal, and behavioral covariates. We used detection probabilities to adjust population parameter estimates. The most common species we detected were Northern Bobwhite ( *Colinus virginianus* ) and Field Sparrow ( *Spizella pusilla* ) on >95% of the routes across all years. The least common species we detected were Blue-winged Warbler ( *Vermivora cyanoptera* ) and Bachman's Sparrow ( *Aimophila aestivalis* ) on <15% of the routes. Detection probability of Northern Bobwhite on roadside routes was influenced by observer, time interval, distance from observer, percent woody cover at a point, and relative abundance. Northern Bobwhite site occupancy from off-road surveys was 1, and detection probability during the second visit was 26% greater than the first and third visits (n = 270). This spatially-balanced sampling design allows analyses to be conducted at multiple spatial scales (i.e., point, route, county, state) while accounting for spatial, temporal, and behavioral variables that impact priority species detection probability.

**T10.5 Liu, Irene**, (Duke University, Durham, United States);  
THE ROLE OF MATING SYSTEM IN SPERM  
COMPETITION AND PROTEIN EVOLUTION IN  
AGELAIUS BLACKBIRDS

In species with polyandry (multiple mating by females), sperm from different males compete for access to a female's eggs. Polyandry can intensify selection on male traits such as seminal fluid proteins (Sfps), which help males outcompete other males by achieving fertilization or reducing subsequent mating in females. Though the molecular basis of postmating adaptations has been documented in many species, information is lacking in birds, a taxon known for its sperm competition but studied primarily at the behavioral, morphological and physiological levels. This study investigates the relationship between mating behavior, sperm competition, and Sfp evolution in Agelaius blackbirds to test the hypothesis that Sfps evolve faster in genetically polyandrous species than genetically monogamous species. I am first measuring the intensity of sperm competition in Agelaius by using field sampling and genotyping to determine the frequency of multiple mating. I will then identify reproductive proteins using a combination of transcriptome sequencing of red-winged blackbird reproductive tissue and proteomic sequencing of red-winged blackbird seminal fluid. Finally, I will use codon substitution models to compare selection pressures acting on Sfps in species with different levels of sperm competition. Together, these steps integrate behavioral, genomic and proteomic approaches to examine the role of sexual selection in DNA sequence evolution.

**PS2.176 Liu, Ming**, (Ming Liu, Vermillion, United States);  
Swanson, David (University of South Dakota, Vermillion, SD,  
United States)

PLASMA METABOLITES SUGGEST SIMILAR STOPOVER  
HABITAT QUALITY FOR RIPARIAN CORRIDOR  
WOODLANDS AND ANTHROPOGENIC WOODLOTS IN  
THE NORTHERN PRAIRIE REGION

Riparian corridor woodlands (hereafter corridors) are the principal historical woodland habitat in the Northern Prairie region, but have been greatly reduced and degraded since Euro-American settlement. Simultaneously, anthropogenic woodlots (hereafter woodlots) have appeared and landbird migrants use both habitat types for stopover, but the relative quality of these two types of stopover habitat for migrating landbirds is unknown. We assess relative habitat quality by comparing

plasma triglycerides,  $\beta$ -hydroxybutyrate, and glycerol in migrating birds. We compared plasma metabolites for individual species and for foraging guilds with sample sizes  $\geq 12$  individuals in each habitat type and hypothesized that higher levels of triglycerides and lower levels of  $\beta$ -hydroxybutyrate and glycerol would occur in migrants from high quality stopover sites. We used ANOVA to compare body masses ( $M_b$ ) and ANCOVA (controlling for year, date, time of day, and body size) to test for differences in plasma metabolite levels between habitat types. The only significant difference between habitats for  $M_b$  occurred for fall Yellow-rumped Warblers ( *Setophaga coronata* ), where  $M_b$  was greater in corridors than in woodlots (  $P < 0.001$  ). For plasma metabolites, the only significant between-habitat differences occurred for plasma triglycerides of fall warblers (higher in corridors;  $P = 0.04$ ), and for plasma glycerol of fall vireos (lower in corridors;  $P = 0.048$ ) and Nashville Warblers (lower in corridors; *Oreothlypis ruficapilla*) (  $P = 0.02$  ). The few significant differences and absence of consistent direction of variation in  $M_b$  and plasma metabolites between corridors and woodlots suggests similar stopover habitat quality in these two woodland habitat types. This suggests that anthropogenic woodlots can, at least partially, substitute as stopover habitat for lost and degraded native riparian habitats for landbird migrants during migration through the Northern Prairie Region.

**PS1.150 Lockhart, Jessica**, (University of Manitoba - Natural  
Resources Institute, Winnipeg, Canada); Koper, Nicola  
(University of Manitoba - Natural Resources Institute,  
Winnipeg, MB, Canada)

ASSESSING THE RELATIVE EFFECTS OF HABITAT  
FRAGMENTATION AND HABITAT LOSS ON  
GRASSLAND BIRD COMMUNITIES IN SOUTH WEST  
MANITOBA

In recent decades grassland songbirds have experienced significant declines throughout their North American breeding range. These declines may be linked to the loss and fragmentation of native grassland habitat. Managing the remaining grassland habitat in this region is therefore key to songbird recovery. However, effective management strategies require knowing whether habitat fragmentation or loss is the main causal factor of species decline. While there is strong evidence that the impacts of habitat loss outweigh those of habitat fragmentation there is disagreement in the literature as to whether habitat loss or fragmentation is the primary cause of species decline. This uncertainty arises primarily because most measurements of habitat fragmentation are highly correlated with those of habitat loss. This study attempts to evaluate the relative effects of habitat loss and fragmentation on grassland bird communities in south west Manitoba. Field work was conducted throughout 40 grassland study units. Study units were systematically selected to avoid correlations between habitat amount and fragmentation indices (number of grassland patches, patch size, patch edge, and patch perimeter/area ratio). Avian diversity and abundance were measured between May and June 2012 by conducting fixed radius point counts within each study unit. In August 2012, generalized linear mixed-effect models will be used to model relationships between habitat amount and fragmentation indices on avian diversity/abundance. This study has direct management implications for grassland bird communities in south west Manitoba, as grasslands in this region have both declined and undergone extensive fragmentation overtime.

**T4.2 Lombardo, Michael P.** (Grand Valley State University, Allendale, United States); Spadacene, Lena; Thorpe, Patrick A (Grand Valley State University, Allendale, United States)

#### CHEWING LICE AND TREE SWALLOW BIOLOGY

Birds are commonly infested with feather chewing lice that have the potential to affect the survival and reproductive success of their hosts. We examined the relationship between the damage to wing and tail feathers caused by chewing lice and Tree Swallow biology. We estimated lice-caused feather damage by counting the number of holes chewed by lice in the primary and secondary feathers and tails of Tree Swallows nesting in nest boxes in west Michigan from 1993-2010. We compared the number of louse-chewed holes found in the feathers of four groups of breeding swallows: second-year (SY) females, after-hatching year (AHY) females, after-second year (ASY) females, and males. There were no significant differences between swallows examined early and late in the season in the number of holes we counted in their feathers. ASY-females had significantly fewer holes than did SY-females, AHY-females, and males. This pattern suggests that ASY-females were more resistant to chewing lice than were the other categories of breeding swallows. There were no significant differences between SY- and AHY-females in the number of holes we counted in their feathers. SY- and AHY-females and their mates did not significantly differ in the number of holes. Although ASY-females had significantly fewer holes than did their mates, there was a significant correlation between them in the number of holes suggesting positive assortative mating for resistance to chewing lice within these pairs. This relationship was not found in SY- or AHY-female pairs. Males, but not females, that bred at our study site for four or more years had significantly fewer holes than did those that bred at our study site less often. This result suggests that the number of louse-chewed holes in wings and tails may indicate male Tree Swallow quality.

**PS1.42 Long, Ashley M.**, (Texas A&M University, College Station, United States); Jensen, William E. (Emporia State University, Emporia, KS, United States); Matlack, Raymond S. (West Texas A&M University, Canyon, TX, United States)

#### EFFECTS OF PRESCRIBED BURNING ON AVIAN NEST SURVIVAL IN THE SOUTHERN GREAT PLAINS

Shrubs, such as mesquite (*Prosopis* spp.) and cholla (*Opuntia* spp.), now dominate fire-suppressed grasslands in southwestern North America. Responses of birds to prescribed burning of the shortgrass prairie in this region are poorly understood. We examined daily survival rates of mourning dove (*Zenaidura macroura*) and lark sparrow (*Chondestes grammacus*) nests in an experimental landscape (4,811 ha) of spatially-replicated, inter-annual fire frequencies (burning every 2, 4, or 10 years) near Amarillo, Texas. Herbaceous habitat structure was most developed in infrequently burned plots, but shrub densities were less variable among the burn treatments. We modeled daily nest survival (DSR) against burn frequency, shrub density at nest sites, and nest stage (incubation or nestling). Daily survival of mourning dove nests was not well-related to any measured covariate, but lark sparrow DSR was negatively related to the duration of inter-annual burn frequency. In semiarid grasslands heavily inundated with shrubs, prescribed burning may positively influence the nest success of some bird species.

**PS1.100 LÓPEZ ISLAS, MARÍA EUGENIA**, (ESCUELA NACIONAL DE CIENCIAS BIOLÓGICAS, INSTITUTO POLITÉCNICO NACIONAL, MEXICO D.F., Mexico); GARCÍA CAMACHO, MA TERESA (Centro de Investigación y de estudios avanzados del Instituto Politécnico Nacional,

México D. F., MÉXICO, Canada); FAVARI, LILIANA (Centro de Investigación y de estudios avanzados del Instituto Politécnico Nacional, México D. F., MÉXICO, Mexico); LÓPEZ LÓPEZ, EUGENIA (Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional, MEXICO D.F., Canada)

#### HEPATIC BIOMARKERS TO ASSESS HEALTH CONDITION IN AMERICAN COOTS (FULICA AMERICANA) FROM TWO WETLANDS IN THE BASIN OF MEXICO: TECOCOMULCO, HIDALGO AND XOCHIMILCO, MEXICO CITY

The aim of this study was to analyze the health condition of the American coot (*Fulica americana*) in two Mexican wetlands (Ramsar sites), Xochimilco Lake (X) and Tecocomulco Lake (T), located in the Basin of México. Both wetlands are important for resident and migratory aquatic birds. Early warning biomarkers were assessed in liver: lipid peroxidation (LPO), alkaline phosphatase (AP) and acetylcholinesterase (AChE), as biomarkers of oxidative stress, liver damage and exposure to organophosphorous and carbamates pesticides, respectively. Furthermore, hepatic glycogen was determined as indicator of energy reservoir. We studied the dry (May-June) and wet (July-August) seasons. Seasonal, spatial and sexual differences in biomarker responses were detected. Global mean values of LPO and AP were higher at Tecocomulco compared to Xochimilco. Males from Tecocomulco reached the highest LPO values in both seasons, while females from Tecocomulco had the higher LPO values in May. AP activities in males and females from Tecocomulco were higher in both seasons. AChE activity was similar in both lakes in the dry season, but higher activities were detected in Tecocomulco in the wet season, both in females and males. Global mean values for hepatic glycogen were higher in Tecocomulco in the dry season, contrary to the wet season when higher values were found in Xochimilco. Our results show that both populations of coots are exposed to different stressors that impair the seasonal and spatial early warning biomarker responses. Tecocomulco coots are submitted to major stressors as was evident by the early warning biomarkers responses.

**PS2.140 Lopez-Saut, Edgar**, (Centro de Investigaciones Biologicas del Noroeste A.C., La Paz, Mexico); Rodriguez-Estrella, Ricardo (Centro de Investigaciones Biologicas del Noroeste A.C., La Paz, Mexico); Chavez-Ramirez, Felipe (Gulf Coast Bird Observatory, Lake Jackson, TX, United States)

#### CHARACTERIZATION OF SANDHILL CRANE WINTERING AREAS THROUGH GLMS IN MEXICO

Sandhill cranes are listed as Threatened under Mexican conservation laws. However, little information exists on wintering habitats of cranes in Mexico. We surveyed the wintering areas of Sandhill crane in Mexico during three winter seasons since 2007. Wetlands were surveyed by ground (52) and by air (83) covering the Chihuahuan Desert in the states of Chihuahua, Coahuila, Nuevo Leon, Durango, San Luis Potosi, Zacatecas, and Guanajuato. Generalized Linear Models are useful to assess landscape components important for birds' habitat selection. Sandhill cranes were present in 45% of 74 wetlands. In each wetland we measured the distance to field crops, to urban centers, to highways and roads, and the horizon visual obstruction, shore slope, wetland surface, and crops surface. We generated GLMs to identify the landscape components that influence the Sandhill crane wetland selection. This information is important for managers and conservation plans.



**PS1.18 López-Segoviano, Gabriel**, (Universidad Nacional Autónoma de México, Tlanepantla, Edo. México, Mexico);  
TERRITORIAL BEHAVIOR AND PREFERENCES OF FORAGING MIGRANT HUMMINGBIRD SELASPHORUS RUFUS IN A WINTER SITE

Was established the foraging behavior by the migration hummingbird *Selasphorus rufus* within a migration zone in the southern mountains of Sinaloa, México (Ejido forestal el Palmito Concordia). We tested the hypothesis that the hummingbird *S. rufus* establish territories in flower patches with the highest number of flowers and nectar quality of these flower patches displacing the local and migratory hummingbirds established prior to the arrival. We identify food preferences of the migration hummingbird depending on the different plant species concentration, nectar volume and calories. The catalog behavior of as subdominant for which he was largely displaced from the best floral patches for the altitudinal migratory species like *Amazilia beryllina* and compete for scarce patches with local hummingbird *Hilocharis leucotis* where *S. rufus* loses most of the meetings. It was determined that this hummingbird feeds mainly on plant *Salvia iodantha* (Lamiaceae) and fewer *Cestrum thirsodeum* (Solanaceae). With all the results obtained from the feeding preference of this migration hummingbird we conclude: *S. Rufus* arrives in the region and feed on all available resources primarily from the flowers of the most abundant plant, without discriminating patches with few flowers (100 to 200 flowers) and low calories.

**F10.3 Lorenz, Teresa**, (University of Idaho, Naches, United States); Sullivan, Kimberly (Utah State University, Logan, UT, United States); Amanda, Bakian (University of Utah, Salt Lake City, UT, United States)

LONG-DISTANCE SEED TRANSPORT AND CACHE SITE SELECTION BY CLARK'S NUTCRACKER: INVESTIGATING THE ROLE OF NUTCRACKERS AS ECOSYSTEM ENGINEERS

Clark's nutcrackers (*Nucifraga columbiana*) are considered effective seed dispersers for some species of pines in western North America because of their scatterhoarding behavior. Past studies have used visual observations of nutcracker seed storage behavior to infer nutcracker caching preferences and generally have focused on their interactions with large-seeded, 'bird-dispersed' pines. We used radio telemetry to track autumn seed harvest and storage of whitebark pine (*Pinus albicaulis*), ponderosa pine (*Pinus ponderosa*), and Douglas-fir (*Pseudotsuga menziesii*) seed by Clark's nutcrackers ( $n = 12$ ) in central Washington State, U.S.A., from 2006 through 2009. On a landscape scale, nutcrackers placed most of their caches within their home range core areas (97% of caches) even when seeds were harvested outside of the home range boundary (43% of seeds). This sometimes required nutcrackers to transport seeds long distances between harvest trees and cache sites, and the maximum seed transport distance across all individuals and years was 32.6 km. Average seed dispersal distances were large compared to previously reported distances: 10.5 km for the declining whitebark pine ( $n = 199$  caches), 9.0 km for ponderosa pine ( $n = 450$  caches), and 3.4 km for Douglas-fir ( $n = 16$  caches). Within home ranges, nutcrackers avoided burned forests and selected cliffs and low elevation forests for seed caches (Wilks's  $\lambda = 0.02$ ,  $P = 0.03$ ). On a microsite scale they placed 58% of all caches above ground in trees. For ground caches, the most parsimonious model describing cache-site selection included understory cover and distance to cover (AICc = 420.86,  $w_i = 0.37$ ). Our results suggest that nutcrackers selected sites that may have increased their accessibility to

cached seeds in winter while potentially reducing their predation risk. Additionally, nutcrackers may act as ecosystem engineers by dispersing seeds for a variety of conifer species within our study area, and their long-distance dispersal behavior may enhance genetic mixing for pines.

**T8.5 Loring, Pam**, (University of Rhode Island, Kingston, United States); McWilliams, Scott; Paton, Peter (University of Rhode Island, Kingston, United States); Osenkowski, Jay (Rhode Island Department of Environmental Management, West Kingston, United States); Gilliland, Scott (Environment Canada, Mount Pearl, Canada); Savard, Jean-Pierre (Environment Canada, Québec, Canada)

PHENOLOGY AND HABITAT USE OF BLACK SCOTERS WINTERING IN SOUTHERN NEW ENGLAND - NEW YORK BIGHT IN RELATION TO PROPOSED OFFSHORE WIND FACILITIES

The Southern New England - New York Bight region supports thousands of wintering and staging seaducks and is a priority area for developing offshore wind energy facilities. However, little is known about the phenology and habitat use of Black Scoters (*Melanitta americana*) in this portion of their range. In this regional Black Scoter study, we used satellite telemetry and spatial modeling techniques to: 1) estimate the fall arrival dates, spring departure dates, and average length of stay on wintering grounds; 2) quantify home range size during the winter and staging periods; 3) examine key habitat characteristics associated with core use areas; and 4) assess potential risks associated with developing offshore renewable energy facilities. We analyzed location data from Black Scoters instrumented with satellite transmitters during May 2010 in Baie des Chaleurs, Quebec, Canada ( $n=22$ ) and December 2010 in coastal Rhode Island, USA ( $n=6$ ). Black Scoters instrumented in Canada arrived between 9 October - 22 November 2010 (median date: 27 October 2010) and departed from 3 March - 18 April 2011 (median date: 27 March 2011). The mean length of stay was 4.9 months. During the winter period, Black Scoters held an average of 1.7 core use areas (50% kernel). For birds that held two or more separate core use areas, mean distance between centroids was 108 km. Average ( $\pm$  SE) area (sq. km) of individual core use areas was 312 ( $\pm$  53), while winter ranges (95% kernel) averaged 3,001 ( $\pm$  508). We also present a resource selection function relating winter habitat use by Black Scoters to the following attributes: water depth, distance to shore, benthic substrate classification, wave energy, chlorophyll-a, sea surface temperature, turbidity, and salinity. Determining relationships between movement patterns of Black Scoters and specific marine habitat features will contribute to future management of seaduck populations along the Atlantic coast. We also discuss how resource managers interested in siting wind facilities can use this information to minimize impacts to seaduck populations.

**WI2.6 Loss, Scott**, (Migratory Bird Center, Smithsonian Conservation Biology Institute, National Zoological Park, Washington, United States); Marra, Peter (Migratory Bird Center, Smithsonian Conservation Biology Institute, National Zoological Park, Washington, DC, United States); Blancher, Peter (Environment Canada, Ottawa, ON, Canada); Will, Tom (U.S. Fish and Wildlife Service, Division of Migratory Birds, Bloomington, MN, United States)

THE IMPACT OF FERAL AND FREE-RANGING HOUSE CATS ON BIRDS IN THE UNITED STATES

Direct anthropogenic mortality sources, including collisions with man-made obstacles, poisoning, and cat predation, combine to kill large numbers of North American birds annually, but there is great uncertainty about the magnitude of this mortality and the relative importance of different mortality sources. Previous estimates of annual mortality from cat predation in the U.S. range from hundreds of millions to greater than one billion birds, but no study to date has taken a systematic data-driven approach. We reviewed temperate-zone cat predation studies and defined inclusion criteria to remove studies with methodological limitations that could substantially bias mortality estimates. From the remaining studies, we defined a distribution range of predation rates and incorporated this range in a calculation that included ranges for population sizes of cats, the proportion of house cats allowed outdoors and of outdoor cats that hunt, and a correction factor for imperfect prey detection. Repeated random draws from these distributions produced mortality estimates that range from 250 million to 1.5 billion birds for free-ranging house cats and from 890 million to 2.7 billion birds for feral/semi-feral cats. These estimates are the first to systematically consider results from multiple cat predation studies and are greater than previous U.S. estimates. Major knowledge gaps still exist, and more study is needed to assess variation in predation vulnerability among bird species, age classes, seasons, habitats, and regions, and to estimate U.S. population sizes of feral and semi-feral cats. Greater data availability will allow more rigorous statistical analyses to be conducted, including hierarchical models to quantify mortality, and full-life cycle models to assess population impacts. These approaches can also be used to improve quantification of other sources of direct anthropogenic mortality.

**W12.7 Lounsberry, Zachary,\*** (Kansas State University, Manhattan, United States); Almeida, Juliana (University of Nevada, Reno, United States); Lanctot, Richard (US Fish and Wildlife Service, Anchorage, AK, United States); Sandercock, Brett; Strum, Khara (Kansas State University, Manhattan, United States); Wisely, Samantha (Kansas State University, Manhattan, KS, United States)

**CONSERVATION STATUS OF BUFF-BREASTED SANDPIPERS (TRYNGITES SUBRUFICOLLIS): A CONSERVATION GENETIC APPROACH**

Range-wide estimations of shorebird (Aves: Charadriiformes) populations suggest a sharp decline in census population sizes across a range of taxa, and efforts to accurately assess the conservation status of wild populations are becoming increasingly vital to species management. One shorebird of conservation concern, the Buff-breasted Sandpiper (*Tryngites subruficollis*; hereafter BBSA), is a New World migrant which overwinters in eastern South America and breeds in the High Arctic. To establish an updated conservation status for BBSA, we conducted a molecular survey of samples representing each of three major migratory regions (breeding, stopover, and overwintering sites) using nine polymorphic microsatellite loci and 1.5-kb of highly variable mitochondrial DNA (mtDNA) from two distinct mitochondrial regions (cytochrome b and control region). We analyzed patterns of contemporary population structure, demographic trends, and phylogeographic patterns of genetic structure. Overall, microsatellite and mtDNA analyses revealed that this population of BBSA is admixed on a global scale (mean  $F_{ST} = 0.0051$ ,  $P > 0.05$ ) with  $N_e$  estimates ranging from 2,657 to 16,400 and no signal of a recent genetic bottleneck. Cytochrome b analyses suggested a pattern of haplotype diversity consistent with a historic radiation from a single refugium (Tajima's  $D: -2.27$ ,  $P < 0.01$ ; Fu's  $FS: -30.6$ ,  $P < 0.0001$ ), which we estimated to have occurred between 8,000 -

45,000 years before present. This pattern is common in Arctic breeding shorebirds and is widely considered to coincide with the retreat of the Laurentide Ice Sheet leading to expansion of suitable breeding habitat. When taken together, these results suggest that BBSA should be treated as a single management unit, and conservation efforts for this species should focus on range-wide habitat conservation.

**PS2.237 Lovell, Scott,** (University of Calgary, Calgary, Canada);

**WARBLING VIREOS IN ALBERTA - ONE OR TWO SPECIES? - REVISITED 27 YEARS LATER**

The Eastern Warbling Vireo (*Vireo gilvus gilvus*) and the Western Warbling Vireo (*V. g. swainsoni*) have largely allopatric breeding ranges across north-central North America, but come into contact in central Alberta, Canada. In 1985 Jon Barlow presented preliminary morphological and song evidence suggesting that the Warbling Vireo complex might comprise more than one valid species. However, to date Barlow's suggestion has been supported only by limited DNA evidence, a demonstration of molt differences between the taxa, and anecdotal accounts suggesting differences in morphology, plumage, and ecology. My objectives were to analyze patterns of variation in mtDNA, song, morphology, plumage, and climate niches of the two taxa in Alberta to determine whether they differ sufficiently to warrant recognition as separate biological species, and to infer the level of hybridization that may be occurring in the contact zone. My results indicate that the two taxa of Warbling Vireo are distinct in all of the characters examined. The two taxa come into contact in a very narrow (< 50 km) zone in Barrhead County, northwest of Edmonton, Alberta. They show few signs of extensive hybridization. The distinct differences are maintained in the contact zone, where individuals of the two taxa were found occupying neighboring territories. These results lead me to conclude that the two taxa represent two distinct cryptic species: an eastern form, *Vireo gilvus*, and a western form, *Vireo swainsoni*.

**PS2.239 Low, Kelsey,** (Villanova University, Bryn Mawr, United States);

**CRYPTIC SEXUAL DIMORPHISM IN CAROLINA CHICKADEES (POECILE CAROLINENSIS): IMPLICATIONS FOR HYBRIDIZATION WITH BLACK-CAPPED CHICKADEES (P. ATRICAPILLUS)?**

Achromatic (black, white, and UV) coloration is widespread in animals, and though often invisible to humans, can be important for inter- and intra-species interactions. For example, Black-capped Chickadees (*Poecile atricapillus*) display cryptic, achromatic sexual dimorphism and males with brighter plumage have greater reproductive success. In the hybrid zone between Black-capped and Carolina Chickadees (*P. carolinensis*), females prefer Carolina-like males as extrapair mates. Between May and June 2011, I investigated the possibility that male Carolina Chickadees have an advantage during hybridization caused by brighter average plumage, with the secondary goal of determining whether Carolina Chickadees are sexually dimorphic. I captured 26 Carolina Chickadees and 19 Black-capped Chickadees at two sites bordering the southeastern Pennsylvania hybrid zone, measuring plumage reflectance at five body regions using a spectrometer. Contrary to my predictions, Carolina Chickadees did not have brighter average plumage than Black-capped Chickadees; in fact, Black-capped Chickadees had significantly brighter white cheeks on average. Carolina Chickadees did exhibit sexual dimorphism: males had black bibs with a significantly higher proportion of UV reflectance (UV chroma) than females. Sexual differences in

white cheek reflectance and UV chroma also approached significance. However, contrary to previous studies of Black-capped Chickadees, there was no sexual dimorphism in the contrast between adjacent black and white plumage regions. My findings suggest that while Carolina Chickadees show measurable plumage differences from Black-capped Chickadees, greater average plumage brightness is probably not the reason for their reproductive success in the hybrid zone. However, this is the first evidence of plumage-based sexual dimorphism in Carolina Chickadees, which could be important for future studies of mate choice and sexual selection in this species. If the same pattern of female preference for brighter males seen in Black-capped Chickadees occurs in Carolina Chickadees, then female preference for duller, Carolina-like males in the hybrid zone is all the more mysterious. My study highlights the importance of understanding achromatic plumage reflectance to elucidate cryptic sexual dimorphism and species differences in songbirds.

**PS1.64 Lu, Nan**, (Institute of Zoology, Chinese Academy of Sciences, Beijing, China); Sun, Yue-Hua (Institute of Zoology, Chinese Academy of Sciences, Beijing, China)

**SPECIES-SPECIFIC HABITAT FRAGMENTATION ASSESSMENT, CONSIDERING THE ECOLOGICAL NICHE REQUIREMENTS AND DISPERSAL CAPABILITY**

Habitat fragmentation assessment is quite important for the endangered risk assessing and conservation management for threatened animals. Note that even sympatric species may differ in habitat fragmentation, due to the various ecological niche requirements and dispersal capabilities. We therefore develop an integrated method for assessing the habitat fragmentation that combines habitat suitability with dispersal distance data to assess the patch isolation, within-patch fragmentation and identify the functional habitat fragmentation categories. Specifically, the ecological niche modeling enables us to identify the species-specific suitable areas through connecting the niche requirements and distribution, which indirectly includes the effects of habitat loss and degradation. The integrated fragmentation assessments enable the conservation planners to consider not only the population isolation level in large scale, but also the spatial connectivity within-patch and different fragmentation categories for landscape conservation that would otherwise appear cryptic under more typical habitat suitability or fragmentation assessing approaches. Furthermore, these assessments can also be applied in the quantitatively endangered status ranking.

We applied this method in two sympatric montane Galliform birds in China, Chinese Grouse (*Bonasa sewerzowi*) and Blood Pheasant (*Ithaginis cruentus*) for comparison and illustration purpose. Generally, the suitable areas of Chinese Grouse were predicted to be significantly smaller (82,077 km<sup>2</sup>) than that of Blood Pheasant (250,524 km<sup>2</sup>). The habitat of Chinese Grouse was also more severely fragmented than the Blood Pheasant through both scales of patch isolation and within-patch fragmentation. We therefore suggest that the Chinese Grouse should be even more threatened than previously considered.

**PS2.71 Ludlow, Sarah**, (University of Regina, Regina, Canada); Davis, Stephen (Environment Canada - Canadian Wildlife Service, Regina, SK, Canada); Brigham, Mark (University of Regina, Regina, SK, Canada)

**THE EFFECTS OF OIL AND GAS DEVELOPMENT ON GRASSLAND SONGBIRDS IN SOUTH-EAST ALBERTA**

With an increasing reliance on fossil fuels, oil and gas development has been increasing on the Great Plains and is now

occurring on the remaining large parcels of native grassland. It is unknown what effects, if any, these activities have on the density, survival, and productivity of grassland birds. We investigated the potential impacts of varying levels of disturbance associated with oil and gas activities on grassland songbirds in the dry, mixed-grass prairie of south-east Alberta. Our main objective was to quantify the reproductive success and density of five species of grassland songbirds (Savannah Sparrow, Vesper Sparrow, Baird's Sparrow, Western Meadowlark, and Sprague's Pipit) in relation to: a) distance from oil and gas infrastructure (e.g. wells, roads), b) amount of invasive plant species (e.g. crested wheatgrass), and c) percent overall disturbance. Results varied by species, with several species being negatively affected while others were either positively affected or showed no apparent effect related to disturbance. The variation in responses observed among species is likely due in part to differences in habitat requirements and life history traits (i.e. generalists vs. specialists), as well as variable responses to disturbance among the predator community.

**PS1.68 Ludwig, Eric**, (University Of Delaware, Millsboro, United States); Bowman, Jacob (University Of Delaware, Newark, DE, United States); Eriksen, Robert (National Wild Turkey Federation, Philipsburg, NJ, United States); Dibona, Matt (Delaware Fish and Wildlife, Symrna, DE, United States)

**REPRODUCTIVE ECOLOGY OF EASTERN WILD TURKEY HENS IN AN AGRICULTURAL LANDSCAPE**

The eastern wild turkey (*Meleagris gallopavo silvestris*) was nearly extirpated from the eastern United States and was completely extirpated from Delaware in the late 1800s. The wild turkey is a reintroduction success story with the current population estimated at 4,000 birds in Delaware and nearly 7 million birds nationwide. Recently, however, turkey populations have been decreasing in some eastern states causing concern for biologists. In order to understand the decline of turkey populations and the slow increase in turkey populations in Delaware, we need an understanding of reproductive success in an agricultural landscape. We attached backpack transmitters to 76 hens during 2010-2011, to estimate hen survival, nest success, and poutl survival. Most nesting (80%) occurred in the first week of May with an average clutch size of 8.3±0.6 eggs. We observed 68 nests initiated by 53 adults and 5 juveniles, with 10 reneating attempts. We were able to locate eggs for 33 of the 68 nests which had 125 eggs hatch and 57 eggs destroyed by predators. Nest success was low averaging 24±5% (2010 = 32±9%, 2011 = 19±6%) and poutl survival was greater averaging 43±22% (2010 = 34±17%, 2011 = 52±16%). Hen survival was 57±6% (2010 = 47±1%, 2011 = 70±1%), with fox and owl predation being important mortality causes. Most (66% n = 19) mortalities occurred during the nesting season (15 April-15 June). The two years of survival vary drastically and nest success is very low creating concern for the population and the need for continued monitoring.

**F2.6 Lukacs, Paul**, (University of Montana, Missoula, United States); Kissling, Michelle (US Fish and Wildlife Service, Juneau, AK, United States); Lewis, Stephen (US Fish and Wildlife Service, Juneau, United States); Gende, Scott (National Park Service, Juneau, AK, United States)

**UNSUSTAINABLY LOW BREEDING SEASON SURVIVAL OF KITTLITZ'S MURRELETS IN ICY BAY, ALASKA**

Adult survival is typically the most sensitive demographic parameter for long-lived, species that reproduce slowly. Life history theory suggests the Kittlitz's Murrelet (*Brachyramphus*

brevirostris ) should show high adult survival given they have delayed maturation and only lay one egg per nest. Moreover, the congeneric marbled murrelet ( *B. marmoratus* ) does exhibit high annual adult survival (0.882, Peery et al. 2006). We used a combination of radio-telemetry ( *n* = 164 birds radio-marked and 3,266 relocations) and leg bands ( *n* = 581 banded birds) to estimate breeding season and annual survival of Kittlitz's murrelets in Icy Bay, Alaska from 2007-2011. Radio-telemetry data analyzed in a multi-state mark-recapture framework provided accurate estimates of breeding season survival (60-day survival = 0.89, SE=0.04). Recaptures of leg-banded murrelets provided a less precise estimate of annual apparent survival (0.73, SE = 0.19), largely attributable to low recapture rates (0.04). Breeding season survival was lower than expected for Kittlitz's murrelets; comparable to an entire year's survival of the marbled murrelet. Daily mortality risk during the breeding season was twice that for the remainder of the year. The difference in mortality risk may be even greater if we consider that the annual apparent survival includes both mortality and permanent emigration which negatively biases survival estimates. Our data suggest the breeding season poses a greater risk to murrelets than the nonbreeding season. Relatively low adult survival in Kittlitz's murrelets may be indicative of population-level effects and is consistent with apparent population trends of this species. To further support our results, we tested for acute effects of handling and radio-attachment and found no measurable impact on daily breeding season survival.

**PS1.11 Lukianchuk, Katrina,\*** (University of Windsor, Windsor, Canada); Doucet, Stephanie (University of Windsor, Windsor, ON, Canada)

#### SOCIAL HIERARCHY AND THE DEVELOPMENT OF DANCING ABILITY IN YOUNG LONG-TAILED MANAKINS

In some species, cooperation among individuals is essential to gain access to resources such as food, territories, and even mates. These behaviours can often be explained by kin selection; however, in some species unrelated individuals cooperate for long periods of time without gaining any obvious benefits. In animals that cooperate, there is often a strict dominance hierarchy in place that maintains the balance of interactions between individuals. In complex systems with many social interactions, social learning can play a key role in the development of coordination and mate preferences, and this can influence how young individuals develop their courtship displays. Long-tailed manakins ( *Chiroxiphia linearis* ) have a unique lek-based mating system in which males form long-term partnerships to perform highly coordinated courtship displays for females. They are also thought to have an age-graded linear dominance hierarchy, in which older males are dominant to younger males. Male manakins are often quite long-lived, and little is known about the dynamics among young males. The goals of my research are to characterize the dominance hierarchy in this system, and to determine how young male manakins develop the skills necessary to perform courtship displays. Our results show that older males perform dominant behaviours more frequently than younger males, providing the first evidence for an age-graded linear dominance hierarchy among long-tailed manakins. Our data also show that older males perform complex display components more frequently than younger males, suggesting that display components may develop as they age. This research may enhance our understanding of complex courtship displays as well as the evolution of cooperation among unrelated individuals.

**PS2.171 Lundblad, Carl,** (AZ Cooperative Fish and Wildlife Unit, Tucson, United States); Conway, Courtney (USGS Arizona Cooperative Fish and Wildlife Research Unit, Tucson, AZ, United States)

#### DIFFERENTIAL MIGRATION OF YELLOW-EYED JUNCOS ALONG AN ELEVATIONAL GRADIENT

All efforts to predict adaptation to climate change and species distribution (i.e., niche) models assume that animals will move in response to future climate change. However, we currently know little about the patterns and causes of seasonal movements in most animals. Species exhibiting partial or differential migration patterns provide opportunities to test which factors mediate intraspecific variation in migratory decisions within populations. Yellow-eyed juncos (*Junco phaeonotus*) make facultative short-distance migrations along elevational gradients in the Sky Island mountain ranges of southern Arizona. We color-banded 250 juncos on their breeding grounds at 4 sites spanning the elevational extent of the species' breeding range in the Santa Catalina Mountains of Arizona. We conducted surveys at each site from late September through early February to estimate the proportion of juncos that overwintered at their breeding site at each elevation. Yellow-eyed juncos exhibited differential migration; propensity to migrate to lower elevations varied among sex and age classes. We detected 12.6% of banded AHY males but only 6.9% of banded AHY females ( $t=1.62$ ,  $P=0.063$ ) overwintering at the highest elevation site. At our second-highest site, we detected 5.0% of banded AHY males and only 1.1% of banded AHY females ( $t=1.74$ ,  $P=0.049$ ). At our lowest elevation site, we detected 25.8% of banded AHY males and only 7.8% of banded AHY females ( $t=2.04$ ,  $P=0.028$ ). Across all 4 sites, we detected 10.0% of banded AHY males and 5.7% of banded AHY females ( $t=2.12$ ,  $P=0.024$ ) during winter. We detected only 2% of banded juveniles during winter, compared to 11.9% of banded adults. This difference between AHY and HY age classes reflects a combination of differential survival differential migration. Overall junco abundance at the 4 sites during winter surveys was positively correlated with average temperature and negatively correlated with both snow cover and snow depth. We will also summarize results of a series of experiments designed to test a suite of hypotheses to explain why some juncos move downslope during winter months and others do not.

**W14.4 Lyons, Don,** (Department of Fisheries and Wildlife, Corvallis, United States); Roby, Dan (USGS - Oregon Cooperative Fish and Wildlife Research Unit, Corvallis, OR, United States)

#### COMPARATIVE FORAGING ECOLOGY OF TWO SYMPATRIC PISCIVOROUS WATERBIRDS IN THE COLUMBIA RIVER ESTUARY, USA

We compared the foraging ecology of double-crested cormorants ( *Phalacrocorax auritus* ; ca. 13,000 breeding pairs) and Caspian terns ( *Hydroprogne caspia* ; ca. 9,000 pairs) nesting sympatrically in the Columbia River estuary, USA, during 2000-2011. Consistent with their foraging mode, cormorants displayed somewhat greater diet diversity (pursuit-diving; prey from 16 families consumed) than did terns (plunge-diving; 13 families), although substantial overlap existed in prey types consumed. A few prey types were of primary importance to terns (Salmonidae [juvenile salmon and trout] and Engraulidae [anchovy] made up >50% of prey consumed; Simpson evenness = 0.30-0.41). Cormorants initially consumed a broader diversity of prey types (Simpson evenness = 0.48-0.60) but in later years became heavily reliant on Gasterosteidae (stickleback) and Engraulidae (>60% of prey consumed;

Simpson evenness = 0.15-0.30). Cormorant access to prey throughout the water column supported high productivity (average = 2.0 fledglings/nest/year) and some colony growth during the study period, and appeared to make productivity of cormorants less vulnerable to climate fluctuations and predator impacts than was productivity of terns (annual productivity anomaly for cormorants = -40% to +41%; for terns = -100% to +108%). Given stable nesting habitat conditions during our study period, the cormorant pursuit-diving foraging mode and r-selected life history strategy appeared better suited to exploit the abundant prey resources available in the Columbia River estuary than was the tern plunge-diving and k-selected life history. Terns may be at a comparative advantage during periods of unstable nesting habitat, however, given their high vagility, long lifespan, and lower energy requirements.

**W10.6 Lyons, Jim**, (U.S. Fish and Wildlife Service, Laurel, United States); Green, Adam (Colorado State University, Fort Collins, United States); Runge, Michael (US Geological Survey, Laurel, MD, MD, United States); Laskowski, Harold (US Fish and Wildlife Service-Retired, Easton, MD, United States); Kendall, William (US Geological Survey, Fort Collins, CO, United States); Lor, Socheata (US Fish and Wildlife Service, Denver, CO, United States); Guiteras, Susan (US Fish and Wildlife Service, Smyrna, DE, United States)

#### DETECTION PROBABILITY OF SHOREBIRDS, WATERFOWL, AND WADING BIRDS IN VEGETATED WETLANDS

To assess management performance, wetland managers need accurate measures of change in local bird populations in response to management actions and environmental variation. Conservation and management for wetland birds often rely on count data protocols that do not account for imperfect detection in vegetated wetlands. Using a double-sampling protocol at 21 National Wildlife Refuges in 12 states of the Northeast and Upper Midwest, USA, we estimated detection probability for shorebirds, waterfowl, and wading birds in managed wetlands. Bird surveys were conducted during spring, summer, and fall during three years as part of an ongoing experiment in wetland management. We used Bayesian estimation methods with hierarchical models to evaluate effects of water level manipulations (treatments) on bird use, while accounting for season, wetland bird guild, vegetation height, and random site and year effects. An information-theoretic approach to model selection indicated that detection probability was lowest for shorebirds (often < 40%) and greatest for waterfowl (often > 60%). Detection was highly variable in time and space; we found evidence of treatment-season interactions, and wetland site-year interactions. Our results demonstrate that monitoring programs for wetland birds can employ robust estimates of detection probability and thus provide efficient evaluations of response to management actions.

**PS1.92 Macchia, Erin**, (Arkansas State University, Jonesboro, United States); Bednarz, Jim; Grippo, Rich (Arkansas State University, Jonesboro, AR, United States)

#### DOES SAMPLING UNDERNEATH GUY WIRES UNDERESTIMATE THE LOSS OF BIRDS AT COMMUNICATION TOWERS?

The loss of birds due to collision with communication towers has been widely documented in the scientific literature, and estimates of loss based on recovered bird carcasses are likely conservative due to imperfect detection by tower searchers and the removal of carcasses by scavengers. Until recently, methods of sampling for avian fatalities at these structures was either not

specified or limited to surveys underneath supporting guy wires. We investigated the degree to which sampling underneath guy wires further underestimates the actual number of birds impacted by communication towers. From 2007 to 2008, we sampled randomly-selected towers for avian fatalities by establishing transects separated by 5 m covering a circular area extending 75 m from the base of the tower. Using GIS, we plotted locations of recovered bird carcasses and generated sampling buffers spanning the length of the guy wires from the tower base to the ultimate anchor points. These buffers ranged from 10 to 60 m in width perpendicular to the guy wires. In a mixed model analysis of tall (>150 m), white-lit towers, the proportion of birds recovered differed significantly ( $p = 0.0006$ ) among buffer widths, and no more than 46% of birds would have been located with sampling buffers of 40 m or less. Based on our analyses, we recommend that future monitoring efforts at communication towers implement a circular sampling area that includes areas both under and between supporting guy wires to more accurately assess negative impacts to migrating birds.

**S2.5 Macdonald, Christie A.**, (University of Windsor, Ottawa, Canada); Fraser, Kevin C. (York University, Toronto, ON, Canada); Gilchrist, H. Grant (Environment Canada, Ottawa, ON, Canada); Kyser, T. Kurt (Queen's University, Kingston, ON, Canada); Fox, James W. (British Antarctic Survey, Cambridge, United Kingdom); Love, Oliver P. (University of Windsor, Windsor, ON, Canada)

#### RANGE-WIDE PATTERNS OF MIGRATORY CONNECTIVITY IN AN ARCTIC-BREEDING PASSERINE, THE SNOW BUNTING (PLECTROPHENAX NIVALIS), REVEALED USING BAND RECOVERIES, GEOLOCATORS AND STABLE ISOTOPE ANALYSIS.

Small, migratory passerines pose a challenge for understanding movement as they travel across large geographic distances, have low band recovery rates and are too small to carry most tracking devices. The Snow Bunting (*Plectrophenax nivalis*) is a small, temperate wintering passerine that breeds across the circumpolar arctic. Due to relatively inaccessible breeding areas and highly variable winter movements, we know little about annual range-wide movement patterns and their influence on population dynamics. We tracked individual Snow Buntings from a breeding population at East Bay Island in Nunavut, Canada throughout the entire annual cycle using light-level geolocators. Initial geolocator results indicate that 6 individuals originating from this small breeding site (0.24km<sup>2</sup>), each followed a similar temporal pattern of migratory movements, and yet traveled to distinct wintering sites in Alberta, Saskatchewan, Manitoba (Canada) and North Dakota (U.S.). Individuals occupied these wintering sites for up to 6 months, highlighting the importance of accounting for the annual movement cycle when considering habitat-related threats as potential mechanisms of suspected widespread population decline (est. 64% over 40 years). Combined with available mark-recapture data, these results suggest that Snow Buntings follow a parallel migration pattern in North America, with strong connectivity within eastern and western migratory sub-populations. Our results are the first linking wintering populations of Snow Buntings with breeding populations in the Canadian arctic. Data from further geolocator retrievals expected in 2012 and 2013, and stable-isotope analysis of feathers and claws will yield further insights into connectivity patterns and ultimately inform conservation strategies for this and other arctic-breeding species.

**PS1.24 Macdonald, Christie A.**, (University of Windsor, Ottawa, Canada); Madliger, Christine L. (University of

Windsor, Windsor, ON, Canada); Janssen, Michael. H. (Environment Canada, Ottawa, ON, Canada); Love, Oliver P. (University of Windsor, Windsor, ON, Canada)

#### GEOGRAPHIC VARIATION IN SEX-RATIOS OF WINTERING SNOW BUNTINGS (PLECTROPHENAX NIVALIS).

Geographic variation in sex-ratios, with males wintering farther north than females, has been observed across many temperate wintering birds in North America. Suggested explanations for wintering segregation include sex-associated differences in dominance, physiological tolerance to climate or food availability, and advantages of early arrival to the wintering or breeding grounds. The Snow Bunting (*Plectrophenax nivalis*) is a temperate wintering passerine that is sexually dimorphic in plumage and body size. Males weigh 2.5g more ( $36.86 \pm 2.96\text{g}$  vs.  $34.34 \pm 3.41\text{g}$ ) and have 6mm longer wing chord ( $107.9 \pm 2.55\text{mm}$  vs.  $102 \pm 2.56\text{mm}$ ) than females (mean $\pm$ SD, n=286 and 198 for males and females, respectively). Historic Christmas Bird Count data suggests that this species may be experiencing widespread population declines (64% over 40 years) which has been tentatively attributed to climate change. Recent banding efforts have revealed strong sex-biases at winter banding sites across southern Ontario and Quebec. Using local winter weather data (temperature and snow cover) and sex-ratios from winter banding sites, we examine the effects of geographic location and climate on the geographic variation in sex ratios. We predict that low temperatures and greater snow depth at more northerly latitudes will be associated with a higher percentage of males in wintering flocks caused by sex-associated differences in energy requirements and temperature tolerance. This study represents the first to document this geographic pattern in Snow Buntings, and presents population implications for sex-associated variation in response to changes in local winter climate.

**T5.1 MacDonald, Elizabeth,** (UBC, Vancouver, Canada); Camfield, Alaine (Canadian Wildlife Service, Environment Canada, Gatineau, PQ, Canada); Jankowski, Jill; Martin, Kathy (UBC, Vancouver, BC, Canada)

#### SONGBIRD INCUBATION DILEMMAS IN THE ALPINE: MANAGING PARENT-OFFSPRING TRADEOFFS IN A VARIABLE THERMAL ENVIRONMENT

Small-bodied, single-sex incubating birds must expend energy to create a buffered thermal environment for their eggs, while meeting their own energetic requirements. The resultant trade-off between incubating and foraging is intensified in cold environments like the alpine. Temperature influences incubation behaviour, with variable relationships across species, habitats and populations. We examined incubation rhythms of an alpine population of Horned Larks (*Eremophila alpestris*) in British Columbia in relation to ambient temperature in 4 years with different thermal regimes (2005 = moderate, 2006 = warm, 2010 = cold overnight, 2011 = cold during day), to see if they exhibited variable relationships between attentiveness and temperature. Early in the morning, females need to leave their nest to forage to reduce their energy deficit after over 7 h of night incubation in near freezing conditions. Since temperatures at this time are still less than 5 °C, the embryos are at a high risk of lethal chilling when females leave the nest. From 6 to 8 am, incubating larks reduced attentiveness to 75% from 94% overnight. Additionally, females in 2010 spent more time off the nest as temperatures warmed than in other years. Throughout the study, adults took "extended recesses" (incubation breaks lasting > 60 mins). These recesses were longer and more frequent in 2010 and 2011 and appear to be related to harsh weather events.

Overall, incubating larks favour themselves in difficult times, and lark embryos appear more tolerant to long periods of considerable cooling than previously thought. However, since egg hatch rate dropped to 81% in 2011 from 94% in the other years, there may be an upper limit to this tolerance.

**S8.7 MacGregor-Fors, Ian,** (Instituto de Ecología, A.C., Xalapa, Mexico);

#### URBANIZATION AND EXOTIC INVADERS IN THE TROPICS

Urbanization and its processes pose one of the most dramatic effects on wildlife species worldwide, and commonly substitutes preexistent habitats with contrastingly different novel systems. Due to the changes implied by urbanization, most of which are long-term, urbanization is negatively related to avian species richness, although some studies have found peaks at intermediate levels of urban development. Conversely, total bird abundance peaks in highly developed urban areas, basically comprised by few urban-exploiter species that experience demographic explosions. Despite the fact that local species can become urban-exploiters if they are able to take advantage of the unlimited resources present in cities, exotic species often comprise the majority of urban bird exploiters. Two frequent exotic and invasive urban-exploiter species in North America are the Rock Pigeon (*Columba livia*) and the House Sparrow (*Passer domesticus*). The largest populations of Rock Pigeons in urban Mexico are related to public areas of high human activity, such as churches and plazas, where habitat suitability for native species is low. However, House Sparrows are ubiquitous in most Mexican cities (excluding some Southeastern ones), representing up to 50% of total bird abundance in a city. Recent studies suggest that House Sparrow numbers can be affected by different variables in contrasting urban land-uses, which explains why their physiological condition is not optimal throughout different conditions within a city. Nonetheless, House Sparrows have been related to the loss of one third of the native species at the local level and to lower numbers of other native species from a diverse array of feeding guilds, thereby representing a synergistic negative force together with urbanization and its processes.

**W12.4 Machtans, Craig,** (Environment Canada, Yellowknife, Canada); Wedeles, Chris (ArborVitae Environmental Services Ltd, Georgetown, ON, Canada)

#### HOW MANY BIRDS DIE EVERY YEAR IN CANADA FROM COLLISIONS WITH BUILDINGS?

The number of birds that die every year by hitting windows has never been calculated for Canada, in spite of the increasing public awareness that these deaths may be a conservation concern. Previous extrapolations for the United States have often used a small number of samples from biased locations to come up with numbers in the tens to hundreds of millions of birds killed/year. We reviewed the existing literature and evaluated the potential bias in the existing extrapolations before determining how to use past studies in a Monte Carlo simulation to create a first estimate for Canada. Data availability seems inversely related to the media profile of bird deaths; studies at tall buildings are extremely limited, mid-rise building literature is only slightly better, but a growing body of literature exists for collisions with windows in homes. We are making three estimates, one for each of the aforementioned building classes. Results will be provided in the conference, however it appears likely that >10 million birds die from collisions with houses in Canada, 1 - 4 million die in collisions with mid-rise buildings

and <1 million die from collisions with high-rises. Limitations of our calculations are primarily from detection error for birds dying at houses and a paucity of robust studies for all building classes that is especially acute for high-rises. Our results should be considered cautiously given the quality of underlying data and the assumptions we had to make. Understanding the biological implications of this level of mortality is difficult without better data on how individual species are affected and how that relates to each species' population parameters.

**W5.1 Macias-Duarte, Alberto**, (ROCKY MOUNTAIN BIRD OBSERVATORY, FORT COLLINS, United States); PANJABI, ARVIND (ROCKY MOUNTAIN BIRD OBSERVATORY, FORT COLLINS, CO, United States); LEVANDOSKI, GREGORY (ROCKY MOUNTAIN BIRD OBSERVATORY, FORT COLLINS, United States); POOL, DUANE (ROCKY MOUNTAIN BIRD OBSERVATORY, FORT COLLINS, CO, United States)

#### ABUNDANCE AND DISTRIBUTION OF WINTERING GRASSLAND BIRDS IN CHIHUAHUAN DESERT GRASSLAND PRIORITY CONSERVATION AREAS FROM 2007-2011

Many grassland bird species are undergoing steep population declines due to habitat degradation over much of their breeding ranges. Furthermore, the contribution of the threats during the winter to these documented population declines remains unknown. Therefore, information on bird distribution and abundance is imperative to guide strategic grassland bird conservation on the wintering grounds. We initiated surveys to monitor wintering birds at 468 randomly-selected grassland sites in 7 Chihuahuan Desert Grassland Priority Conservation Areas (GPCA) in 2007, and expanded surveys each year to ultimately include 1,147 sites in 16 GPCAs in 2011. We surveyed birds through 1-km line transects at each site using distance sampling. These surveys generated abundance data for 50 grassland obligate or facultative species, including 29 priority species of high regional or continental conservation interest. We used hierarchical models of distance sampling to estimate parameters of bird density models that account for imperfect detection and random spatio-temporal variation. We used the Bayesian estimation paradigm to obtain model parameters using the program WinBUGS. Winter grassland bird communities throughout the Chihuahuan Desert were highly variable in species abundance and composition between winters. Bird densities may change by orders of magnitude at the GPCA level and bird species may reach their maximum density at different GPCAs between winters. Therefore, we emphasize need to investigate the ultimate processes driving this high variability in winter bird abundance throughout the Chihuahuan Desert, highlighting the role of rainfall on food limitation. The winter avifaunas of Chihuahuan Desert grasslands are characterized by the dominance of a few species including Chestnut-collared Longspur, Lark Bunting, Vesper Sparrow, Horned Lark, Brewer's Sparrow, and Savannah Sparrow. A cluster analysis based on bird species composition shows geographically consistent clusters of GPCAs suggesting a delineation of 6 conservation regions for grassland birds in the Chihuahuan Desert. Biodiversity metrics suggest that Cuchillas de la Zarca in northern Durango, Janos in northwestern Chihuahua, and Malpais in southeastern Durango harbor diverse winter bird communities and require effective protection and management.

**PS2.68 MacKay, Allison**, (Université de Moncton, Moncton, Canada); Villard, Marc-André (Université de Moncton, Moncton, NB, Canada)

#### FORTY YEAR-OLD SPRUCE PLANTATIONS ARE NOT ECOLOGICAL SURROGATES FOR NATURAL CONIFER STANDS FOR SEVERAL DEAD WOOD ASSOCIATED BIRD SPECIES.

Plantation forestry simplifies both stand and landscape structures by replacing floristically complex stands with generally monospecific, single-aged blocks. This results in a reduction in the density of large diameter snags and coarse woody material, which in turn would be expected to negatively affect biodiversity. This study aims to analyse the effectiveness of aging black spruce plantations (> 40 years) to meet the needs of bird species associated with mature and old, naturally-regenerated conifer stands (referred to hereafter as "natural conifer forests"). Our study area, an intensely managed forest district, consists of >35% conifer plantations as well as fragments of natural conifer forest. Using point count data, we found that species assemblages from plantations (n= 67) differed from those of natural conifer forests (n= 42), mainly as a result of the lower abundance of some dead wood associates (e.g. Red-breasted Nuthatch and Winter Wren). We also searched specifically for Black-backed and American Three-toed Woodpeckers (actual detections and foraging signs), two species with high deadwood requirements. Using generalized linear mixed models, we found a positive relationship between the proportion of natural stands within a 700 m radius and the occurrence of Black-backed and American Three-toed Woodpeckers (t=2.044; df=75; p=0.044). However, basal area of spruce snags was not a significant predictor of woodpecker occurrence. Indeed, their basal area did not differ between plantations and natural conifer stands, although large snags (>30 cm dbh) were nonexistent in plantations. These findings suggest that >40-yr old spruce plantations fail to meet the requirements of species most demanding in terms of dead wood.

**SAT16.7 Mackenzie, Stuart**, (Long Point Bird Observatory, Port Rowan, Canada); Calvert, Anna (Bird Studies Canada, Montreal, PQ, Canada); Taylor, Philip (Acadia University, Wolfville, NS, Canada)

#### INITIAL SITE SELECTION INFLUENCES BEHAVIOUR AND LANDSCAPE USE BY A MIGRATORY PASSERINE DURING STOPOVER

Migratory stopover begins with the initial assessment and selection of an adequate site, which may depend on the landscape, weather, or an individual's condition or motivation. Migrants encountered at stopover sites may be seeking sanctuary (short-term cessation of migration before re-initiating migration or moving to more adequate habitat), or stopover (longer term cessation used for adequate rest and refuelling before re-initiating migration). The frequency of these behaviours may vary with characteristics of a particular site. We set out to determine how the stopover behaviour of migratory passerines differs between three sites of varying quality and position on the stopover landscape (low-peninsula, moderate-coastal, high-inland). We tagged 83 black-throated blue warblers (*Dendroica caerulescens*) with digitally encoded radio transmitters during fall 2009, and tracked them using manual searches and an array of five automated radio receivers which sampled an airspace of 20x40 km along the northern shore of Lake Erie, Ontario, Canada. Using multi-state mark recapture models, we estimated the daily probability that individuals would either (i) embark on migratory departure, or (ii) relocate &gt; 1 km from their initial stopover site to elsewhere in the stopover landscape. Landscape-

scale relocations &gt;1 km were made by 44 birds, while 39 remained within 1 km of the capture site. Final migratory departures were identified for 48 birds. Individuals at the inland site had lower daily probabilities of departure ( $0.07 \pm \text{SE } 0.03$ ) than those at the peninsula ( $0.15 \pm 0.06$ ) or coastal site ( $0.12 \pm 0.03$ ), while relocation movements were most common among birds at the peninsula site ( $0.39 \pm 0.08$ , vs.  $0.10 \pm 0.03$  coastal,  $0.16 \pm 0.04$  inland). Daily departure probabilities were higher for migrants that had made a landscape-scale relocation ( $0.24 \pm 0.03$ ) than for migrants that did not make such movements ( $0.11 \pm 0.02$ ). Higher probabilities of departure and movement from the peninsula site suggest that it is used primarily as a short-term sanctuary, whereas the inland site appears to be used primarily for long-term stopover; the coastal site provided adequate habitat for a combination of both. Our results suggest that an individual's stopover behaviour and use of the broader stopover landscape will vary with the characteristics of the site where they initially alight.

**F10.7 MacLean, Sarah, \*U** (Cornell University, Ithaca, United States); Bonter, David (Cornell Lab of Ornithology, Ithaca, NY, United States)

#### REAL DANGER OR CRYING WOLF? AUDITORY AND VISUAL THREAT RECOGNITION IN GULLS

Anti-predator behaviors can provide significant benefits to an organism and its offspring, but are also costly in terms of energy and risk. Identifying information about predators from a variety of sources and responding accordingly to the level of threat is adaptive. To test the ability of birds to recognize and respond appropriately to various predator cues, we experimentally exposed nesting Herring Gulls (*Larus argentatus*) and Great Black-backed Gulls (*L. marinus*) to visual and auditory stimuli representing a range of potential threats and quantified anti-predator behaviors. The gulls responded to the range of threats in a manner commensurate with the level of threat, demonstrating the ability to recognize different cues and assess the risk presented. Gulls essentially ignored the song of a Song Sparrow (*Melospiza melodia*, a non-threatening, familiar stimulus), while the visual presence of a human near the nest elicited the most energy-intensive responses. A recording of a human voice received the most intense reaction among the auditory stimuli, though still less than the visual stimulus. Both species of gulls reacted to heterospecific alarm calls, and both species respond more strongly to the call of the Great Black-backed Gull. Our study demonstrates that gulls identify potential threats using both auditory and visual cues and react with behaviors appropriate to the level of threat.

**SAT8.4 MacPherson, Maggie,** (Tulane University, New Orleans, United States); Morales, Marvin (University of Florida, Gainesville, United States); Jahn, Alex (Aves Internacionales, Gainesville, United States)

#### THE PHYSIOLOGICAL ECOLOGY OF LONG-DISTANCE BIRD MIGRATION: A COMPARATIVE APPROACH CONTRASTING AUSTRAL AND NEARCTIC-NEOTROPICAL MIGRATION

A clear understanding of how long-distance bird migration evolves remains an outstanding question in ornithology. Despite ample research on the proximate and ultimate drivers of migration in north temperate migratory systems, relatively few studies have considered austral migratory systems (i.e., migration of birds that breed in the Southern Hemisphere). A comparison of the life-history strategies (physiological condition and molt strategy) that drive annual energy balance and population dynamics between migratory systems could yield

novel information on the mechanisms driving and regulating bird migration. Suboscine flycatchers (Tyrannidae) constitute the most speciose avian family in the world, within which multiple clades have independently evolved migration. This is exemplified by the 13 species in the genus *Tyrannus* that undertake most described forms of migration (including partial migration). Genus-level comparisons, allow for minimization of confounding factors resulting from divergent evolutionary histories while maintaining a robust ability to compare the plasticity of life history characters (physiology, molt strategy, mating system etc.) associated with a given migratory strategy. We contrast the molt schedule and pre-migratory energetic condition of Fork-tailed Flycatchers (*Tyrannus savanna*), a Neotropical austral migrant (i.e., which migrants wholly within South America) with other *Tyrannus* species, and long-distance migrants from other guilds. We identify patterns in their life-history strategies useful to further test hypotheses on the evolution of avian migratory behavior.

**PS1.226 Madliger, Christine,\*** (University of Windsor, Windsor, Canada); Love, Oliver (University of Windsor, Windsor, ON, Canada)

#### APPLYING STRESS HORMONES TO CONSERVATION: CONSIDERING THE REPEATABILITY OF CORTICOSTERONE LEVELS

Levels of stress hormones (eg. corticosterone - CORT) are increasingly being implemented as conservation biomarkers for monitoring disturbance levels and overall condition in wild populations. However, the applicability of any trait in this regard is dependent on three essential characteristics: i) link to changing environmental conditions; ii) a predictable relationship with fitness; iii) repeatability (consistency over time). The study of stress hormones in response to environmental variability, and more recently their relationship with fitness, has garnered much attention from ecophysiologists. In contrast, the repeatability of stress hormone levels has rarely been considered in any context-specific manner. We investigated the repeatability of baseline CORT in a free-living population of tree swallows (*Tachycineta bicolor*) within and across breeding seasons. In addition, we incorporated a feather-clipping manipulation to examine the influence of changing energetic cost (i.e. environmental quality) on repeatability. We find high repeatability within, but not across, years. However, our results indicate that this high within-season repeatability is dependent on age and energetic constraints, providing evidence for individually-specific plasticity in the response to environmental fluctuations. Our results indicate that individuals differentially respond to the same environmental perturbation, cautioning the interpretation of individual baseline CORT levels as population-level indicators of environmental disturbance.

**S10.2 Madliger, Christine,** (University of Windsor, Windsor, Canada); Love, Oliver (University of Windsor, Windsor, ON, Canada)

#### LINKING INDIVIDUAL VARIATION IN PHYSIOLOGY DURING REPRODUCTION WITH FITNESS

The presence of intra-specific (i.e. inter-individual) variation in physiological traits (eg. glucocorticoids, immune factors, gonadal steroids, and metabolites) is well established. However, the relationship of such variation to organismal fitness is much less clearly understood. Within the larger topic of this symposium, we focus on whether individual variation in physiological traits during the reproductive stage can contribute to individual variation in reproductive performance measures and ultimately fitness. Importantly, the highlighted work illustrates that the pleiotropic nature of physiological traits



makes them excellent candidates for mediating life-history decisions and trade-offs. Using examples from a variety of physiological traits and systems, we stress that information on both inter- and intra-individual variation in physiology during reproduction profoundly increases our understanding of the adaptive role of physiological traits. In particular, studies within three classes of traits are currently contributing the greatest insight into the role of individual variation in physiology during reproduction: i) steroid hormones; ii) immunological indices; iii) energetic physiology. Overall, we conclude that biologically-relevant manipulations of physiological traits, an appreciation of environmental and life-history context, and the monitoring of individuals across time and space are key to progressing the investigation of the evolutionary role of individual variation in physiology. An ever-increasing appreciation of the mechanistic role of inter- and intra-individual variation in physiology will serve to enhance our knowledge of the relationships between performance, behaviour, and fitness in avian systems.

**T14.2 Mahoney, Anika**, (University of Wyoming, Laramie, United States); Chalfoun, Anna (University of Wyoming, Laramie, United States)

#### INDIRECT EFFECTS OF WIND ENERGY DEVELOPMENT ON BREEDING GRASSLAND BIRDS

Industrial-scale wind energy developments are a novel and rapidly increasing form of anthropogenic disturbance. The vast majority of research to date has investigated direct effects of wind energy development on wildlife, such as mortality from turbine strikes, whereas few studies have focused on potential indirect effects. We examined variation in grassland bird nesting success and offspring size along a spatial gradient of 500m within 2 wind farms in Wyoming during 2011. We modeled daily nest survival using logistic regression analysis with AICc model ranking of landscape-scale and nest site-scale predictor variables. The null model ranked highest, though all models were closely weighted and within 2  $\Delta$ AICc units, indicating no overwhelming support for a single model. Daily nest survival rates for the horned lark, our most abundant species, did not vary with proximity to turbines, but the rate was extremely low (89%,  $n = 554$ ). Horned lark nestling mass ( $n = 31$ ), an index of nestling quality, increased with proximity to turbines. McCown's longspur, the second most abundant species at our sites, showed no trend in nestling mass ( $n = 16$ ) in relation to turbine proximity. Our preliminary results show no clear trend across species in avian nesting success with proximity to turbines, however the uniformly low rate of nest success for horned larks may indicate a larger scale is necessary to better describe any potential variation. On-going research includes examining responses of avian density and abundance, continuing reproductive success monitoring and incorporating a longer distance gradient and a turbine density metric. Research illuminating potential impacts and means of mitigating any impacts of wind energy development to avian grassland species is absolutely necessary, particularly in light of the steep rates of population decline grassland birds have experienced throughout North America over the last 40 years.

**PS1.130 Mahony, Nancy**, (Environment Canada, Delta, Canada); Krebs, Elsie (Environment Canada, Delta, BC, Canada)

#### ASSESSING THE UTILITY OF A HABITAT MONITORING SCHEME IN DEVELOPING SPECIES-HABITAT RELATIONSHIPS ALONG BBS ROUTES.

Population trends of many North American birds are determined from the road-side counts of the North American Breeding Bird Survey (BBS). Because BBS does not track habitat trends along

survey routes, any changes in bird counts detected could be true population changes, or be biased by habitat changes along routes. Given the importance of BBS to prioritizing bird conservation, it is critical to understand the dynamics between bird numbers and habitat changes. To assess habitat along BBS routes we used a simple habitat monitoring scheme at 37 BBS routes across British Columbia. We used Canonical Correspondence Analysis to test the utility of the scheme to detect species-habitat associations. We focussed on 16 species from the aerial insectivore guild due to their strong apparent population declines based on BBS. The first two ordination axes explained 60% of the variation in habitat variables expressing the two most important habitat gradients, from forested to open habitats and from deciduous to coniferous vegetation. Six of seven flycatchers were associated with forest with Alder and Least strongly associated with deciduous forest, Olive-sided with mixed forest and Dusky, Pacific-slope and Hammond's with coniferous trees. All swallows and kingbirds were associated with open habitats with Barn Swallows showing the strongest negative relationship with forest. We propose that a simple habitat scheme, if regularly conducted across BBS routes would enable tracking of habitat change, testing hypotheses of habitat-change driven bird trends and assessing the relative rates of habitat change between routes and wider landscapes. The next step is to extend the analysis to other bird groups and use air-photos to assess habitat change over time along each route.

**PS1.1 Maldonado, Erika**, (INSTITUTO DE BIOLOGÍA, UNAM, MEXICO, Mexico); Klicka, John (Barrick Museum of Natural History, Las Vegas, United States); ESCALANTE, PATRICIA (INSTITUTO DE BIOLOGÍA, UNAM, MEXICO, Mexico)

#### PHYLOGEOGRAPHY OF THE BLUE BUNTING, CYANOCOMPSA PARELLINA (AVES: CARDINALIDAE)

Cyanocompsa parellina is a resident passerine bird distributed throughout the lowlands of the Gulf and Pacific slopes of Mexico, reaching Honduras and Nicaragua. Intraspecific variability in Cyanocompsa parellina has been recognized by naming four subspecies. We sequenced 2 molecular markers the first marker was a fragment of the mitochondrial COI gene and the ND2 gene, so in this paper it was used to document the evolutionary history of Cyanocompsa populations. In total, we produced sequence data from 94 individuals. Tissue loans were obtained from three biological collections. Field collecting was also undertaken during 2008-2010, in different states of Mexico. All these samples were processed in the lab. Later we obtained a network for connecting haplotypes and the phylogenetic relationships among the samples were resolved through phylogenetic trees.

The two markers showed a deep separation of *C. p. indigotica* from the Western slope of Mexico to the clade formed by the other three represented subspecies (*beneplocita*, *parellina*, *dearbonii*). Mitochondrial DNA shows that there are enough differences at the genetic level to recognize the two as different species, this is *indigotica* and other forms in *C. parellina*. The genetic difference at the mitochondrial level between the Western and Eastern populations indicates a history of divergence, driven by isolation caused by climatic events that occurred in late Pliocene-early. It would be optional then to consider *Cyanocompsa parellina* as two species instead of one, since they are clearly differentiated and the clear lack of contact between populations indicate that they represent independent evolutionary lineages.

**SAT15.10 Maley, James**, (University of Wyoming, Laramie, United States); Brumfield, Robb (Louisiana State University Museum of Natural Science, Baton Rouge, LA, United States)  
USING MORPHOLOGICAL AND GENETIC CHARACTERS TO INFER SELECTION AGAINST HYBRID CLAPPER AND KING RAILS

Hybridization between Clapper and King rails is frequent in brackish marshes along the coastlines of eastern North America. We measured morphological characters on 99 males collected across the hybrid zone in Louisiana to examine if these characters covaried and were correlated with genotypes from four nuclear markers. We found that King Rails are significantly larger, but when we corrected all characters by dividing by tarsus length all significant differences disappeared except for salt gland weight and bill length. We analyzed tarsus length as a proxy for overall size difference, salt gland weight/tarsus length, and bill length/tarsus length. We fit clines to these characters and found steep transitions that were coincident and concordant with the genetic cline centers and widths. We then calculated the expected covariance between genetic and morphological characters using an estimate of average linkage disequilibrium for four hybrid localities and compared these estimates to infer selection against hybrids. We used our width estimates and to calculate dispersal distance in the hybrid zone and then used the mean dispersal estimate to calculate the time since contact and selection coefficients, as well as the expected widths under a neutral diffusion model. For our four hybrid sites we found six of twelve correlations were significant, and ten of twelve estimates of covariance were greater than the expected covariance, suggesting selection against recombinants for the quantitative characters salt gland weight, bill length, and overall size. Our estimates of dispersal distances within the hybrid zone for genetic characters (0.61 – 3.35 km) and morphological characters (0.57 – 1.92 km) were more than an order of magnitude lower than our only estimate from a banding study (~55 km). These results suggest that while rails are capable of dispersing well across the zone, they do not, and more likely move within preferred habitat.

**PS2.249 Malpass, Jennifer**, (The Ohio State University, Columbus, United States); Rodewald, Amanda (The Ohio State University, Columbus, OH, United States)  
THE INFLUENCE OF ANTHROPOGENIC RESOURCES ON NEST PREDATOR ACTIVITY AND NEST SURVIVAL IN SUBURBAN YARDS

In the face of increasing urbanization, understanding the influence of human development on wildlife in suburban areas is paramount for biological conservation. Human behaviors regarding resource availability in suburban settings can directly or indirectly affect patterns of wildlife diversity, species interactions, and ultimately population viability. Our research investigates how human-mediated changes in food and vegetation resources in suburban neighborhoods influence avian population demography and predator-prey interactions between birds and their nest predators. Working in >150 private yards across seven suburban neighborhoods in Franklin County, Ohio, USA, we examine the extent to which resource levels predict use by birds, activity levels by nest predators, and avian nesting success of two urban-adapted species, American Robin (*Turdus migratorius*) and Northern Cardinal (*Cardinalis cardinalis*). Between April and August 2011, we monitored avian nests (n=238), surveyed predator activity and food availability, measured vegetation characteristics, and deployed miniature video cameras at a subset of nests to document nest predator species. Our data suggest important links between anthropogenic foods,

predator activity, and avian nest survival. Activity of mammalian predators increased with availability of anthropogenic food. Daily nest survival of American Robins was negatively associated with mammalian predator activity, availability of anthropogenic food, and the availability of bird feeders specifically. For Northern Cardinals, however, nest survival rates were not associated with food availability metrics but were negatively associated with activity levels of predators, pooled over both avian and mammalian species. Our continuing analyses will better resolve which factors are the most important determinants of nest survival. Our research will improve the understanding of how resident behaviors about food provisioning and vegetation management affect birds and bird-predator interactions at yard and neighborhood scales. Ultimately, by elucidating how human behaviors influence wildlife in suburban areas, this research will help identify effective strategies to conserve biodiversity in an urbanizing world.

**PS1.115 Mancuso, Kristen**, (Trent University, Peterborough, Canada);  
THE EFFECT OF SELECTION LOGGING ON SAPWELL TREE SELECTION BY THE YELLOW-BELLIED SAPSUCKER IN ALGONQUIN PROVINCIAL PARK

Sapwell tree selection by the yellow-bellied sapsucker (*Sphyrapicus varius*) was studied in logged and unlogged sugar maple (*Acer saccharum*) dominated hardwood stands of Algonquin Provincial Park in 2010 and 2011. Logging treatments included recently cut single tree selection, intensive group selection, and typical group selection and comparisons were made to uncut reference treatments that had not been logged in at least 60 years. Distances sapsuckers travelled from the nest to sapwell trees and the characteristics of sapwell trees were compared between logging treatments. Travel distances were not affected by logging treatment and overall in the reference treatments sapsuckers showed a preference for large trees, trees considered unacceptable growth stock (UGS), sugar maple, trees with old sapwell scars, and to a lesser extent, birch trees. In general, selection for all characteristics was weakened or absent in the logged treatments (with the exception of birch). The main differences between the three logging treatments were the relative amount of UGS trees removed and the potential to recruit intolerant and midtolerant tree species. Based on this, and the selection exhibited by the yellow-bellied sapsuckers, the order of silvicultural treatments which best meet the selection characteristics of yellow-bellied sapsuckers for sapwell trees would be intensive group selection, typical group selection and lastly single tree selection.

**W8.3 Manthey, Joseph**, (University of Kansas, Lawrence, United States); Edwards, Scott (Harvard University, Cambridge, MA, United States); Klicka, John (Marjorie Barrick Museum of Natural History, Las Vegas, NV, United States); Spellman, Garth (Black Hills State University, Spearfish, SD, United States)

ECOLOGICAL SELECTION OR ENVIRONMENTAL DRIFT IN WESTERN NORTH AMERICAN PHYLO-SPECIES?

The Pleistocene glacial cycles left a genetic legacy on taxa throughout the world. A major question in avian diversification is whether species diverged mainly by selection or drift while in refugia. Here, we investigated Mengel's model to determine if avian species of western North America diverged (H0) due to ecological pressures in different refugia or, alternatively, that (H1) species diverged via drift. We used seven intraspecific and four interspecific species that exhibit phylogeographic structure

between a Rocky Mountain and a Pacific (Sierra Nevada and Cascade Mountains) lineage in mitochondrial DNA. Using the two lineages for each taxon group as phylo-species, we created ecological niche models for the present and projected to the past (Last Glacial Maximum, ~21,000 ybp) and subsequently tested for niche conservatism or divergence between lineages. Finally, we created regressions of environmental overlap and genetic divergence. Regression analyses show a significant negative correlation between environmental overlap and genetic distance, supporting H1 (environmental drift). Alternatively, testing for niche conservatism or divergence identified 6 of 11 taxon groups that showed evidence for niche divergence of the Rocky Mountain lineage. The Rocky Mountain lineages in these groups also exhibit greater movement of potential geographic space than their sister Pacific lineages between glacial and interglacial periods, suggesting the Rocky Mountain lineages were continually under changing environmental pressures. These two pieces of evidence support H0 (ecological selection), at least in some taxa. Those species that showed evidence for niche divergence (ecological selection) also showed the most nonsynonymous changes between sister lineages, while showing no pattern in overall genetic distance. This indicates a potential role for selection in the formation of islands of genomic differentiation in response to ecological speciation as a result of the climatic fluctuations of the Pleistocene.

**W5.4 Marín-Togo, María Consuelo**, (Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Mexico); MONTerrubio-Rico, Tiberio C.; Ortega-Rodríguez, Juan Manuel (Universidad Michoacana de San Nicolás de Hidalgo, Morelia, Mexico)  
CONNECTIVITY AND PRIORITY SITES FOR CONSERVING PSITTACIDAE ON THE MEXICAN PACIFIC COAST

In Mexico there are some protected areas with unsuitable representation of biological diversity; which reflect the need to include spatial criteria to help define optimal sites to ensure the protection of biodiversity. We applied the focus of selecting conservation objects, and we use of algorithms, to identify priority sites for conservation, and connectivity between these. Our conservation objects were six species of the Psittacidae family living in the Mexican Pacific slope (*Ara militaris*, *Amazona oratrix*, *Amazona albifrons*, *Amazona finschi*, *Aratinga canicularis* and *Forpus cyanopygius*).

#### Methods

We used the ResNet algorithm to identify priority sites, and we used the module Land Change Modeler in Idrisi software to determine connectivity sites. Later the both results, were overlap with modeling of potential distribution of species (determined with algorithm GARP), and polygons of the current network of protected natural areas, to determine connectivity routes.

#### Results

We obtained 25,642.9 km<sup>2</sup> of priority sites, these sites are within a distance at less 10 km protected natural areas, if they would consider as protected habitat, some species increases until 15% of protected habitat.

Through vegetation remnants larger than 50 km<sup>2</sup> (totaling an area of 133,145 km<sup>2</sup>) was determinate connectivity between priority sites and protected natural areas; showing possibility of connectivity with distances less than 160 km<sup>2</sup> in Michoacan and Sinaloa, on the contrary, Guerrero showed difficulty of connectivity, for lack of habitat, of priority sites and of protected natural areas.

**PS2.167 Marra, Peter**, (Smithsonian Migratory Bird Center, Washington, United States); Haig, Susan (USGS Forest and Rangeland Ecosystem Science Center, Corvallis, OR, United

States); Diggs, Nora (Smithsonian Migratory Bird Center, Washington, DC, United States)

THE MIGRATORY CONNECTIVITY PROJECT - ADVANCING THE SCIENCE OF GLOBAL ANIMAL MOVEMENTS AND CONNECTIVITY BY PROMOTING THE RESEARCH AND CONSERVATION OF SPECIES THROUGHOUT THE ANNUAL CYCLE.

Our understanding of migratory connectivity, the geographic linking of individuals and populations between one life-cycle stage and another, remains one of the greatest barriers to species conservation. For migratory animals, especially birds, their biology has historically been biased toward breeding season research and examined as disjointed seasonal events because, until recently, we lacked the tools to answer the complicated questions regarding seasonal interactions. The Migratory Connectivity Project ([www.migratoryconnectivityproject.org](http://www.migratoryconnectivityproject.org)) is an initiative to conduct and promote comprehensive life cycle analyses for wildlife, pushing forward the science of animal movements by: 1) Advancing the use of current technologies and facilitating development of new technologies to increase the understanding of migratory connectivity. 2) Studying migratory connectivity and seasonal interactions at multiple temporal and spatial scales. 3) Integrating the use of migratory connectivity knowledge (data, models, analyses) to make it available to environmental managers and policy makers for informed decision making. 4) Working among government agencies and with a suite of public and private partners to accomplish these tasks. 5) Educating the public about migratory connectivity and international conservation. MCP activities are key to dealing with environmental challenges as large as climate change or a devastating oil spill, and as small as a housing permit as the study of migratory connectivity is critical to predicting and addressing the spread of zoonotic diseases, bird collisions with aircraft, positioning alternative energy structures and many other human development options. It can mean the difference between saving or losing an endangered species and the areas it occupies throughout its life.

**F15.5 Martin, Michaela**, (Simon Fraser University, Burnaby, Canada); Drake, Anna; Christine, Rock; Green, David (Simon Fraser University, Burnaby, BC, Canada)

LATITUDINAL VARIATION IN LIFE HISTORY TRAITS OF YELLOW WARBLERS

Latitudinal variation in avian life history strategies is well documented. Clutch size and nest success tend to increase with latitude, while metabolic rates, development times, and longevity have been argued to decrease with latitude. We expect species to evolve different strategies to optimize survival and reproduction under different environment conditions. However, there is no clear consensus of the underlying environmental factors that are driving latitudinal life history variation. Further, most studies of high latitude breeders focus on species with relatively narrow distributions, making it difficult to draw comparisons with low latitude populations without confounding factors related to phylogeny. We compare the life history of Yellow Warblers breeding in Inuvik, NT (68°N) at the northern extent of their range, to Revelstoke, BC (50°N) 2000km to the south, and use data from 20 populations spanning 0°N to 68°N to evaluate latitudinal trends in life history traits. Yellow Warblers breeding in Inuvik laid larger clutches and had higher nest success (due to low nest predation rates) which resulted in higher annual productivity compared to their low latitude counterparts. Clutch, size and nest success increased with latitude across all studies. Incubation and nestling periods of Yellow Warblers did not vary between the two sites, and no

latitudinal trends were observed across studies. Adult survival rates were comparable between Inuvik and Revelstoke and were similar to survival estimates derived elsewhere. We observed latitudinal variation in some life history traits, but not a general transition of traits associated with a shift from a slow to fast life history. This indicates that multiple environmental factors may select for variation in life history traits, and that trade-offs amongst traits may be counteracted by the combined influence of multiple environmental factors.

**PS2.56 Martinez, Ari**, (University of Florida, Gainesville, United States);

#### CHARACTERIZING ASSEMBLY RULES IN AMAZONIAN MIXED-SPECIES FLOCKS ACROSS HABITATS

There is a revived interest and an increasing number of studies addressing assembly rules across both plant and animal taxa. Mixed-species bird flocks have received much attention as a potential community module to which assembly rules can be applied. In Amazonian bird communities, mixed-species flocks form socially complex and stable aggregations that exhibit multi-species territoriality. Although they are widespread throughout the Amazon, variation in the composition of flocks presents an opportunity to evaluate the extent to which similar traits explain flock assembly across different habitats. I analyzed trait-based assembly rules in mixed species flocks for both terra firme and inundated forests by incorporating genetic distance, abundance, degree of participation in flocks, and morphology in order to determine 1) the traits that characterize species that flock when compared to species in the available forest species pool and 2) the traits that determine species co-existence among flocking species.

**W1.3 Marzluff, John**, (University of Washington, Seattle, United States); Cross, Donna (University of Washington, Seattle, WA, United States); Miyaoka, Robert (University of Washington, Seattle, United States)

#### BRAIN IMAGING REVEALS NEURONAL CIRCUITRY UNDERLYING THE CROW'S PERCEPTION OF HUMAN FACES

Crows pay close attention to people they encounter and can remember specific faces for several years after a single encounter. In mammals, including humans, faces are evaluated by an integrated neural system involving the sensory cortex, limbic system, and striatum. Because birds and mammals share major sensory and motor circuits, we hypothesized that recognition of humans by crows might involve a distributed set of interactive brain regions. Here we test this hypothesis by providing the first imaging analysis of an awake, wild animal's brain as it performs an adaptive, complex cognitive task. We show that in vivo imaging of crow brain activity during exposure to familiar human faces previously associated with either capture (threatening) or caretaking (caring) activated several brain regions that allow birds to discriminate, associate, and remember visual stimuli, including the rostral hyper-, nido-, and mesopallium, and lateral striatum. Perception of threatening faces activated circuitry including amygdalar, thalamic, and brainstem regions, known in humans and other vertebrates to be related to emotion, motivation, and conditioned fear learning. In contrast, perception of caring faces activated motivation and striatal regions. In our experiments and in nature, when perceiving a threatening face, crows froze and fixed their gaze (decreased blink rate), which was associated with activation of brain regions known in birds to regulate perception, attention, fear, and escape behavior. These findings indicate that, similar to humans, crows use sophisticated visual sensory systems to recognize faces and modulate behavioral responses by

integrating visual information with expectation and emotion. Our approach has wide applicability and potential to improve our understanding of the neural basis for animal behavior.

**PS1.113 Mason, Nicholas\*** (San Diego State University, San Diego, United States); Shultz, Allison (Harvard University, Cambridge, United States); Burns, Kevin (San Diego State University, San Diego, United States)

#### EVOLUTIONARY PATTERNS AND CORRELATES OF AVIAN VOCALIZATIONS IN A CONTINENT-WIDE RADIATION OF SONGBIRDS (THRAUPIDAE).

Avian vocalizations are subject to an impressive host of selective pressures that make bird song a difficult character to study above the species level. Sexual selection, sensory drive, body size, and bill morphology all influence the evolution of avian vocalizations. The study of the interplay of these factors and their effect on song evolution has been encumbered by the lack of an appropriate methodology and a paucity of large-scale, species-level phylogenies. Here, we conducted the largest-scale study on evolutionary patterns and correlates of bird song to date in an attempt to identify general trends among songbirds and more specifically, elucidate how these factors might interact and shape the vocalizations of tanagers.

Habitats that vary in vegetation density effect different levels of degradation and attenuation and thus influence which frequencies are successfully transmitted to their intended audience. We found that species of closed habitats have evolved lower peak and minimum frequencies than those of open habitats, as predicted by the acoustic adaptation hypothesis. Our study is the first to examine acoustic adaptation within a large-scale phylogenetic context. Previous efforts have focused largely on ecological communities of birds in different habitats while ignoring phylogenetic relatedness, or have been restricted to sister species.

The complex songs and elaborate plumage of birds are two of the most celebrated examples of sexually selected traits; however, the relationship between them remains contentious. We examined the interplay of song and plumage elaboration and were the first to do so while using an avian visual model. We found evidence for a negative correlation between song and plumage elaboration that is robust to phylogenetic uncertainty. This correlation is predicted by theory when resources follow a normal distribution and predation limits the overall level of conspicuousness that animals can express while in pursuit of a mate. In conclusion, we found support for acoustic adaptation and transference between song and plumage elaboration in tanagers. Our study is the first to consider how habitat, plumage and morphology influence bird song within the same system and the large scale of this project (roughly 9.25% of songbirds are tanagers) allows us to comment on general trends of acoustic adaptation and the transfer hypothesis in light of the current literature.

**SAT3.2 Masse, Roger J.**, (University of Rhode Island, Kingston, United States); Tefft, Brian C. (Division of Fish and Wildlife, Rhode Island Department of Environmental Management, West Kingston, RI, United States); Amador, Jose A.; McWilliams, Scott R. (University of Rhode Island, Kingston, RI, United States)

#### TESTING THE FORAGING-BENEFIT AND PREDATION-RISK HYPOTHESES TO EXPLAIN SUMMER COMMUTES BY AMERICAN WOODCOCK

Active management to create and maintain young forest and other early successional habitat has been prescribed to conserve declining populations of American Woodcock (*Scolopax*

minor). However, management for woodcock habitat is complicated by the fact that individuals frequently commute between structurally different vegetation types. At dusk during summer, woodcock often move from moist forests, where they spend the day, to forest openings, where they spend the night. Despite investigations into the nocturnal ecology of woodcock, the importance of nocturnal roost site use during summer months remains largely speculative. We tested the foraging-benefit and predation-risk hypotheses to explain these summer commutes. We used telemetry to identify the diurnal coverts and nocturnal roost sites of radio-marked woodcock in southern Rhode Island, USA during 2010 (n = 5) and 2011 (n = 17). At each diurnal covert and nocturnal roost site, we collected earthworms (Lumbricidae) by hand sorting soil samples and quantified nocturnal mammalian predator activity using baited track stations. We compared the density and fresh weight of earthworms between diurnal coverts and nocturnal roost sites using the Wilcoxon signed-rank test. We compared the number of times that nocturnal mammalian predators visited baited track stations during monitoring periods at diurnal coverts and nocturnal roost sites using log-linear regression. During 2010, we always found earthworms at diurnal coverts, but never found earthworms at nocturnal roost sites. During 2011, earthworm density and fresh weight were 3-4 times higher at diurnal coverts compared to nocturnal roost sites ( $P \leq 0.032$ ). At night, mammalian predators were more active at diurnal coverts compared to nocturnal roosts during 2010 ( $P = 0.058$ ) and 2011 ( $P = 0.017$ ). Woodcock commuting from diurnal coverts to nocturnal roost sites during summer moved from areas where earthworms were abundant and mammalian predator activity was high to areas where both food availability and mammalian predator activity were low. Our results provide the first empirical support for the hypothesis that woodcock commuting from diurnal coverts to nocturnal roost sites during summer are afforded protection from mammalian predators. Land managers interested in conserving woodcock populations should maintain high-quality diurnal coverts and nocturnal roost sites so that, during summer, woodcock can eat by day and stay safe by night.

**PS2.210 Mata, Astolfo**, (Instituto Venezolano de Investigaciones Científicas, Caracas, Venezuela, Columbia); Bosque, Carlos (Universidad Simón Bolívar, Caracas, Venezuela, Columbia)

#### NEOTROPICAL MONTANE BIRDS DO NOT HAVE REDUCED ENERGY EXPENDITURE RATES.

Neotropical birds are known to live longer, lay smaller clutches and develop slower than northern-temperate species. This set of attributes places tropical birds at the slow end of a slow-fast life-history continuum. Associated to this “slow pace of life” is the proposition that tropical birds have lower energy turnover rates; in fact, Wiersma and co-workers have demonstrated that tropical birds have reduced Basal Metabolic Rates (BMR), when compared to temperate species. However, the association between low BMR and tropical birds has been postulated while considering lowland birds only; information on Neotropical montane birds is currently lacking. We re-examined the hypothesis that tropical birds have evolved reduced BMR by studying birds of higher elevation in northern Venezuela. We measured nightly rates of oxygen consumption and CO<sub>2</sub> production, of over 45 species of passerines by standard flow-through respirometry (Sable System), while controlling chamber temperature between 30 and 5 or 10°C approximately. Birds were not breeding or molting and were post-absorptive. Our mid-montane forest study site (Yacambú National Park), in the northern end of the Andes, lies at approximately 1250 m asl and has a temperature range of 13 – 25 °C. We expected BMR of

montane birds to be higher than those of lowland species because of the need for higher levels of thermogenesis at higher elevations. In agreement with expectation, we showed by conventional statistics that montane passerines had a significantly and substantially higher rate of metabolism than lowland species when considering body mass. Our results suggest that to better understand the connection between the slow pace of life of tropical birds and their rates of energy expenditure we also need to consider the challenges imposed by the environment on their thermal equilibrium. Montane tropical birds did not have reduced BMR.

**SAT17.11 Mathewson, Heather**, (Texas A&M Institute of Renewable Natural Resources, College Station, United States); McFarland, Tiffany (Texas A&M Institute of Renewable Natural Resources, College Station, TX, United States); Campomizzi, Andy; Farrell, Shannon (Texas A&M Institute of Renewable Natural Resources, College Station, United States); Morrison, Michael (Texas A&M University, College Station, United States); Wilkins, Neal (Texas A&M Institute of Renewable Natural Resources, College Station, United States)

#### VARIATION IN THE RANGE-WIDE DISTRIBUTION, ABUNDANCE AND PRODUCTIVITY OF A HABITAT SPECIALIST SONGBIRD

Habitat associations can vary across a species range yet often this is overlooked for habitat specialists. The breeding range of the federally endangered Golden-cheeked warbler (*Setophaga chrysoparia*) is restricted to oak-juniper woodlands in central Texas. Habitat associations for this species have been defined from studies predominately from the eastern portion of the range. We initiated a range-wide study on relationships between population demographic responses and habitat characteristics to investigate how these associations change across the warbler range. We conducted occupancy and abundance surveys across XX counties and developed broad-scale predictive models based on remotely-sensed vegetation and topographic characteristics. Additionally, we investigated reproductive success on study areas on public and private lands across the range. Across the range, habitat patch size, landscape composition, and relative geographic location predicted occupancy, which, in turn, best predicted abundance. Occupancy and abundance were higher in the southwest corresponding to areas with large, contiguous patches of habitat. We estimated a population size of approximately 200,000 males, an estimate 4 times greater than previously reported. Pairing success was approximately 75% (n = 1,382) across the range and habitat characteristics predicted pairing success to a greater degree than territory fledging success. Plant species composition and associated ecosites predicted pairing success. However, in the northeast pairing success also was determined by public or private land management, likely reflecting effects of patch size and canopy cover. Our research is being used to inform conservation planning for the warbler.

**S1.7 Matthews, Stephen**, (The Ohio State University, Columbus, United States); Iverson, Louis; Prasad, Anantha; Peters, Matthew (Northern Research Station, USDA Forest Service, Delaware, OH, United States); Rodenhouse, Nicholas (Wellesley College, Wellesley, MA, United States)

#### INTEGRATING PATTERN AND PROCESS ACROSS SPATIAL SCALES TO ASSESS THE POTENTIAL EFFECTS OF CLIMATE CHANGE ON FOREST BIRDS

Species distribution models aid in the evaluation of the potential ecological responses of birds to climate change, and they can

assist in the development of management options. However, analyzing ecological impacts by using summaries of coarse-scale models inhibits the ability to explain the structure of these models and how they influence habitat projections. In fact, such models are often treated as “black boxes”, making translation of modeled relationships into ecological associations difficult. We developed tools to better understand how potential habitat changes may affect 147 bird species in the eastern United States based at a coarse-scale (20 x 20 km) using RandomForest methods. Results highlighted the importance of including both climate and tree species variables in the species distribution models, where >60% of the models show more extreme projections of shifts in habitat when only climate variables were used as compared to model containing climate and tree species variables. Here we, also, present how fine-scale (1 x 1 km resolution, as aggregated from 30m National Land Cover Data) landscape composition complements and extends course-scale results. We selected 24 forest bird species from the northeastern U.S. and modeled the spatial agreement between course and fine-scale species patterns to elucidate cross scale differences. Finally, we linked these results to demographic parameters that suggest how species may respond differentially to climate change. By using a multi-layered approach, we were able to quantify to what extent broad-scale climatic and habitat pressures integrate with fine-scale stressors and avian demographic mechanisms, allowing a more comprehensive picture of potential change in the forest bird communities at a coarse spatial scale -- northeastern United States.

**T13.5 Mauck III, William M,** (American Museum of Natural History, New York, United States); Groth, Jeff G; Barrowclough, George F (American Museum of Natural History, New York, NY, United States)

#### PHYLOGEOGRAPHY OF THE RED-SHOULDERED HAWK (BUTEO LINEATUS): A CASE OF MULTIPLE REFUGIA IN THE EASTERN UNITED STATES

The Red-Shouldered Hawk (*Buteo lineatus*) is a relatively sedentary species that is distributed in two allopatric populations within North America; eastern populations (*B. l. lineatus*, *alleni*, *extimus*, and *texasus*) from Minnesota through southern Canada to Nova Scotia and south from Texas through Florida, and western populations (*B. l. elegans*) from Oregon to Baja California. Previous subspecies designations were based on variation in both plumage coloration and body size with gradations between the eastern subspecies. Eastern populations in the north tend to be larger and darker overall, with dark barring on the breast, while southern birds are smaller and generally paler. Western birds are the lightest of any subspecies on the head and back but have a solid bright rufous breast. The clinal variation calls into question the appropriateness of subspecies designation. To understand the evolutionary history, we sampled individuals from populations of all five subspecies and sequenced both mitochondrial and nuclear loci. The haplotype diversity of *B. lineatus* indicates that there is geographic structure among populations. Specifically, that there were three areas of recent refugia; southern Florida, the Gulf Coast, and the west coast. This reflects a similar biogeographic history found in two other avian studies (Barred Owl, *Strix varia* and Carolina Chickadee, *Poecile carolinensis*). This study corroborates the existence of multiple refugia in the Southeastern United States.

**PS2.102 McAuley, Emily,** (Simon Fraser University, Burnaby, Canada);

#### USING STABLE ISOTOPE ANALYSIS TO ASSESS HARLEQUIN DUCK PRODUCTIVITY

Sea duck numbers, including some harlequin duck populations, have been in decline for several decades. Harlequin declines appear to be due to recruitment (number of offspring) being too low to offset mortality. The density of breeding harlequin ducks decreases on streams with high fish diversity (number of fish species). This is likely because aquatic invertebrates increase hiding, decrease drift and switch to nocturnal feeding behaviour in the presence of fish, all of which decrease their availability as food items to harlequins. Thus, introduced fish may be contributing to low harlequin recruitment. Fish presence also alters invertebrate community composition on harlequin breeding streams. For example, the ratio of small to large stonefly nymphs was found to decrease in the presence of fish. These community changes may make it possible to determine the level of fish diversity present in harlequin breeding streams by performing stable isotope analysis on harlequin body tissues. I combined data from two previous breeding harlequin studies to examine the effect of fish diversity on stable isotope ratios of <sup>13</sup>C and <sup>15</sup>N in harlequin blood and eggs. The ratios of <sup>15</sup>N in adult female harlequin duck blood and the eggs (albumen and lipid-free portion of yolk) were significantly and positively correlated with fish diversity. As such, it may be possible to use stable isotope analysis to determine the level of fish diversity in streams on which harlequin adults have bred or juveniles have been raised from blood and feather samples collected on the wintering grounds. By comparing the proportion of adults to the proportion of juveniles breeding or being raised on streams at each level of fish diversity, it will be possible to calculate relative harlequin productivity at each level of fish diversity.

**PS2.175 McCabe, Jennifer,** (University of Maine, Orono, United States); Olsen, Brian (University of Maine, Orono, United States)

#### DEFINING CRITICAL HABITAT FOR MIGRATORY SONGBIRDS IN THE GULF OF MAINE

The processes that govern habitat quality during migration affect individual success and population viability across the annual cycle for many songbird species. The importance of migratory habitat is thus disproportionate to the time it is used, and this pattern is amplified further at migratory bottlenecks, such as coastal habitats along the Gulf of Maine. We are investigating the significance of habitat type, structure, and food availability for migratory songbirds in the Gulf of Maine Flyway. Results from our first field season indicate songbirds utilized habitats containing a shrub component more often than forest or field habitats regardless of position from the mainland. During fall 2011 we conducted a small-scale experiment at two sites to test the effect of food availability and vegetation structure on shrub-habitat use of migratory songbirds. We manipulated shrub structure and food resources within two sites using paired treatment and control plots. Our analysis revealed a simple, additive relationship between bird abundance and both food and shrub density. The effect size of food on bird abundance was slightly greater than shrub density, possibly indicating that food is more important in migratory stopover habitat selection in the region. Results of this study will be critical for management and conservation efforts, especially in the face of habitat alteration from climate change and coastal development.

**SAT2.2 McClain, Douglas,** (Cooperative Wildlife Research Lab, Southern Illinois University Carbondale, Carbondale, United States); Eichholz, Michael (Cooperative Wildlife Research Lab, Southern Illinois University Carbondale, Carbondale, United States)

#### NEST SITE SELECTION OF A CAVITY NESTING SPECIES AS A FUNCTION OF HABITAT QUALITY

Nest site selection among open or cup-nesting birds is thought to have evolved as the result of a trade-off between concealment and visibility. Individuals are thought to choose nest sites that are adequately concealed to avoid egg and chick predation yet provide adequate visibility to allow incubating adults to detect approaching predators. Because it is unlikely cavity nesting species can see approaching predators, cavity nesting species are likely under different selective pressures.

Cavity nesting species may rely on larger-scale landscape variables to choose cavities with a lower risk of predation or higher food availability. We will examine the nest site selection of wood ducks, *Aix sponsa*, a cavity nesting duck species, in the Cache River system of southern Illinois. Anthropogenic disturbances have altered the Cache River by limiting hydrologic flow, thus oxygen availability in the lower half of the river and associated flood plain, likely dramatically decreasing invertebrate productivity in this region. This has resulted in differing habitat quality between the two portions of the river. We will examine nest site selection by placing artificial nest boxes in both upland and wetland habitat throughout both river segments. In this way, we will compare nest box usage between different quality habitats, as well as between upland and wetland habitat. We predict increased occupancy of nest boxes in the Upper Cache, as well as increased usage in boxes located over water in wetland habitat.

**PS2.39 McClintock, Maureen**, (Auburn University, Auburn, United States); Hepp, Gary (Auburn University, Auburn, AL, United States); Kennamer, Robert (SREL, Aiken, SC, United States)

COST OF INCUBATION: USING NEST MICROCLIMATE TO UNDERSTAND TRADEOFFS DURING EARLY SEASON BREEDING IN WOOD DUCKS (*AIX SPONSA*). M.E. MCCLINTOCK, G.R. HEPP, AUBURN UNIV., AUBURN, ALABAMA, USA; R.A. KENNAMER SAVANNAH RIVER ECOLOGY LAB, AIKEN, SOUTH CAROLINA, U

Reproduction is energetically expensive, yet specific costs of incubation have often been overlooked. Wood Ducks (*Aix sponsa*) are abundant in the southeastern U.S. and nest from January to July. Optimal development of embryos occurs within a narrow range of temperatures. Cool incubation temperature can slow embryonic development and influence hatchling phenotype. Incubating hens are challenged to balance their time on the nest while taking foraging recesses to satisfy their own energetic requirements. Nesting early in the season has advantages; however, cold temperatures further challenge incubating hens, increasing energy required to maintain egg temperatures, as well as increasing cooling rates of eggs during feeding recesses. To explore the costs of early-season nesting, we manipulated the microclimate of nests by removing down insulation. We compared females with 0.5 and 4.0 g of down insulation and predicted that the ability of females to change incubation behaviors, and thereby minimize the effects of reduced insulation on thermal properties of eggs would be condition-dependent. Large females with increased nutrient reserves should change incubation behaviors to keep eggs warm while smaller females may show restraint and not increase constancy. Results of tradeoff experiments will be illustrated by changes in incubation behaviors, female body mass, length of the incubation period, hatching success, duckling mass, and duckling body composition. Preliminary results showed that females with reduced insulation took shorter morning recesses and had greater overall incubation constancy than females with

more insulation. We are continuing the study in 2012 and will report these new results.

**SAT17.8 McClung, Maureen**, (Hendrix College, Conway, United States); Smith, Kimberly (University of Arkansas, Fayetteville, AR, United States)

THE RESPONSE OF BREEDING BIRD POPULATIONS TO ICE DAMAGE IN THE OZARK MOUNTAINS, ARKANSAS

Due to the unpredictable nature of severe ice storms, there are relatively few studies that investigate the effects of ice damage on breeding bird populations. In January 2009, an ice storm of great magnitude hit the upland oak-hickory forests of the Ozarks Mountains, where our study sites had been surveyed during the 2008 breeding season as part of another study. We used this opportunity to examine the potential influence of habitat damage from the ice storm by comparing point count data collected one year before and two years after the storm in sites with varying degrees of damage. We estimated species richness of forest bird communities and occupancy for two ground-nesting species: Ovenbird (*Seiurus aurocapillus*) and Black-and-white Warbler (*Mniotilta varia*), and two gap-nesting species: Indigo Bunting (*Passerina cyanea*) and Hooded Warbler (*Setophaga citrina*). Species richness did not differ across years, however population responses varied. The two ground-nesting species, Black-and-white Warblers and Ovenbirds, tended to decline in occupancy in years following the ice storm in severely damaged sites, while Indigo Buntings increased in occupancy in these sites. Hooded Warblers demonstrated no change in occupancy. These results indicate that severe ice storms have the potential to influence certain breeding bird populations in the short-term by creating canopy gaps with substantial woody debris ground cover. However, given the patchiness and size of these gaps, it is unlikely that these effects will be long-lived.

**S5.4 McCormack, John**, (Occidental College, Los Angeles, United States); Harvey, Michael (Louisiana State University, Baton Rouge, LA, United States); Faircloth, Brant (UCLA, Los Angeles, CA, United States); Crawford, Nicholas (Boston University, Boston, MA, United States); Glenn, Travis (University of Georgia, Athens, GA, United States); Brumfield, Robb (Louisiana State University, Baton Rouge, LA, United States)

NEXT-GENERATION PHYLOGENOMICS OF 416 LOCI PROVIDES FURTHER RESOLUTION TO THE AVIAN TREE OF LIFE

We apply a novel phylogenomic approach to elucidate the avian tree of life using sequence capture and next-generation sequencing. Resolving rapid, ancient radiations poses one of the biggest challenges to the field of systematics. The evolutionary relationships among the major bird orders and families have been clouded by their explosive diversification around 65 million years ago. We targeted a novel class of molecular marker anchored by ultraconserved elements (UCEs) in bird genomes. UCEs allow for rapid, efficient collection of hundreds of loci across taxonomically disparate species using sequence capture. Phylogenetic results from 416 UCEs assembled and aligned among 29 members of Neoaves and one outgroup reveal several novel relationships and strengthen support for results from other recent studies. Novel results include a well-resolved backbone composed of three large clades: the 'waterbirds' and 'landbirds' (of previous studies) and a novel group including most of the remaining families of Neoaves. Columbidae was strongly supported as the earliest diverging lineage of Neoaves, indicating an ancient evolutionary history of pigeons and doves.

Increasing resolution with increasing data suggests that a fully resolved bird tree of life is within sight.

**SAT18.3 McCracken, Kevin**, (University of Alaska Fairbanks, Fairbanks, United States); Martin, Tony (British Antarctic Survey, Cambridge, United Kingdom); Wilson, Robert; Winker, Kevin (University of Alaska Fairbanks, Fairbanks, AK, United States); Peters, Jeffrey (Wright State University, Dayton, OH, United States)

### THREE INTRIGUING EXAMPLES OF HYBRIDIZATION BETWEEN TWO COMMON SPECIES OF SOUTH AMERICAN DUCKS

Interspecific hybridization is common in plants and animals, particularly in the waterfowl (Anatidae). One factor shown to contribute to hybridization is restricted mate choice, which can occur when two species occur in sympatry but one is rare. The Hubbs principle, or “desperation hypothesis,” states that under such circumstances the rarer species is more likely to mate with heterospecifics. Here we report three separate examples of interspecific hybridization between two common South American waterfowl species, the Speckled Teal (*Anas flavirostris*) and the Yellow-billed Pintail (*Anas georgica*). Both species coexist in broad sympatry and mixed flocks throughout southern South America, where evidence for hybridization was mostly undetectable. Intriguingly, we discovered that these two species have hybridized on two separate island groups in the South Atlantic. In the first case, we detected an F1 hybrid and offspring in the Falkland Islands, where Speckled Teal outnumber pintails 10:1. In the second case we identified introgressed Speckled Teal alleles in the endemic pintail population on South Georgia Island, where pintails outnumber teal by >100:1. In both cases, rarity of one species coupled with abundance of the other appears to have led to interspecific hybridization. Finally, we report a third case of hybridization between this particular pair of species in which a potentially beneficial beta-globin allele was acquired by Yellow-billed Pintails from Speckled Teal and swept to near fixation in high-altitude regions of the Andes. This latter example demonstrates the potential role of interspecific hybridization in adaptive evolution.

**PS1.26 McCracken, Kevin**, (University of Alaska Fairbanks, Fairbanks, United States); Muñoz-Fuentes, Violeta (Estación Biológica de Doñana-CSIC, Sevilla, Spain); Cortázar Chinarro, María (Uppsala University, Uppsala, Sweden); Lozano, María (Universidad de Los Andes, Bogotá, Columbia)

### MULTILOCUS COALESCENT ANALYSIS REVEALS STEPWISE COLONIZATION OF SOUTH AMERICA BY RUDDY DUCKS DISPERSING FROM NORTH AMERICA, FIRST TO HIGH ALTITUDE IN THE NORTHERN ANDES FOLLOWED BY LOW ALTITUDE IN THE SOUTHERN ANDES

Andean uplift played a key role in Neotropical bird diversification, yet historical dispersal to and from montane habitats is little understood. Here we study dispersal and gene flow in the Ruddy Duck (*Oxyura jamaicensis*), which is distributed from southern Canada to Tierra del Fuego and inhabits Andean wetlands from sea level to 4,500 meters. We sequenced the mtDNA control region, four introns, and three hemoglobin genes and used isolation-with-migration (IM) to study gene flow between North America and South America, and between low- and high-altitude regions in the southern and northern Andes. We conclude that Ruddy Ducks colonized the Andes stepwise, first from North America to high altitude in the

northern Andes followed by secondary dispersal to low altitude in the southern Andes. While no nonsynonymous substitutions were found in either alpha-globin, three derived amino acid substitutions were observed in the beta globin. The first beta-globin substitution (Ser-b69) was acquired when Ruddy Ducks expanded their range from North America to high altitude in the northern Andes, while two additional substitutions at tandem positions (Ser-b13, Ile-b14) were acquired more recently, when Ruddy Ducks dispersed from high altitude in the northern Andes to low altitude in the southern Andes. Stepwise colonization of new habitats coupled with an unusual sequence of amino acid replacements suggests that Ruddy Ducks first adapted to the highlands and then again to the lowlands, colonizing the Andes via a less common route as compared to other waterfowl species that likely colonized the Andes northwards from southern South America.

**F4.3 McDermott, Molly**, (The Ohio State University, Columbus, United States); Rodewald, Amanda (The Ohio State University, Columbus, OH, United States)

### ECOLOGY OF MIXED-SPECIES FLOCKS IN SHADED MONOCULTURES AND SILVOPASTURES IN THE COLOMBIAN ANDES

In the face of continued habitat loss and fragmentation in the Andes, shade agroforestry systems provide habitat for a diverse assemblage of resident and migratory birds. However, shaded crops are being rapidly converted to more structurally simple land uses such as pasture that provide fewer ecosystem services, reduce habitat complexity and thus, support less biodiversity. Reductions in habitat complexity are likely to impact mixed-species flocks, but little is known of the relative value of silvopasture to flocking birds and Neotropical migrants. In Jan-Feb 2011, we recorded species composition, flock size, and individual foraging heights for 146 flocks in the central Andes of Colombia. We sampled shade-coffee, shade-cardamom, and silvopasture (i.e., pasture with remnant trees) at ~1,350-1,700 m elevation. Habitats did not significantly differ in flock size or species richness, although silvopastures tended to support smaller, less diverse flocks. Given that silvopastures supported proportionally fewer migrant species, more generalist residents, and fewer male migrants, our data suggest that silvopastoral systems provide less suitable habitat to flocking birds than other agroforestry systems. Because males tend to be competitively dominant, differences in sex ratios suggest that silvopastures may be less preferred by migrants than other agroforestry habitats. We suspect that lower vegetative complexity in silvopastures may be the driver of patterns in avian use, as complexity was positively associated with flock size and richness, as well as numbers of imperiled migrant species such as Cerulean Warblers (*Setophaga cerulea*). Additional results from 2012 will be presented to better resolve how agroforestry practices differ in habitat quality for Andean forest birds. In addition, the roles of nuclear flock species and predators in impacting Neotropical migrant behavior within flocks will be explored.

**PS2.36 McDonald, M. Victoria**, (University of Central Arkansas, Conway, United States);

### GRASSLAND, SHRUB, AND FOREST EDGE BIRDS POPULATION TRENDS INFLUENCED BY INVASIVE PLANTS

Habitat data on invasive plant species have been taken as a part of an ongoing study of forest, edge, and grassland species that have been studied continuously at the Smithsonian Conservation and Research Center near Front Royal, Virginia. Within suitable and preferred habitat, shifts in habitat occupancy have occurred



due to various phenomena, including natural succession, during the 25 years of the project. During the past 10 years several aggressive invasive plant species have rapidly changed certain sub-areas, but not all, of the 2000 ha study site. Because of the large overall size of the study area, and because of the variable rate of encroachment throughout the study area, it was possible to test the effect of invasives using several non-parametric statistics. The most rapidly advancing plants and also apparently the species of most negative consequence are Tree of Heaven (*Ailanthus altissima* [Mill.] Swingle, [Simaroubaceae]), Mile-A-Minute Weed (*Polygonum perfoliatum* [L.] [Polygonaceae]), and Japanese Stiltgrass (*Microstegium vimineum* [Poaceae]). To a lesser extent, forest bird habitat at this research site has been degraded by the encroachment of Wineberry (*Rubus phoenicolasius* [Maxim] [Rosaceae]), Autumn Olive (*Elaeagnus umbellata*) Thunb. [Elaeagnaceae]), and Japanese Barberry (*Berberis thunbergii* [Berberidaceae]). Two tree species, Black locust (*Robinia pseudoacacia*) and Princess Tree (*Paulownia tomentosa*), considered to be invasive, have indeed increased significantly within the core areas of the birds' habitat, but the encroachment of these plants does not appear to have deterred the expected bird occupancy or their nesting success. Overall, invasive plants encroachment into oak-hickory second-growth forest bird habitat at this north-central Virginia site, and its effect on bird occupancy and nesting success is probably typical of mid-Atlantic piedmont and Appalachian forests.

**S2.6 McFarland, Kent**, (Vermont Center for Ecostudies, Norwich, Canada); Rimmer, Chris (Vermont Center for Ecostudies, Norwich, VT, United States); Aubry, Yves (Canadian Wildlife Service, Quebec Region, Environment Canada, Ste-Foy, PQ, Canada); Whittam, Becky (Canadian Wildlife Service Environment Canada, Sackville, NB, Canada); Stewart, Becky; Campbell, Greg (Bird Studies Canada, Sackville, NB, Canada); Renfrew, Roslind (Vermont Center for Ecostudies, Norwich, VT, United States)

**MIGRATORY MOVEMENTS AND WINTER DISTRIBUTION OF BICKNELL'S THRUSH (CATHARUS BICKNELLI): GAINING INSIGHTS FROM GEOLOCATORS**  
 Bicknell's Thrush, considered one of the Nearctic-Neotropical migrants highest continental conservation concern, is classified as globally "vulnerable" by the International Union for the Conservation of Nature. At both ends of its range, it occupies a limited, highly fragmented distribution and faces multiple habitat threats. Marshall (2001) postulated that loss of breeding populations at several sites in Nova Scotia was directly related to extensive deforestation of wintering habitat in Haiti, implying strong population connectivity. Overall, documented population declines in Canada and New Hampshire, combined with severe and ongoing habitat loss on Hispaniola, have heightened concern about the conservation status of Bicknell's Thrush. We deployed Mk10S light level geolocators from the British Antarctic Survey on 139 thrushes in 2009 and 2010. Only 17 were recovered. The data showed extreme shading for much of the year, indicating that individuals are often under heavy forest canopy cover during daily sun transitions. Analysis of the scant specimen and banding data indicated that fall migrants tend to pass from coastal Virginia and North Carolina across open waters and through the eastern Bahamas to the wintering grounds, while spring migration appears to be through eastern Florida and northward to the breeding grounds. Data from geolocators confirms this annual elliptical pathway. Winter longitude locations suggested most birds were found on Hispaniola. With heavy shading in winter, we recommend deployment of geolocators on winter grounds to discover

connectivity with breeding grounds where birds are often found in the canopy during sun transitions.

**F14.12 McFarland, Tiffany**, (Institute of Renewable Natural Resources, Texas A&M University, College Station, United States); Mathewson, Heather (Institute of Renewable Natural Resources, Texas A&M University, College Station, United States); Morrison, Michael (Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, United States); Wilkins, Neal (Institute of Renewable Natural Resources, Texas A&M University, College Station, United States); Conkling, Tara (Department of Wildlife, Fisheries and Aquaculture, Starkville, United States)

**RANGE-WIDE VARIATION IN BLACK-CAPPED VIREO BREEDING ECOLOGY: IMPLICATIONS FOR CONSERVATION AND MANAGEMENT**

Management designed to conserve at-risk species is often based on data from only a few well-studied locations, especially when the range is primarily private lands. However, these practices may be insufficient for conservation when applied range-wide. The black-capped vireo (*Vireo atricapilla*) is a neotropical migrant with a breeding range predominately within Texas and was listed as federally endangered in 1987. Most of the current standards concerning vireo habitat requirements are based primarily on data from three locations. As part of an ongoing range-wide study, we used a combination of presence/absence surveys across the range and focused efforts to monitor territories within 5 study locations to demonstrate the variation in habitat and predator assemblages. We surveyed for vireo at over 10,700 points in 57 counties in Texas. We found that vireo occupancy correlated with several remote-sensing metrics, particularly soil type, which changed along a gradient from west to east with aridity. Additionally, we found that previously accepted habitat requirements, such as the amount of canopy cover, do not apply range-wide. We also found evidence that the perceived role of Ashe juniper (*Juniperus asheii*) in vireo habitat may be erroneous, and the current standard of juniper eradication may not be beneficial in much of the range. Predator assemblages were more diverse in the west, and we identified previously unknown predators. Thus, vireo management should vary by location, as current practices may not apply range-wide.

**PS2.79 McGowan, Conor**, (U.S. Geological Survey, Auburn, United States); Michelle, Klopfer (Virginia Tech University, Blacksburg, VA, United States); Spear, Braddock (Atlantic State Marine Fisheries Commission, Alexandria, VA, United States); David, Smith (U.S. Geological Survey, Kearneysville, WV, United States); Nichols, James (U.S. Geological Survey, Laurel, MD, United States); Lyons, Jim (U.S. Fish and Wildlife Service, Laurel, MD, United States); Sweka, John (U.S. Fish and Wildlife Service, Lamar, PA, United States); Kevin, Kalasz (Delaware Division of Fish and Wildlife, Smyrna, DE, United States); Niles, Lawrence (Conser Wildlife Foundation, Greenwich, NJ, United States); Brust, Jeffery (New Jersey Department of Environmental Protection, Port Republic, NJ, United States); Richard, Wong (Delaware Division of Fish and Wildlife, Dover, DE, United States)

**INTEGRATING MIGRATORY SHOREBIRD CONSERVATION NEEDS INTO AN INDUSTRIAL FISHERIES MANAGEMENT PLAN IN THE DELAWARE BAY**

Population viability of Red Knots, a medium sized long distance migratory shorebird, has been linked to stopover conditions and food availability in the Delaware Bay. The birds, traveling far as far south as Tierra del Fuego in Argentina to the arctic regions of Canada for breeding, stop in Delaware Bay and rely heavily on Horseshoe Crab eggs as a food source during their approximately two week stopover. Recent unregulated harvest of horseshoe crabs for use as bait in other fisheries may have contributed to steep population declines of red knots, and effective management of crab harvest requires explicit integration of red knots into fishery objectives and predictive management models. We present objective functions with both horseshoe crab harvest objectives and red knot population objectives, and use two species, two sex population models, directly linking red knot survival (as supported by multistate mark recapture analyses) to the number of female horseshoe crabs that spawn during or before stopover. Simulation results indicated that horseshoe crab harvest may affect red knot population viability and that constraining harvest by some red knot abundance threshold had the capacity to conserve red knots while enabling some resource extraction. Simulations also indicated that even with high survival rates, past harvest may have contributed to red knot population decline. Optimization analyses using a set of possible harvest actions and the two species objective function allows for some harvest while conserving important red knot food resources.

**PS2.4 McGowan, Kevin,** (Cornell Lab of Ornithology, Ithaca, United States);

#### EVERYBODY POOPS: A REVIEW OF DEFECACTION BEHAVIOR IN BIRDS

Defecation is a fact of life for all animals. Although some nestling defecation postures have been described, little has been written about defecation behavior in adult birds. Defecating without soiling feathers can be a challenge, and a variety of defecation strategies are employed by birds. Factors influencing the technique used include phylogeny, environment, diet, and foraging method. Defecation posture and behavior within a single species can vary because of age, activity, perching substrate, and social context.

**PS1.55 McGuire, Sarah,** (Trent University, Peterborough, Canada); Nocera, Joe (Ontario Ministry of Natural Resources, Peterborough, ON, Canada)

#### INTERSPECIFIC COMPETITION SHAPES GRASSLAND BIRD COMMUNITIES IN SOUTHERN ONTARIO AGRO-ECOSYSTEMS.

Loss of historical prairie habitat has forced many grassland birds in North America to adopt agricultural fields as surrogate habitat in which they have been experiencing rapid population declines. Agro-ecosystems vary widely in both their production systems and wildlife habitat quality, and the ramifications of this variation on grassland bird communities have been little studied. We examined community structure of breeding grassland birds within agro-ecosystems in southern Ontario, Canada by conducting point counts in four habitat types: non-intensive agriculture, intensive agriculture, cultural meadows, and natural grasslands. We used null-model analysis to detect patterns of co-occurrence among 48 species and calculated C-scores for each species pair, with a high C-score indicating increased competition. Our results suggest that interspecific competition is an important factor shaping grassland bird communities, and that competition is generally strongest in non-intensive agriculture (primarily hayfields and pastures), likely because this type of agricultural habitat is of higher quality than the other types. Species pairs involving Grasshopper Sparrows and Field

Sparrows often yielded unexpectedly high C-scores (e.g.,  $C = 75$  between Grasshopper Sparrows and Red-winged Blackbirds). Surprisingly, some of the strongest competition involving Grasshopper Sparrows was observed in intensive agriculture (e.g., when paired with Savannah Sparrow,  $C = 50$ ), a habitat type we predicted to be quite low in quality. We have identified the interactions among six species with notably high C-scores in non-intensive agriculture and intensive agriculture as the focus of our future work to test the mechanisms behind these competitive interactions in the field.

**SAT11.9 McKay, Bailey,** (American Museum of Natural History, New York, United States);

#### USING DIGITAL PHOTOGRAPHY TO INVESTIGATE PLUMAGE COLORATION

Color has long featured prominently in avian systematics. Traditionally, systematic studies have tended to use necessarily subjective human comparisons to assess color variation. For example, the use of arbitrary categorical rankings (bright vs dull) or by matching perceived color to color standards. Results from these techniques suffer from inter- and intra-observer reliability, effects of neighboring color patches on perception, and the fact that humans cannot perceive all of the colors featured in avian plumage (e.g. ultraviolet). Spectrophotometers are widely used for the objective assessment of plumage coloration. However, spectrophotometers only measure color across a very small area, making them inadequate for measuring large plumage patches, assessing the topographical relationships among multiple patches, or quantifying heterogeneous patches (e.g. spotting, barring, etc.). These limitations might explain why spectrophotometers are not widely used in fields such as systematics. Digital photography is an alternative to spectrophotometry that can provide objective measurements of color while preserving the topographical relationships of plumage patches. I will describe a method that uses digital photography to produce accurate measurements of bird plumage coloration. This method combines visual images with ultraviolet images to obtain photon catch data in four channels (red, green, blue, and ultraviolet). I will show that with even lighting and proper calibration to known reflectance standards, accurate measurements of color can be quickly and easily obtained from entire avian specimens. I will discuss the potential applications of this method, especially concerning its use in avian systematics. I will also demonstrate how these measurements can be mapped into a tetrahedral colorspace defined by the spectral sensitivities of avian cones.

**PS2.134 McKay, Kelly,** (BioEco Research and Monitoring Center, Hampton, United States); Monson, Cathleen (BioEco Research and Monitoring Center, Reynolds, IL, United States); Bryant, Robert (BioEco Research and Monitoring Center, Davenport, IN, United States); Ritter, Brian (Eastern Iowa Community College, Davenport, IA, United States); Blevins, Brian (BioEco Research and Monitoring Center, Davenport, IA, United States); Rothe, Jennifer (BioEco Research and Monitoring Center, Oshkosh, WI, United States); Bolinger, Marc (BioEco Research and Monitoring Center, Moline, IL, United States); Schmitz, Ryan (BioEco Research and Monitoring Center, Cassville, WI, United States); Monson, Jason (BioEco Research and Monitoring Center, Reynolds, IN, United States)

#### SUMMARY AND RESULTS OF THE MILAN BOTTOMS BALD EAGLE NIGHT ROOST SURVEY PROJECT

Human development and activities continue to increase and encroach on the floodplain habitats of the Upper Mississippi River. For example, economic development is occurring immediately adjacent to the Milan Bottoms Complex in Rock Island County, Illinois. Evidence suggests that this area functions as a major night roost location for wintering Bald eagles (*Haliaeetus leucocephalus*). Therefore we conducted a standardized night roost survey here during three consecutive winters (2005-2008), in order to document the importance of this site to wintering eagles. Each week, one evening and one morning survey were carried out from early December through late March (17 weeks). In 2005-2006, a total of 10,386 observations were recorded of eagles entering or exiting the night roost. Of these, 32% were adults, 36% were immatures, and 32% were unaged. In contrast, only 2,553 eagle observations were reported in 2006-2007, including 44% adults, 32% immatures, and 24% unaged. Eagle numbers increased in 2007-2008 to 6,957 observations. Among these, 39% were adults, 27% were immatures, and the remaining 34% were unaged. During the first three years of this project, the majority of night roosting eagle observations occurred in December and January, with steadily decreasing numbers in February and March, respectively. The upstream end of Milan Bottoms (i.e. the widest track of floodplain forest habitat appears to be the most heavily utilized portion of the study area for night roosting purposes.

**W7.6 McKellar, Ann,\*** (Queen's University, Kingston, Canada); Marra, Peter (Smithsonian Migratory Bird Center, Washington, DC, United States); Ratcliffe, Laurene (Queen's University, Kingston, ON, Canada)

#### EXPERIMENTALLY DELAYING ARRIVAL TIMING REDUCES REPRODUCTIVE SUCCESS OF MALE AMERICAN REDSTARTS

Early-arriving and breeding birds often have higher reproductive success than late individuals, either as a consequence of timing-specific advantages (the timing hypothesis) or because these individuals and/or their resources are of higher quality (the quality hypothesis). In this study, we assessed the relative roles of several factors under the timing and quality hypotheses by experimentally delaying arrival date in male American redstarts (*Setophaga ruticilla*), a species for which early male arrival is known to be strongly related to increased reproductive success. Our manipulation involved the removal and release of early-arriving males following pairing and territory establishment, simulating an arrival date approximately 12 days after their initial arrival and resulting in the loss of their initial mate and/or territory. Manipulated males did not experience any decrease in body condition, nor did their reproductive behavior differ from that of early-arriving control males. We found that naturally early-arriving but experimentally delayed males suffered reduced reproductive success in comparison to both early-arriving and late-breeding males, but equivalent success in comparison to late-arriving males. Our results indicate that neither individual male quality nor absolute arrival timing alone can explain the relationship between early arrival and higher reproductive success in this species, suggesting that some other aspect of resource quality is likely important. We discuss and present evidence for two alternative explanations under the quality hypothesis: female quality and territory quality. Our study is the first to investigate the effects of experimentally manipulating male arrival date, strengthening previous correlational evidence for resource quality as a potentially important selective agent driving early arrival in migratory birds.

**F2.1 McKim-Louder, Matt,\*** (University of Illinois at Urbana-Champaign, Champaign, United States); Jeffrey, Hoover; Benson, Thomas; Schelsky, Wendy (Illinois Natural History Survey, Champaign, United States)

#### FIRST-YEAR SURVIVAL IN A NEOTROPICAL MIGRATORY PASSERINE IS LOWER THAN EXPECTED

For birds, survival between fledging and the first reproductive attempt (first-year survival) is one of the most influential demographic parameters contributing to population growth. However, reliable estimates of first-year survival rates for migratory passerines are exceedingly rare. In lieu of reliable estimates of first-year survival, population modelers have used values thought to represent adequate population-level replacement rates, such as one-half of adult survival (adult survival  $\sim 0.60$ ; first-year survival  $\sim 0.30$ ). However, in most mark-recapture studies of migratory passerines, less than 5% of individuals marked prior to fledging are relocated in a subsequent year. Whether this lower than expected return rate is the result of dispersal or mortality remains unresolved. Here we used a nest box study of Prothonotary Warblers (*Protonotaria citrea*) in southern Illinois to estimate a first-year survival rate while accounting for biases related to dispersal that are common in mark-recapture studies. The distribution of natal dispersal distances (median = 1420 m;  $n = 429$ ) in conjunction with a systematic survey for birds returning outside the nest box study sites (up to 30 km in all directions) within a majority (81%) of total available habitat, supported the pattern of short-distance natal dispersal. Using multistate mark-recapture modeling, we incorporated natal dispersal distance to account for the potential confounding effects of dispersal on recapture probabilities for warblers that fledged during 2004-2009 ( $n = 6093$ ). Despite our attempts to locate birds outside of the study system and account for variation in recapture probabilities with dispersal distance we found the first-year survival estimate ( $0.11 \pm 0.01$ ) to be less than half of the expected rate (i.e. 0.30). This very low rate suggests that surviving the first year of life as a Neotropical migrant is even more difficult than previously thought, forcing us to possibly rethink estimates used in population models. By accounting for the potential effects of recapture probability in a population with a documented pattern of short-distance natal dispersal, this study presents one of the most robust estimates of first-year survival in a migratory songbird.

**S2.12 McKinnon, Emily,\*** (York University, Toronto, Canada); Fraser, Kevin; Stanley, Calandra (York University, Toronto, ON, Canada); MacPherson, Maggie (Tulane University, New Orleans, LA, United States); Stutchbury, Bridget (York University, Toronto, ON, Canada)

#### TESTING PROXIMATE HYPOTHESES FOR SPRING PROTANDRY IN WOOD THRUSHES USING GEOLOCATORS

Patterns of protandry in spring arrival of songbirds, where males arrive earlier to breeding sites than females, are well-documented. Proximate hypotheses to explain spring protandry have rarely been explored owing to difficulties in tracking individuals of both sexes over spring migration. Using geolocators, we tracked spring migration in 45 Wood Thrushes (*Hylocichla mustelina*) to test proximate hypotheses explaining protandry. We determined if: 1) males migrate faster than females (flight speed hypothesis), 2) males winter further north than females (the constraint hypothesis), or 3) males depart from winter sites earlier than females (carry-over effects/endogenous program hypothesis). We found no evidence that spring migration rate differed for males and females (average rate was 222km/day and 224km/day for males and females, respectively).

There were no patterns related to sex in winter latitude; males did not winter further north than females. We found that males departed significantly earlier from winter sites than females (mean departure dates: Apr 14, and Apr 21 for males and females, respectively), which suggests that protandry at breeding sites is controlled by departure from winter sites. This could be because males respond differently to cues at the wintering sites that initiate departure, such as photoperiod changes. This pattern could also be a result of male dominance at winter sites and earlier departure dependant on individual condition. Examining condition of males versus females in late winter would help elucidate which hypothesis accounts for earlier winter departure of males.

**SAT7.5 McKinnon, Laura**, (Trent University, Peterborough, Canada); Nol, Erica (Trent University, Peterborough, ON, Canada)

#### OPTIMIZING SHOREBIRD BREEDING PHENOLOGY IN A CHANGING ARCTIC ENVIRONMENT

In seasonal environments, breeding events must be synchronized with resource peaks to ensure production and growth of offspring. As changes in climate may affect trophic levels differentially, we hypothesized that a lack of synchrony between chick hatch and resource peaks could decrease growth rates in chicks of sub-arctic nesting shorebirds. More specifically, we predicted that chicks hatching prior to the peak period of arthropod abundance would experience higher growth rates than chicks hatching afterwards. By monitoring arthropod abundance and chick growth during 2 summers (2010, 2011) in Churchill, Manitoba, we generated non-linear growth models to study effects of arthropod abundance on chick growth. A non-linear growth model which described variation in mass by age and a continuous factor indicating the distance of hatch from the peak in dipteran abundance fit the data better than models describing variation by 1) year, 2) a binomial variable indicating whether chicks hatched before or after the dipteran peak, and 3) age alone. Our study indicates that asynchrony between hatch and peaks in arthropod abundance may reduce growth rates in shorebird chicks. As anticipated changes in climate may decouple phenological events, the effects of asynchrony on growth rates of arctic-nesting birds warrant further investigation.

**S4.9 McKown, Matthew**, (University of California Santa Cruz, Santa Cruz, United States); Lukac, Martin (Nexleaf Analytics, Los Angeles, CA, United States); Borker, Abraham (University of California Santa Cruz, Santa Cruz, CA, United States); Bradley, Russell (PRBO Conservation Science, Petaluma, CA, United States); Tershy, Bernie (University of California Santa Cruz, Santa Cruz, CA, United States); Croll, Donald (University of California Santa Cruz, Santa Cruz, United States)

#### A WIRELESS ACOUSTIC SENSOR NETWORK FOR DETECTING RARE AND ELUSIVE SEABIRD SPECIES: MONITORING ASHY STORM-PETRELS (OCEANODROMA HOMOCROA) ON SOUTHEAST FARALLON ISLAND

Managers and researchers face considerable financial and logistical challenges designing programs to monitor the status of the world's threatened seabirds (representing ~28% of all seabird species). These challenges are exacerbated by the fact that threatened seabirds often breed in isolated and inaccessible locations, have cryptic nest sites, and return to their colonies only at night. Acoustic sensors have been used as an effective tool for monitoring the presence, distribution and relative abundance of many threatened seabirds including Hawaiian Petrel ( *Pterodroma sandwichensis* ), Newell's Shearwater (

*Puffinus newelli* ), Tristram's Storm-petrel ( *Oceanodroma tristrami* ), and Marbled Murrelet ( *Brachyramphus marmoratus* ). We have developed new wireless acoustic sensors that 1) are comparable to currently available state-of-the-art sensors, 2) are affordable (~US\$500.00 per unit), 3) can sample continuously over months-years, 4) can telemeter data from remote locations via a cellular, microwave, or satellite link, and 5) can be controlled or re-programmed remotely. We deployed a network of wireless acoustic sensors to monitor Ashy Storm-petrels on Southeast Farallon Island, CA, a globally important seabird colony 27 miles from the mainland. The network remained functional despite harsh conditions including dense fog, salt, high-wind, humidity, and vandalism by gulls. Analysis of recordings detected all 3 primary species of interest to island managers: Ashy Storm Petrel, Cassin's Auklet ( *Ptychoramphus aleuticus* ), and Rhinoceros Auklet ( *Cerorhinca monocerata* ). Measures of Ashy Storm-petrel acoustic activity (mean calls per minute) corresponded with known colony attendance patterns and breeding habitat preferences. We propose that low-cost wireless sensors and automated call detection software offer a scalable option for finding and monitoring the world's endangered seabird species.

**PS1.158 McLaren, James**, (University of Amsterdam, Amsterdam, The Netherlands); Shamoun-Baranes, Judy; Bouten, Willem (University of Amsterdam, Amsterdam, The Netherlands)

#### MODELLING STOPOVER SCHEDULING AND REACTION TO WIND AMONG NOCTURNAL MIGRANTS IN A SPATIAL CONTEXT

How nocturnally migrating birds negotiate variable winds and heterogeneous food availability remains a fascinating and elusive subject. Despite ever-improving tracking technology, refuelling rates and compensation for wind drift cannot be monitored accurately over migration-scale distances. Theoretical models have therefore been developed to predict the adaptive value of locally observed stopover and flight decisions. Here we present behavioural models of stopover scheduling, wind selectivity and wind compensation among nocturnal migrants, using both synthetic and realistic environmental data. Time- or energy-minimizing behaviours are taken as proxies for fitness. We illustrate how the extent of adaptive compensation can depend on regional wind patterns, seasonal carry-over effects and the spatial extent of destination areas. We model stopover scheduling to show how risk-averse choice of stopover quality and wind assistance benefit expenditure of both time and total energy, and compare predicted departure fuel loads with published data. Finally, we use a spatially-explicit model with realistic wind data along the SW European migration corridor to show that unsupportive winds on departure can be tolerated with partial compensation to enhance not only consistency of arrival at destinations, but also migration speeds. We support these predictions with radar measurements of orientation aloft, and conclude that our models can help interpreting observed behaviour of nocturnal migrants, and discuss possible applications.

**PS2.90 Meads, Lauren**, (The Burrowing Owl Conservation Society of British Columbia, Oliver, Canada); Mackintosh, Mike (The Burrowing Owl Conservation Society of British Columbia, North Vancouver, BC, Canada); Brodie, Dawn (The Burrowing Owl Conservation Society of British Columbia, Knutsford, BC, Canada)

## BRINGING BACK THE BURROWING OWL TO BRITISH COLUMBIA: A STORY OF COMMUNITY CONSERVATION

The Burrowing Owl is a Species at Risk in Canada and was originally extirpated from British Columbia in the 1980s. Their natural habitats are the grasslands and deserts of North America. In Canada, the populations of burrowing owls migrate in the fall to the southern United States and possibly Mexico. With a loss of native habitat, along with the decline in burrowing mammals the Burrowing Owl populations continue on a downward trend. Starting in 1990, volunteers initiated a comprehensive program for the re-introduction of captive bred owls to the wild, including captive breeding facilities, artificial burrow networks and field monitoring research. In 2000, the Burrowing Owl Conservation Society of BC was formally created to set program direction, finance the program and increase public awareness of grassland habitat. The Society now produces over 100 owls each year to release in the Nicola Valley and South Okanagan grasslands of BC. Three breeding facilities are located separately across the province.

A large volunteer team prepares artificial burrows on the private ranch land, park land and first Nation properties. Improved release techniques, including soft-release caging, has resulted in greater numbers of wild-born broods and offspring. With more owls produced, the numbers of owls returning to BC are gradually increasing each year. We are currently working internationally to follow and protect the owls on their migration route which will help with their continued success in BC and Canada.

The Burrowing Owl program is an example of an applied conservation project with strong community support.

**PS2.137 Melcer, Ronald**, (CA Department of Water Resources, Sacramento, United States); Nightingale, Ann (Rocky Point Bird Observatory, Saanichton, BC, Canada)

### MIGRATION ECOLOGY OF LANDBIRDS AT A RIPARIAN STOPOVER SITE ON VANCOUVER ISLAND, B.C.

Rocky Point Bird Observatory (RPBO) is located on the southern tip of Vancouver Island, B.C. and is the only Pacific coastal member of the Canadian Migration Monitoring Network. RPBO provides important information on coastal and western landbird populations which allows us to gain insight into age and sex differences in the stopover ecology of migrant passerines. Migration monitoring has been conducted during southward migration (July-October) at RPBO since 1994. Mist nets are located within a Scouler's willow (*Salix scouleriana*), red alder (*Alnus rubra*) –dominated riparian corridor surrounded by a Douglas fir (*Pseudotsuga menziesii*), Garry Oak (*Quercus garryana*) –dominated forest. We investigated the migration timing, body condition, and mass gain for 8 common fall migrants: Common Yellowthroat (*Geothlypis trichas*), Wilson's Warbler (*Wilsonia pusilla*), Golden-crowned Kinglet (*Regulus satrapa*), Ruby-crowned Kinglet (*Regulus calendula*), Lincoln's Sparrow (*Melospiza lincolni*), Fox Sparrow (*Passerella iliaca*), Hermit Thrush (*Catharus guttatus*) and Swainson's Thrush (*C. ustulatus*). We found migrant arrival dates to vary by species, age, and sex, and some patterns were consistent with other investigations. Mass varied by age in some species, and not in others. All species had positive trends in regressions of mass by capture time, indicating that the site may provide quality stopover habitat.

**PS2.136 Melcer, Ronald**, (Department of Water Resources, Sacramento, United States); Villablanca, Francis (Cal Poly State University, San Luis Obispo, CA, United States)

## LANDBIRD RESPONSE TO FINE SCALE HABITAT CHARACTERISTICS WITHIN RIPARIAN FORESTS OF THE CENTRAL CALIFORNIA COAST

Riparian corridors in California are known to be an important but reduced and degraded resource for landbirds. In spite of previous research the habitat characteristics that correlate with high landbird abundance are poorly understood. In particular, the scale at which predictive models are useful (fine scale, watershed, sub-region or region) is ill defined. Herein, point count based abundance indices for 8 riparian associated/obligate species with uniform and high detection probabilities are correlated with biotic and abiotic habitat variables: a sums of squares procedure is used to select the top 5 predictive variables for each species, best fit linear models are selected in an information theoretic framework, and the relative importance of individual variables assessed. A general suite of habitat characteristics can be identified that could serve as targets for restoration and conservation efforts within this Coastal Central California Region. The specific characteristics vary somewhat across the 8 species we surveyed. In addition, for riparian species that others have studied the characteristics that we find are good predictors are distinct from the characteristics that others have recovered. Therefore, just as we should probably accept regional variation in the composition of riparian avifaunas, we should probably expect regional variation in the relationship between habitat variables and avian abundance. It appears that important habitat characteristics vary at the fine, watershed, sub-region and regional scales thus reducing the generality of all of the currently available models.

**PS2.86 Mendez-Aranda, Daniel**, \*U (Universidad Nacional Autónoma de México, Mexico City, Mexico); Navarro-Sigüenza, Adolfo G. (Museo de Zoología Departamento de Biología Evolutiva Facultad de Ciencias Universidad Nacional Autónoma de México Apartado Postal 70-399, México D. F., México City, Mexico)

### THE USE OF ECOLOGICAL NICHE MODELS AND ALTERNATIVE SPECIES CONCEPTS IN RISK ASSESSMENT OF ENDEMIC BIRD SPECIES OF THE WEST OF MEXICO

We examined the effects of the use of the Phylogenetic (PSC) and Evolutionary (ESC) Species Concepts versus the Biological Species Concepts (BSC) in the assessment of risk status of 49 phylogenetic/evolutionary bird species endemic to the West of Mexico, through the National assessment criteria: the method for extinction risk evaluation of wild species [MER]. This was done through the use of Geographic Information Systems (GIS). The phylogenetic/evolutionary species (PES) were selected from an alternative species taxonomy of the birds of Mexico (Navarro and Peterson, 2004). We used GARP and the Atlas of the Birds of Mexico database, 19 climate variables and 1 topographic variable to model the ecological niches. We measured the distribution range extension; applied land use cover changes from 1970 and 2000 as well as the Human Footprint; obtained the vegetation types ecological restriction and measured the distribution area and percentage in Natural Protected Areas (ANP). With this information we assessed the extinction risk status following the MER criteria, with two results: with the potential vegetation cover and the post-2000 vegetation cover. We obtained that 17 species prior to and 15 after deforestation were not listed in any risk category; 18 and 20 (prior and post disturbance) were listed as Threatened and 14 (both prior and post deforestation) were Endangered.

We compared the area size of the PES with the Biological Species (BS), as well as the endangerment status (taken from the

National Red List [NOM059-ECOL-2010]) to appreciate the underestimation of the risk status due to the use of the BSC. From the 49 species used, 27 species before disturbance and 29 after 2000 deforestation changed in their risk status due to the use of alternative species concepts.

We concluded that the use of the BSC underestimated the risk status of the majority (27 and 29) of the studied (PE) species. Also that deforestation elevated the risk category of 2 species; hence the importance of the use of alternative species concepts such as the Phylogenetic and Evolutionary Species Concepts.

**PS2.231 Mennill, Daniel**, (University of Windsor, Windsor, Canada); Battiston, Matthew (University of Windsor, Belle River, ON, Canada); Wilson, David (University of Windsor, Windsor, Canada); Foote, Jennifer (Algoma University, Sault Ste Marie, ON, Canada); Doucet, Stephanie (University of Windsor, Windsor, ON, Canada)

#### FIELD TEST OF AN AFFORDABLE WIRELESS MICROPHONE ARRAY THAT FITS IN A BACKPACK

Using arrays of microphones, biologists can monitor the position of free-living birds based on the sounds they produce. Microphone array technology exploits differences in sound arrival times at each microphone to calculate a bird's position. This technology provides new opportunities for studying avian ecology and behaviour and has many advantages over tracking technologies that require capturing birds and fitting them with external devices, or technologies that focus on one individual in isolation of the activities of nearby birds. The efficacy of microphone arrays for triangulating the position of wild birds has been established through previous studies. Yet widespread use of microphone array technology has been limited by many factors: arrays are expensive, custom-manufactured, and cumbersome. Consequently, microphone arrays are used infrequently, in spite of their transformative potential for studying animal ecology and behaviour. We conducted a field test of a new wireless microphone array system that has multiple advantages over previous systems: it is relatively inexpensive, commercially available, includes an integrated global-positioning system (GPS) for time-synchronizing microphones, and it is small enough to fit in a backpack. We set up an array of four stereo recorders (each with a pair of stereo microphones) at 12 sites and tested the system's accuracy for estimating the location of loudspeakers broadcasting 25 types of bird, mammal, and frog sounds. We found that this system produced accurate location estimates based on multi-channel recordings of many types of acoustic signals. The average location accuracy was  $1.8 \pm 0.1$  m, on par with cable based microphone array systems. Location accuracy was significantly higher when the recorders were closer together and when sounds were broadcast inside the area bounded by the microphones. Accuracy tended to be higher in field versus forest habitats. We discuss how this system may be used to enhance studies of animal ecology and behaviour across a wide range of contexts. As with previous arrays, this system will allow researchers to monitor animals that produce distinctive acoustic signals. In marked contrast to previous microphone arrays, however, this system is affordable, portable, and commercially available and consequently stands to dramatically enhance research on wild, free-living animals.

**PS1.149 Merkord, Christopher L.**, (University of South Dakota, Vermillion, United States); Dixon, Mark D. (University of South Dakota, Vermillion, United States); Swanson, David L. (University of South Dakota, Vermillion, SD, United States); Johnson, W. Carter (South Dakota State University, Brookings,

SD, ND, United States); Benson, Adam (University of South Dakota, Vermillion, SD, United States)

#### PROJECTING LONG-TERM LANDSCAPE CHANGE ALONG THE MISSOURI RIVER: IMPLICATIONS FOR COTTONWOOD FORESTS AND BIRD POPULATIONS

Missouri River floodplain forests comprise much of the forest within the northern Great Plains and harbor the richest diversity of birds in the region. The extent of floodplain forest has decreased steadily since western settlement due to agricultural land conversion. The damming of the river in the 1950s altered fluvial geomorphic processes, ultimately decreasing recruitment rates of the historically dominant plains cottonwood (*Populus deltoides*), resulting in an overall ageing of cottonwood forests and decrease in the extent of early successional habitat used by many bird species. We surveyed birds and measured forest structure in 75 forest stands stratified by age-class and species composition (cottonwood vs. non-cottonwood) along the Missouri River in South Dakota and Nebraska. We estimated the future (~25, 50, 100 years) land area of each forest stratum using recent rates of land conversion and then multiplied these land areas by stratum-specific bird densities to project future changes in riparian forest bird populations. Our results highlight the need for future conservation and restoration efforts limiting further loss of remnant cottonwood stands and restoring river dynamics that promote cottonwood regeneration.

**PS1.14 Middleton, Holly**, (Centre for Wildlife Ecology, Burnaby, Canada);

#### RESPONSE OF WINTERING DUCKS TO DISTURBANCE AT ANTHROPOGENIC EDGES IN DELTA, BC

Anthropogenic edges can reduce available duck habitat if patches near edges perceived as dangerous are avoided. Avoidance will result in less time spent in patches near dangerous edges and, seasonally, greater cumulative time spent in less dangerous patches. Using a predation risk framework I examined the spatial use of wintering ducks in response to the presence of an anthropogenic edge and the role disturbance plays in these patterns. Dropping densities were counted weekly on transects in fields in Delta, British Columbia adjacent to either a greenhouse, a residential area or a busy road in winter 2007-2008 and 2009-2010. Response to an edge was quantified using the distance at which 50% of the total droppings accumulated and the mean cumulative dropping density in each field. Disturbance was measured in 3 hr blocks per field across day and night in winter 2010-2011. The roles of disturbance and edge type on the 50% distance and cumulative density were examined using a generalized least squares model. Ducks spent more time near and more cumulative time at greenhouse than residential and road edges in both winters. Disturbance was similar and highest at residential and road edges and lowest at greenhouse edges. With decreasing disturbance habitat use increased towards the edge regardless of edge type and cumulative use increased, although at a greater rate at greenhouses. High levels of disturbance and the placement of certain edges near duck habitat can exacerbate avoidance resulting in loss of available duck wintering habitat.

**F7.4 Milenkaya, Olga**, (Virginia Tech, Blacksburg, United States); Walters, Jeffrey R. (Virginia Tech, Blacksburg, VA, United States)

#### CONDITION INDICES AMONG CRIMSON FINCHES ARE REPEATABLE BUT DO NOT PREDICT REPRODUCTIVE SUCCESS OR SURVIVAL.

Condition indices may be interpreted as indicators of individual quality. As such, these indices need to be repeatable across time

within individuals and they need to predict reproductive success and survival. We tested these hypotheses in adult Crimson Finches (*Neochmia phaeton*) in north-western Australia. Reproductive success was quantified as the number of young fledged and the number of fledglings that survived to independence over the course of a breeding season. Survival was assessed through the resighting of color-banded individuals. Birds were sampled for several condition indices including hematocrit, hemoglobin, total plasma protein, heterophil to lymphocyte ratio (H:L), scaled mass index, muscle score, and fat score. Each index was tested for repeatability and for their utility at predicting annual reproductive success and survival. We used the rpt package in R, generalized linear mixed models in SAS, and Program MARK for these analyses, respectively. We used an information theoretic approach to evaluate the evidence for each model, using model weights, model averaged beta estimates, and evidence ratios to assess the effects of condition on reproductive success and survival. We included covariates such as sex, age, year, and breeding stage in some of the models to control for their effects on the condition indices. All condition indices, with the exception of H:L, were repeatable across short and long (one year) time scales. However, none of the condition indices were meaningful indicators of annual reproductive success or survival. Models that included condition indices were poorly supported and did not improve model fit over the baseline models. While our repeatability analysis suggests that these condition indices may be good candidates for indicating individual quality, our negative results on reproductive success and survival raise some concerns. Either condition indices generally do not reflect individual quality, the individuals in our study were not challenged enough for condition to be meaningful, or the indices we measured are not relevant to Crimson Finches. Researchers should be cautious about using condition indices as indicators of individual quality.

**F10.4 Miller, Aileen**, (Portland State University, Portland, United States);

#### MIGRATORY SHOREBIRD STOP-OVER SITES: HABITAT AND PREY ASSOCIATIONS IN OREGON ESTUARIES

Loss of stop-over sites is a primary threat to shorebird populations on the West Coast of the United States (e.g. *Calidris mauri*). Research has focused on the largest of these sites; however, smaller estuaries also host thousands of migratory shorebirds. Furthermore, the reasons for stop-over site selection are largely unknown. Estuarine inter-tidal microhabitats are non-uniform, varying in both biotic and abiotic characteristics. In order to identify factors that may predict site selection, we measured shorebird abundance, habitat characteristics, and food resources – invertebrates and a newly considered source, biofilm -- within two Oregon estuaries during the fall migration period. Invertebrates were assessed with sediment cores, biofilm with measurement of surface Chl A and ash-free dry mass. Additionally, we compiled shorebird abundance data from estuaries throughout the Pacific Northwest to identify broader scale predictors of stop-over site usage. Shorebird density, considered over the broader-range, did not correlate with estuary size, but densities tended to be consistent over years. These patterns indicate that site selection is non-random, and suggest that size-independent characteristics will best predict estuary usage. In the focus estuaries, shorebird abundance was an order of magnitude higher in the estuary with higher invertebrate abundance and Chl A, but no difference was found in surface ash-free dry mass. Within estuaries, abundance of biofilm was patchy and did not consistently predict shorebird abundance micro-habitat selection. These results suggest that overall quality of food resources is important in stop-over site selection,

but may not effectively track the finer scale movements of these birds.

**PS1.250 Miller, Edward H.**, (Memorial University of Newfoundland, St. John's, Canada);

#### SYSTEMATIC VALUE OF SNIPE SOUNDS

Shorebird vocalizations (possibly including instrumental sounds) may be especially informative about relationships because they are not learned. We describe some vocal and non-vocal sounds of snipe (*Gallinago*), a group in which species relationships have not been resolved on molecular grounds. Sounds of many species have been analyzed and published as spectrograms, but acoustic evidence has only been used once to investigate possible species differences; in that case substantial differences were found (Wilson's Snipe *G. delicata* and Common Snipe *G. gallinago*). We analyzed three vocal classes and one non-vocal sound from a number of *Gallinago* species. Two vocal classes (Chip; Chipper) show a fair amount of differentiation across species but the non-vocal *Winnow* varies most. We conclude that vocal and non-vocal sounds of *Gallinago* have the potential to resolve some species relationships and may reveal the presence of currently unrecognized species.

**PS2.165 Miller, Katherine**, (Caesar Kleberg Wildlife Research Center, Kingsville, United States); DeYoung, Randy (Caesar Kleberg Wildlife Research Institute, Kingsville, United States); Corman, Kelly (Natural Resources Conservation Service, Lamar, CO, United States)

#### DO BROOD PARASITISM AND MULTIPLE MATING OCCUR IN LESSER PRAIRIE-CHICKENS IN TEXAS AND NEW MEXICO?

In bird species where males form leks, it has been commonly thought that females choose the best male partner from his display. Male lesser prairie-chickens exhibit fidelity for a given lek, while females may move up to 30 km, therefore connectivity between leks is very important. Multiple mating has been documented in certain lekking species, which should improve genetic diversity and reduce the variance in the male reproductive success. Our goal was to assess whether multiple mating and brood parasitism occur in lesser prairie-chickens in Texas and eastern New Mexico. We extracted DNA from 206 lesser prairie-chicken eggs representing 28 nests. Using 5 microsatellites, we compared egg genotypes to known genotypes of hens. We found an overall FST of 0.2578, and a high variation within broods (74.23%). Nest dumping occurred in 22 (78.57%) of the nests. Our next step is to assign individuals into genetic groups (full-siblings, half-siblings, unrelated, and parentage) and estimate the number of sires for each brood with the maximum-likelihood method, using Colony 2.0. Multiple mating may ensure fertilization for a hen's entire clutch or increase hatching success by reducing the number of deleterious alleles in a population. This is significant in populations with low genetic diversity; multiple mating could increase the effective population size. The loss of native prairie greatly impacts lesser prairie-chickens, which occupy less than 10% of their historical range. Maintaining a high genetic diversity will require multiple leks in an area, and connectivity between those leks for the females.

**W6.6 Miller, Katherine**, (Caesar Kleberg Wildlife Research Center, Kingsville, United States); Brennan, Leonard (Caesar Kleberg Wildlife Research Institute, Kingsville, TX, United States); DeYoung, Randy; Hernandez, Fidel (Caesar Kleberg Wildlife Research Institute, Kingsville, TX, United States); Wu,

X. Ben (Department of Ecosystem Science and Management, College Station, TX, United States)

#### NORTHERN BOBWHITE POPULATION STRUCTURE AND DIVERSITY IN TEXAS AND THE GREAT PLAINS

Throughout its range, many northern bobwhite (*Colinus virginianus*) populations have been experiencing severe declines. Fragmented habitats may impact northern bobwhite genetic structure. Our goal is to assess whether landscape affects the population structure and diversity for northern bobwhite in Texas and the Great Plains. We extracted DNA from hunter-harvested northern bobwhites for 19 sites in south Texas from 2004-2010, and analyzed 7 microsatellites. We used FST to measure genetic structure and AMOVA for genetic variation. In order to compare the genetic structure to the landscape, we used matrices built from geographic distances (km), barriers (large water bodies and highways), and the Biologist Ranking Information from the National Bobwhite Conservation Initiative. These matrices were compared to the genetic structure (pairwise FST), using Mantel tests (Mantel 1967) with 10,000 permutations. We used partial Mantel tests to test the correlation of pairwise FST to combinations of distance and barriers, distance and habitat, and barriers and habitat. Overall FST was < 0.01, suggesting low levels of population differentiation. The AMOVA revealed that most variation was within individuals. Mantel tests all showed a positive correlation with genetic differentiation, however, barriers appear to be an important factor for the observed genetic patterns. We are presenting preliminary results using a portion of the data from our ongoing research in northern bobwhite population structure. This research will be expanded throughout Texas and into the Great Plains to determine the effect that landscape has on northern bobwhite populations, and how we manage for the species.

**PS2.99 Miller, Mark**, (University of Alaska, Fairbanks, United States); Pearlstine, Elise (University of Florida, Belle Glade, FL, United States)

#### ESTIMATING THE EFFECT OF EURASIAN COLLARED-DOVES ON ABUNDANCE OF NATIVE DOVES IN SOUTH FLORIDA

Percent area occupied models enable estimation of the distribution of a single species accounting for imperfect detection. Two-species occupancy models allow estimation of the effect competitors have on the distribution of each other. Similar models have been developed to estimate abundance of a species. We combine these approaches to estimate the effect a dominant competitor has on the abundance of other species. We apply our model to estimate the effect of exotic Eurasian collared-dove (*Streptopelia decaocto*) on abundance of native doves in south Florida.

The distribution of the Eurasian collared-dove is expanding and now encompasses much of North America. This species potentially could out-compete native doves for breeding habitat. Competitive exclusion predicts that Eurasian collared-doves and other doves co-occur less often than expected by random chance and that native species are less abundant where the two species do co-occur.

Abundance was estimated for each of four dove species in two habitats in south Florida during 7 March – 26 May, 2006. We recorded count data for each species in 103 sites in urban habitat in Fort Lauderdale and 45 sites in sugarcane fields in the Everglades Agricultural Area. Each site was visited four times. We programmed our newly-developed two-species abundance model in Program R to estimate whether abundance of

Mourning Doves (*Zenaida macroura*), White-winged Doves (*Zenaida asiatica*), and Common Ground-doves (*Columbina passerina*) was affected by the presence of the Eurasian Collared-dove.

Eurasian Collared-doves were more widespread in urban habitat than other doves and rare in agricultural habitat. Mourning Doves were equally widespread in both habitats. Common ground-doves were virtually restricted to the agricultural area and White-winged Doves were found only in Fort Lauderdale. Two-species occupancy models suggested Eurasian Collared-doves and Mourning Doves co-occurred more often than expected by random chance, as did Eurasian Collared-doves and White-winged Doves, and White-winged Doves and Mourning Doves, inconsistent with predictions of competitive exclusion. Estimation of the effects of competition on abundance of natives using our newly-developed model is on-going and will be presented.

**W15.7 Miller, Matthew**, (Smithsonian Tropical Research Institute, Panama, Canada);

#### IMPLICATIONS FOR THE SPECIATION PROCESS FROM A SURVEY OF SECONDARY CONTACT AMONG PANAMANIAN LANDBIRDS

Increasingly, the study of avian speciation is focused on secondary contact and hybridization, and their roles as a constructive or disruptive forces in the process of species formation. Unfortunately, most studies of avian hybrid zones are from temperate regions where, relative to tropical areas, most bird species are young. Furthermore, our appreciation for the ubiquity of hybridization among tropical birds is limited by substantial uncertainty about species limits for many taxa. I begin by reviewing patterns of genetic differentiation and secondary contact for the entire assemblage of Panamanian landbirds based on mitochondrial DNA (mtDNA). Among Panamanian landbirds as a whole, secondary contact is common, occurring principally across two north-south axes. Despite the apparent similarities of geography, the extreme variation in mtDNA divergences among taxa argues against shared history. A substantial portion of secondary contact is obscured by the lack of obvious phenotypic differences among populations, even at the level of subspecies; instead, discovery of contact is only apparent through phylogeographic surveys. Among these cases of cryptic secondary contact two outcomes are possible: abrupt geographic replacement of one mtDNA clade for another, or relatively widespread mtDNA introgression. However, the degree of mtDNA divergence among parental clades is a poor predictor of this outcome. Using examples from *Henicorhina*, *Myrmeciza*, *Amazilia*, and *Jacana*, I demonstrate that not only are the levels of mtDNA introgression a good predictor of genome-wide patterns of gene flow, but also that ecology appears to predict the extent of introgression across these cryptic contact zones.

**S6.5 Miller, Robert**, (Idaho Bird Observatory at Boise State University, Boise, United States); Carlisle, Jay (Idaho Bird Observatory at Boise State University, Boise, ID, United States); Paprocki, Neil (Boise State University, Boise, ID, United States); Kaltenecker, Gregory (Idaho Bird Observatory at Boise State University, Boise, ID, United States); Heath, Julie (Boise State University, Boise, ID, United States)

#### EXPLORING CLIMATE IMPACTS ON MIGRATION TIMING AND ENERGETIC CONDITION OF AUTUMN MIGRANT RAPTORS AND PASSERINES IN SOUTHWESTERN IDAHO



Climate can have profound impacts on avian life histories but links between climate change and behavior of birds during autumn migration have been less studied than responses during spring migration. To better understand how migratory birds may be adapting to these changes, we investigated the effects of climate on autumn migrants in the Rocky Mountains of southwestern Idaho. We first asked if there was evidence for a change in autumn migration phenology. We then looked for any evidence that climate is impacting energetic condition of migrants and if this depends on diet. We used 15 years of climate data from the northwestern U.S. and western Canada and bird migration data from southwestern Idaho to examine several hypotheses. In particular, we hypothesized that (1) years with warmer winter or spring temperatures would result in earlier breeding and better energetic condition of migrants in autumn as birds would have more time after breeding to build fat stores; and (2) species responses to earlier clutch completion will differ, with some species shifting migration timing and possibly disrupting predator-prey relationships. Specifically, we looked at local and regional temperatures (winter, spring, and summer), late-spring snow depth, and precipitation. We then evaluated the predictive power of these variables for autumn migration timing and energetic condition of two raptor species and 10 passerine species, including temperate and Neotropical migrants with varying diet types. We found that warmer spring temperatures are correlated with improved energetic condition but no change in phenology was evident for most passerine species. Raptor species showed no change in energetic condition; however their phenology trended later. The differential response of passerines and raptors to spring warming has the potential to disrupt the predator-prey relationships before and during autumn migration.

**PS1.34 Miller, Sara**, (Arkansas State University, State University, United States); Dykstra, Cheryl (Raptor Environmental, West Chester, OH, United States); Simon, Melinda; Hays, Jeff (RAPTOR, Inc., Milford, OH, United States); Bednarz, Jim (Arkansas State University, State University, AR, United States)

#### USE OF VIDEO-MONITORING TO STUDY PARTIAL INCUBATION AND CLUTCH-INITIATION BEHAVIOR OF RED-SHOULDERED HAWKS (*BUTEO LINEATUS*)

We studied clutch-initiation behavior of Red-shouldered Hawks (*Buteo lineatus*; RSHA) in suburban areas around Cincinnati, Ohio. RSHAs exhibit asynchronous hatching, which has been hypothesized as a parental strategy for rearing a maximum number of offspring allowed by unpredictable food resource availability. Partial incubation is a behavioral pattern in which parents spend a lesser proportion of time sitting on and warming their eggs before clutch completion than after clutch completion, which likely affects the asynchronous hatching interval. Current knowledge of the incubation patterns and associated behavioral mechanisms by which asynchronous hatching occurs in raptors is limited, and detailed observational studies are nonexistent for any species of Accipitriformes in the wild. We used 24-hour video cameras mounted above nests ( $n = 5$  nests) to record parental behaviors (e.g., absent, standing, incubating) during clutch initiation to determine the type of incubation pattern displayed. Our analysis of video data revealed that RSHAs exhibit partial incubation, with a delay in the onset of full incubation. We define the onset of full incubation as the point at which incubation becomes relatively continuous. In each of the three 3-egg clutches observed, full incubation began after the second (penultimate) egg was laid. For one 4-egg clutch, full incubation began on the second egg, not the penultimate (3rd) egg. For one 2-egg clutch, full incubation began before the

second egg (ultimate) was laid. The mean egg-laying interval was 2.9 d or 69.0 h (66.3 – 74.2 h), the first egg was laid in the afternoon, and the female parent remained at the nest for the entire duration of the night, each night after laying the first egg, either standing over the egg or incubating. Of the five nests observed, four hatched eggs. Estimations of hatching intervals indicated that eggs hatched with a mean of 1.3 days between eggs, which was a shorter interval than that of egg-laying (2.9 d). In summary, RSHAs exhibit partial incubation, with the onset of incubation varying with clutch size. We propose that this pattern is adaptive, and may be a mechanism to reduce the hatching interval while maintaining the asynchronous pattern. Further, our method of installing cameras prior to egg-laying did not disturb the birds in our study species and may be a suitable approach to study clutch initiation and incubation patterns in other raptor species.

**T17.12 Miller, Tricia**, (West Virginia University, Morgantown, United States); Brooks, Robert (The Pennsylvania State University, University Park, PA, United States); Katzner, Todd (West Virginia University, Morgantown, PA, United States); Lanzone, Michael (Cellular Tracking Technologies, Somerset, United States); Maisonneuve, Charles (Ministère des Ressources naturelles et de la Faune, Rimouski, PQ, Canada); Tremblay, Junior (Ministère des Ressources naturelles et de la Faune, Quebec City, PQ, Canada); Cooper, Jeff (Virginia Department of Game and Inland Fisheries, Fredericksburg, United States); O'Malley, Kieran (West Virginia Division of Natural Resources, Romney, United States)

#### SEASONAL AND INTRASPECIFIC DRIVERS OF MOVEMENT ECOLOGY OF A MIGRATORY AVIAN PREDATOR

Animals move about their environment and often confine these movements seasonally to specific areas. Selective pressures influence these movements as animals must balance the costs and benefits of utilizing or not utilizing an area. Determinants of these movements have been little studied especially in birds. We examined inter- and intra-seasonal variation in movement of a complete migrant, the Golden Eagle (*Aquila chrysaetos*), in eastern North America. We calculated home range size (a proxy for amount of movement) using adaptive local convex hulls and developed a novel movement index, a central place foraging index (CPFI), which is the ratio of the home range to the minimum convex polygon. For each season, we examined the influence on amount and type of movement of age class, latitude, forest, open cover, water, and for summer only, burned cover. We found that during summer, home range size depended upon age and that during winter, home range size was negatively correlated to forest cover. Mean summer home range size was  $812.7 \pm 344.7$  km<sup>2</sup> ( $\pm$ SE,  $n = 10$ ) for adults,  $3684.9 \pm 2397.9$  km<sup>2</sup> ( $n = 3$ ) for sub-adults, and  $2917.3 \pm 1833.9$  km<sup>2</sup> ( $n = 4$ ) for juveniles. Seasonality also influenced amount of movement and during winter, home range size was smaller and much less variable than during summer ( $p = 0.018$ ). Mean winter home range sizes were  $164.2 \pm 132.2$  km<sup>2</sup> ( $n = 10$ ) for adults,  $695.8 \pm 4577.7$  km<sup>2</sup> for sub-adults, and  $372.3 \pm 199.4$  km<sup>2</sup> ( $n = 9$ ) for juveniles. During summer, adult movements were more centralized than those of sub-adults or juveniles (CPFI =  $0.28 \pm 0.03$  (A) vs.  $0.21 \pm 0.03$  (SA) vs.  $0.05 \pm 0.15$  (J);  $p = 0.011$ ). However, during winter, CPFI was similar for all age classes ( $p > 0.05$ ). The complex interactions between season and age we document show the importance of considering such parameters in evaluating movement ecology.

**PS1.164 millikin, rhonda**, (www.echotrack.com, vancouver, Canada);

#### MIGRATION CORRIDORS; A STUDY OF FRAME BIAS IN THE MIGRATION MONITORING OF LANDBIRDS

Decisions to take conservation action depend on the results of population trend surveys. For landbirds that breed in remote habitats and migrate large distances, these surveys include migration at stopover sites. However, recent work on shorebirds suggests trend estimates obtained from stopover sites may have a frame bias where population declines measured at the survey site, may reflect the re-distribution of birds to areas that are not surveyed (the re-distribution hypothesis or "frame bias"). Contrary to shorebirds, landbirds are thought to migrate along broad fronts and their stopover sites are not well understood. To investigate the issue of frame bias in migration monitoring of landbirds, I chose two valleys in southern B.C. with migration survey sites and another eight valleys that replicated the orientation of these valleys and included other orientations expected to influence the volume of migration and species complex. I expected the orientation of the valleys to be more important than site-level habitat. I found orientation did influence abundance and species but not in the way expected. The results suggest frame bias can be addressed by including larger-scale surveys of the valley ridge as well as riparian lowlands.

**PS1.214 Minoletti, Andrea**, (Universidad Mayor, Santiago, Chile); Alvarado, Sergio (DEscuela de Salud Pública, Universidad de Chile, Santiago, Chile); Mattar, César (Centro de Investigaciones Ecotoxicológicas, Universidad Mayor, Santiago, Chile)

#### TIME INVESTMENT IN PARENTAL CARE OF THE CHILEAN HAWK (ACCIPITER CHILENSIS) IN A WHITE OAK (NOTHOFAGUS MACROCARPA) FOREST OF CENTRAL CHILE

During the breeding season 2009-2010, we described the time investment in parental care of a pair of Chilean Hawks (*Accipiter chilensis*) in Altos de Chicauma (33°S), situated in the Coastal mountain range of Santiago Metropolitan Region, central Chile. The nesting site was located in a white oak (*Nothofagus macrocarpa*) forest remnant of nearly 70 ha, where behavioral sampling was performed two days per week from November 2009, during the incubation period, until February 2010, at the end of the rearing period.

Within the nesting site, the active nest was found on a peumo tree (*Cryptocarya alba*). The female was involved in 97% of incubation records. Occasionally, the male incubated or remained in the nest during the incubation period for 3-11 min while the female fed out of the nest. The female was the only one that fed the young directly, with a frequency of 0.76 times/hour of observation during the nestling stage and 0.29 times/hour of observation during the first 10 days of the fledgling stage, and each feeding event had an average duration of 6 min (n=80). Prey delivery to the young in order to feed on their own was recorded 0.44 times/hour of observation during the first 10 days of the fledgling stage, when the female contributed with 75% of the deliveries; afterwards only the male made deliveries, with a frequency of 0.09 times/hour of observation. The female represented 81% of the adult record in the nest, but in the last 2-3 weeks of rearing only the male arrived at the nest. In the total period of observation, the average permanence in the nest was 36 min (n=138) for the female and 3 min (n=29) for the male.

The incubation period extended for at least 21 days (November-December) and the rearing for 11 weeks (December-February). The female was the main one that remained in the nest because it was the primary responsible for incubation and care of the chicks until their first days of flight. The events of direct feeding to the young were more frequent during the nestling stage, while the prey delivery to the young in order to feed on their own were more frequent during the early fledgling period. In the last stage of rearing, the presence of the female in the breeding site decreased and only the male was observed taking care of the chicks more actively through prey deliveries.

**T3.2 Mitchell, Greg,\*** (University of Guelph, Guelph, Canada); Newman, Amy (University of Guelph, Guelph, ON, Canada); Wikelski, Martin (Max Planck Institute for Ornithology, Radolfzell, Germany); Norris, Ryan (University of Guelph, Guelph, ON, Canada)

#### TIMING OF BREEDING CARRIES OVER TO INFLUENCE MIGRATORY DEPARTURE IN A SONGBIRD: AN AUTOMATED RADIOTRACKING STUDY

Determining how events interact across stages of the annual cycle is critical for understanding the factors that affect individual fitness. However, there is currently little information detailing how breeding events influence migratory behavior. Using an automated digital telemetry array and an isolated island-breeding population of Savanna sparrows (*Passerculus sandwichensis*), we provide the first direct evidence that the timing of breeding events carries over to influence the timing of migration in a songbird and assess for the first time how weather conditions on the breeding grounds also affect departure dates. Date of migratory departure between September and October was strongly influenced by date of breeding completion in adults and fledging date in juveniles from June to July. With respect to weather, adults departed during the first half of high-pressure systems, while juveniles departed throughout the entirety of high-pressure systems (including rainy evenings on the western edge of systems). By combining both ecological and weather data, we could explain almost all variation in departure date for adults (95%), but weather conditions were not a good predictor of departure date for juveniles. Our results provide strong evidence that the timing of breeding events is an important driver of migration timing and that exact departure dates are fine-tuned according to local weather conditions in adults, but not in juveniles. Given increasingly inclement weather as the fall season progresses and the potential for resource suppression by earlier migrants, we suggest that the timing of breeding events may affect individual survival through their effects on the timing of migration.

**S3.5 Mizrahi, David**, (New Jersey Audubon, Cape May Court House, United States); Fogg, Robert (New Jersey Audubon, Cape May Court House, NJ, United States)

#### USING MARINE RADAR TO CHARACTERIZE AVIAN MOVEMENT DYNAMICS IN OFFSHORE MARINE ENVIRONMENTS: ADVANTAGES, CHALLENGES AND FINDINGS

Understanding avian movement dynamics (magnitude, altitude, direction) is critical to evaluating potential impacts from offshore wind power development. Marine radar systems can provide information on spatial and temporal flux in movement dynamics, and insight into how birds respond to wind turbines in land/seascapes. Collecting these types of data can be difficult using traditional methods (visual observation), especially at night. Although using radars to study bird movements in marine environments has inherent challenges, they can be overcome

with various hardware and operational modifications. Since 2005, we have conducted three radar studies to characterize avian movement patterns in marine environments. Overall, our data suggest that movement dynamics are highly varied temporally and spatially, but consistently indicate that more birds are airborne at night than during the day and during fall migration than at other times of the year. Importantly, birds flying over marine environments at night during fall migration tend to do so at higher altitudes compared to diurnal periods and other seasons. Generally, as nocturnal movement magnitude increased, regardless of season, the proportion of bird flying below 200 m above sea level decreased significantly. In contrast, diurnal movements during the spring and summer were typically lower in altitude, exhibited more variable flight directions and appeared to coincide with the onset of sunrise or sunset, suggesting that patterns we observed might be related, in part, to departure from or arrival at nesting areas or nocturnal roost sites. Taken together, birds may be more likely to interact with wind turbines during diurnal movements because they tend to fly at lower altitudes, especially during periods with low light levels (i.e., sunrise, sunset). However, on nights with high migration traffic, numbers of birds flying at low altitudes may be similar and at even lower light levels. That our data reflects the behavior of birds in areas where no wind turbines were present is important to note. Establishing how birds respond to obstructions is vital to assessing the potential effect of wind power development in marine environments.

**PS2.59 Molloy, Kelsey,** (University of Manitoba, Winnipeg, Canada); **Koper, Nicola** (University of Manitoba, Winnipeg, MB, Canada)

#### IMPACTS OF CATTLE STOCKING RATES ON PLANT SPECIES COMPOSITION AND GRASSLAND BIRD COMMUNITIES IN A NORTHERN MIXED-GRASS PRAIRIE

Grassland songbirds in North America are experiencing significant declines across the continent due to factors such as habitat loss and changes in disturbance regimes. Grassland birds evolved with disturbances such as grazing, which alters vegetation structure and composition, thereby creating habitats for a range of different avian species. It is important to manage grazing on remaining grasslands to continue providing habitat for a complete grassland bird community. Our study will examine the impacts of different cattle stocking rates on plant species communities, and in turn on avian species composition and abundances. The study area contains twelve 300 ha pastures, within Grasslands National Park and the nearby Mankota Community Pastures, in the mixed-grass prairie of southern Saskatchewan. There are three control (ungrazed) pastures; the remaining nine pastures are grazed from 20% to 70% estimated biomass removal. This study is unique since it uses a grazing intensity as a continuous variable rather than a categorical variable (e.g. low, medium, high grazing intensity), unlike many previous studies. This provides for a more complete picture of the effects of grazing and allows results to be more easily used by management. Between May and June 2012 100 m fixed-radius point counts were conducted at ten survey points within each pasture. At each survey point ten frames within a modified Whittaker plots were used to assess plant species composition and structure. In the fall of 2012 we will analyze the data using generalized linear mixed-effect models to determine if cattle are impacting some bird communities disproportionately. Additionally, we will create continuous models showing the effect of specific habitat variables (e.g. amount of shrub and common grass species cover, vegetation density) on the presence and abundance of

each avian study species. These models will provide a useful management tool so that cattle grazing can be used to manage specific habitat characteristics favorable for avian species of conservation concern.

**SAT2.4 Monroy Ojeda, Alan,** (Tierra de Aves, Celaya, Mexico); **Grosselet, Manuel** (Tierra de Aves, Distrito federal, Mexico); **Ruíz Michel, Georgita** (Tierra de Aves, Distrito Federal, Canada)

#### POPULATION TRENDS OF SIX SPECIES OF NEOTROPICAL MIGRATORY BIRDS. A NINE YEARS STUDY IN OAXACA, OAXACA, MEXICO.

Despite the great multi national attention migratory birds have received during the last decades, the ignorance in a great variety of biological, ethological and demographic aspects still remain in the majority of the species, especially during the time they spend in their wintering grounds. Using data from a nine-year monitoring study (2001 – 2010) carried out in the green area of the Ethno-botanical Garden in the urban area of Oaxaca, Oaxaca, we determined the population trends of six neotropical migratory birds: Warbling Vireo, Cedar Waxwing, Nashville Warbler, Audubon's Warbler, Western Tanager and Orchard Oriole. The monitoring method was capture and banding. Twelve banding sessions of six hours each were done throughout the year; one each month. The mist net effort remained constant during the nine-year monitoring study. Forty-eight migratory species were captured during this period; the six most captured species were selected for the analysis, counting a total of 2,160 captured birds. Four species showed a statistically significant change in the population trend; two species increased and two decreased their population numbers. The two remaining species showed a positive, but not statistically significant trend. Audubon's Warbler showed the highest rates of population decline while Warbling Vireo showed the highest rates of population increase. The study results contrasts with several studies done with the same species in their breeding grounds where a general declining tendency is shown. The absence of long-term researches focused in demographical aspects of neotropical migratory birds in their wintering grounds remarks the results of this study.

**PS2.23 Montes-Medina, Adolfo Christian,** (Instituto de Biología, Universidad Nacional Autónoma de México, México D.F., Mexico); **Salinas-Melgoza, Alejandro** (Department of Biology, New Mexico State University, Las Cruces, United States); **Wright, Timothy** (Department of Biology MSC 3AF New Mexico State University, Las Cruces, NM, United States); **Renton, Katherine** (Estacion de Biología Chamela, Instituto de Biología, Universidad Nacional Autónoma de México, Melaque, Mexico)

#### INDIVIDUAL VARIATION IN NESTING VOCALIZATIONS OF THE LILAC-CROWNED PARROT (AMAZONA FINSCHI) IN MEXICO

Birds use vocal repertoires in a variety of behavioral contexts and may present individual vocal recognition. In the present study, we aimed to characterize nesting vocalizations and evaluate their role in individual variation and pair recognition for nesting parrots. During 2010 and 2011, we recorded and characterized the vocalizations of 29 reproductive pairs of the Lilac-crowned Parrot (*Amazona finschi*) in Chamela-Cuixmala Biosphere Reserve. Using 11 spectral parameters, we applied Discriminant Function Analysis and Principal Component Analysis, as well as Kruskal-Wallis tests to confirm differences among notes. To determine variation among individuals we

applied a cross correlation and a Principal Coordinates analysis for note/syllable. Finally, we conducted a playback experiment to determine whether nesting females differed in their response to vocalizations of the focal male, an unknown male, and a control vocalization of another parrot species. Male vocalizations to the incubating female consisted of 18 main notes (98% of the vocalizations), whereas the female's answering vocalization consisted of 8 principal notes (95% of the vocalizations). In both 2010 and 2011, we found significant differences and Principal Coordinates Analysis demonstrated spatial separation among individuals for the most frequent male notes B and C and the syllable BCC, and for the most frequent female note C2. This was confirmed by the significant values of the Mantel test. Finally in the playback experiment, females responded with significantly greater intensity to vocalizations of their focal male, compared to an unknown male and the control. The high diversity of vocalizations used by nesting Lilac-crowned Parrots may indicate greater cultural evolution, or the existence of local geographic variation for this species. Our methodological emphasis on characterization of notes, compared to onomatopoeic call classification provides greater resolution in vocal characterization. The existence of inter-individual variation and pair recognition could be an important aspect of reproductive behavior, ensuring that the female only leaves the nest-cavity when her male is present. Failure to recognize or synchronize activities between the nesting pair may have repercussions in leaving the nest contents vulnerable to predation or loss of the nest-cavity to conspecifics.

**SAT13.9 Montgomerie, Robert**, (Queen's University, Kingston, Canada); Lyon, Bruce (UC Santa Cruz, Santa Cruz, CA, United States)

#### WHY BIRDS SING AT DAWN

Despite 30 years of interest—including several theories and a dozen or more field studies—we are still in the dark about why birds sing at dawn. To date, most studies have been focussed on detailed analyses of patterns in a single species that shows a clear dawn chorus. We suggest that important insights can be gained by comparative studies of variation in the presence and intensity of a dawn chorus—why do some species show a clear dawn chorus, while others do not? Using comparative field data from Australia, California, the French Pyrenees, and high arctic Canada, we examine patterns of variation among species in the occurrence and intensity of the dawn chorus to test the most compelling theories to explain this apparently widespread feature of many songbird communities. Interspecific patterns in the timing and intensity of crepuscular singing (both dawn and dusk), and the absence of such choruses in a few species, provide some support for the idea that the timing of major bouts of singing is a component of male advertisement to neighbours and both current and potential mates. The main question is whether birds sing in these choruses because that is the time that singing is either most or least costly energetically, and thus whether the timing is maintained by signal honesty.

**S7.4 Mooers, Arne**, (Simon Fraser University, Burnaby, Canada); Jetz, Walter (Yale University, New Haven, United States); Joy, Jeff (Simon Fraser University, Burnaby, Canada); Hartmann, Klaas; Redding, Dave (Canada); Thomas, Gavin (University of Bristol, Bristol, United Kingdom)

#### MEASURES OF EVOLUTIONARY ISOLATION AND CONSERVATION OF BIRDS

Species with fewer close relatives may warrant increased conservation attention because of their more isolated place on the tree of life: such species represent rarer solutions to evolutionary problems. We now have data and approaches (i) to

identify the most evolutionary isolated bird species, both currently and projected into the future; (ii) to map their occurrence and co-occurrence with other bird species; and (iii) to integrate this information with knowledge of current conservation status. This in turn allows us to identify both lineages and places where focussed conservation attention may most efficiently preserve the evolutionary history of the class Aves.

**PS1.236 Moore, Dave**, (Canadian Wildlife Service, Environment Canada, Burlington, Canada); Weseloh, Chip (Canadian Wildlife Service, Environment Canada, Toronto, ON, Canada)

#### BREEDING SITE TENACITY AND PRODUCTIVITY OF COMMON TERNS NESTING IN THE NORTH CHANNEL OF LAKE HURON.

While breeding site fidelity is thought to be high for the Common Tern (*Sterna hirundo*) in general, there is evidence of high rates of turnover for breeding sites in the Laurentian Great Lakes. The objectives of this study were to: (i) determine the ecological factors affecting site fidelity and breeding success in this species and, thereby, (ii) identify the appropriate scales for monitoring and conservation efforts. During 2008-2012, we surveyed Common Tern breeding colonies on northern Lake Huron, and recorded the number of nests in June to assess site tenacity. In 2010 and 2011, we enclosed 10-30, 3-egg clutches at each of 4-5 colonies per year, and collected data on: egg size, hatching success, chick morphology and nestling survival to 21 d. There was considerable within-season movement of terns among colonies. Despite a net gain of nests between the first and last week of June 2008, nests declined at 4 (15%) of 27 colonies, 8 (30%) sites were abandoned and 7 (26%) new colonies were established. We also observed inter-annual variation in site use, despite similar maximum annual nest counts (2,805 in 2008; 2,983 in 2010; 3,066 in 2011). Of the 27 sites occupied in 2008, 20 (74%) were not re-used and 5 new colonies were established in 2010; 5 of 12 (42%) colonies occupied in 2010 were abandoned and 10 new sites were established in 2011. In 2010, mean hatching success was intermediate ( $1.3 \pm 1.4$  eggs/clutch) and variable (range=0-2.4 per site); higher hatching success was observed in 2011 ( $2.4 \pm 1.0$  eggs/clutch; range=1.8-2.9 per site). In contrast, nestling survival to 21 d was low in both years (2010: mean brood size = 0.08, range=0- 0.22 per site; 2011: mean=0.25±0.61, range=0-1.40 per site). The apparent causes of egg and chick loss were related to weather/storm surge at some sites and predation at others. The observed low site tenacity and poor breeding success may have important implications for population dynamics in this region. Results for the 2012 breeding season will be presented, as well as, an assessment of the ability of occupancy models (incorporating habitat variables) to predict of breeding success, site use and colony persistence in this species.

**PS2.76 Moore, Janet**, (Bird Studies Canada, Port Rowan, Canada); Barry, Karen (Bird Studies Canada, Delta, BC, Canada); Couturier, Andrew (Bird Studies Canada, Port Rowan, ON, Canada); Davidson, Pete (Bird Studies Canada, Delta, BC, Canada); Marquez, Sandra (Bird Studies Canada, Port Rowan, ON, Canada)

#### IMPORTANT BIRD AREAS OF CANADA: PROTECTION STATUS AND STEWARDSHIP

The Important Bird Areas (IBA) Program aims to identify, monitor, and protect a global network of discrete sites for the conservation of the world's birds and other biodiversity. A site is recognized as an IBA only if it meets certain standardized,

quantitative, and defensible criteria. The majority of Canada's IBAs regularly support significant numbers of breeding or migratory birds; other IBAs have been recognized because they regularly support significant numbers of threatened birds (IUCN/COSEWIC listed). In European Union countries, IBAs are safeguarded (Directive 2009/147/EC); in Canada, IBAs are afforded varying degrees of protection if they overlap with one of our officially designated protected areas (e.g. National Parks). The degree of protection is correlated to IUCN classes, which are recognized by the United Nations and many national governments as the global standard for defining and recording protected areas. Our analysis, using the federally supported CARTS database of protected areas, reveals that almost 70% of our nearly 600 IBAs exhibit little (<20%) or no overlap with designated protected areas, leaving many vulnerable to development/harmful activities. Where IBAs do overlap with designated protected areas, roughly half of the overlap is in areas where protection is rigorous (IUCN classes 1A - II). The remainder occurs in protected areas where a range of human activities may be permitted, such as logging and mining; some protected areas are designated for recreational pursuits (IUCN classes III-VI). The Canadian IBA Program complements state laws and policies drafted for the purpose of conserving bird populations. Conservation of Canada's IBAs - irreplaceable bird hotspots - will depend on communities and partners that are committed to the IBA Program, engaged in IBA stewardship, and effectively advocating for their protection. Towards this, networks of volunteer "Caretakers" are working to safeguard IBAs through a variety of activities, including habitat enhancement, education and outreach, and advocacy. Caretakers are helping to ensure that information about threats, habitats, and bird populations is up-to-date and accurate. We also report on these activities in British Columbia and Nova Scotia, where these efforts are advanced.

**PS1.171 Moran, Alison**, (Rocky Point Bird Observatory, Victoria, Canada); Hoebel, Michael (Hummingbird Project, Rocky Point Bird Observatory, Victoria, BC, Canada); Teo, Roy (Hummingbird Project, Rocky Point Bird Observatory, Victoria, BC, Canada); Elwell, Sue; Finlay, J. Cam (Hummingbird Project, Rocky Point Bird Observatory, Victoria, BC, Canada); Moran, Jonathan (Royal Roads University, Victoria, BC, Canada)

#### SWOLLEN ANKLES: CAN TARSAL SWELLING BE USED TO DISTINGUISH BETWEEN RUFOUS HUMMINGBIRDS THAT ARE ACTIVELY NESTING AND THOSE THAT ARE PASSING THROUGH?

A problem in establishing migratory connectivity in species with extensive breeding ranges, is uncertainty in deciding whether a bird is breeding at a given banding station or still passing to or from its eventual breeding destination.

In *Selasphorus rufus*, the presence of an egg and cloacal condition are indicators of breeding. However, these are only temporary indicators and the cloaca soon reverts to its pre-egg laying state, after eggs have been laid. Thus, females show no cloacal differences for most of the time that they are tending a nest. Further, hummingbirds do not develop a brood patch. Therefore, it is not possible to distinguish between females that are sitting on nests and those that are passing through.

However, tarsal swelling has been observed in nesting females of many North American hummingbird species. This condition lasts longer than cloacal changes and can, therefore, be used as a proxy indicator of current reproductive activity.

Using data from a number of sites in Southern British Columbia, we investigated the use of tarsal swelling as a proxy indicator of

breeding status. This indicator may enhance our discriminatory capabilities with regards to locally nesting birds and transitory migrants.

**PS1.211 Morrison, Ashley**, (Thompson Rivers University, Kamloops, Canada); Reudink, Matthew (Thompson Rivers University, Kamloops, BC, Canada)

#### STRUCTURAL PLUMAGE COLOURATION AS AN INDICATOR OF DIRECT REPRODUCTIVE BENEFITS IN THE MOUNTAIN BLUEBIRD (*SIALIA CURRUCOIDES*)

Ornamental plumage colouration in birds can be a reflection of individual quality and is often important in mate choice. Multiple studies have shown that male plumage colouration reflects different aspects of individual quality, indicating direct or indirect benefits the female would gain from pairing with that male. Some females also display ornamental plumage colouration; however the function of female colouration is less understood. Mountain Bluebirds (*Sialia currucoides*) are sexually dichromatic, where the male displays full body, UV-blue plumage colouration, while the females are more subdued, with colour focused in the rump and tail region. Female colour in the closely related Eastern Bluebird (*Sialia sialis*) is correlated with condition, reproductive success, and maternal care. This project explores whether both male and female Mountain Bluebird colouration can indicate direct reproductive benefits to potential mates. We examined multiple body regions in both males and females to determine whether individuals paired with brightly coloured mates gained higher levels of parental care and reproductive success, using reflectance spectrometry to quantify plumage colouration. We predict that bright plumage colouration in both male and female Mountain Bluebirds may function as an indicator of quality and be under sexual selection.

**T11.1 Morrison, Kyle W.**, (Massey University, Palmerston North, New Zealand);

#### DOES A MIGRATION CARRYOVER EFFECT UNDERLIE INDIVIDUAL VARIATION IN EXTREME EGG-SIZE DIMORPHISM IN EASTERN ROCKHOPPER PENGUINS?

Penguins of the genus *Eudyptes* are unique among birds, in that their first-laid A-egg is 56-84% the mass of the second-laid B-egg. Although the degree of egg-size dimorphism varies among the 7 species of the genus, obligate brood reduction is typical of each, with most fledged chicks resulting from the larger B-egg. Many authors have speculated upon why *Eudyptes* penguins have maintained a 2-egg clutch, and why it is the first-laid egg which is so much smaller than the second, without producing robust hypotheses. After *Eudyptes* penguins return from their wintering grounds they fast at their nest sites between arrival and laying (the pre-laying period). A recent study of Macaroni Penguins (*Eudyptes chrysolophus*), a species with extremely size-dimorphic eggs, has shown that the degree of egg-size dimorphism of individual females is inversely correlated with the duration of their pre-laying period. In other words, females with a greater overlap between egg-formation and migration lay more dimorphic eggs, suggesting a physiological conflict. The authors argued their result supported the hypothesis that extreme egg-size dimorphism in *Eudyptes* penguins results from a physiological constraint imposed by a migratory carryover effect, but this hypothesis has yet to be examined in any other species.

I tested the 'migration carryover effect' hypothesis in Eastern Rockhopper Penguins (*E. chrysolophus*) on Campbell Island, New Zealand, by recording the arrival and laying dates, and egg masses of transponder-tagged females. On average, female Rockhopper Penguins had a pre-laying period 4 days longer than that of Macaroni Penguins, a result congruent with

the lesser degree of egg size dimorphism of Rockhopper Penguins. Also in agreement with the hypothesis, I found an inverse relationship between the degree of egg size dimorphism and the duration of the pre-laying period. Female arrival date was negatively correlated with the duration of the pre-laying period, in agreement with previous studies which found that female penguins adjusted their timing of laying towards synchrony with conspecifics. These results support the 'migration carryover effect' hypothesis, but suggest that individual variation in the duration of the egg formation period may contribute to individual variation in the degree of egg size dimorphism in Eudyptes penguins.

**SAT10.3 Morrissey, Christy,** (University of Saskatchewan, Saskatoon, Canada); Pollet, Ingrid (Acadia University, Wolfville, NS, Canada); Ormerod, Steve (Cardiff University, Cardiff, Wales, United Kingdom); Elliott, John (Environment Canada, Delta, BC, Canada)

#### PACIFIC SALMON AS A SOURCE OF PERSISTENT ORGANIC POLLUTANTS TO AMERICAN DIPPERS

Spawning salmon enhance productivity in Pacific Northwestern streams and lakes through deposition of nutrients from their decomposing carcasses. However, studies also report increased biotransport of persistent organic pollutants in lakes and resident fish, although no studies have conclusively shown this in rivers. We tested the prediction that salmon enhance contaminants in river food webs, particularly in the American dipper (*Cinclus mexicanus*), an aquatic songbird and a recognized indicator of stream quality. Over 3 years, we analyzed 29 dipper eggs and aquatic invertebrate samples from 14 different rivers in 10 catchments in southern British Columbia, Canada to assess whether variations in autumn salmon spawning density were reflected in dipper egg contamination or stable carbon and nitrogen isotopes.  $\delta^{13}\text{C}$  isotope signatures, but not  $\delta^{15}\text{N}$ , in aquatic invertebrates and dipper eggs increased among catchments in proportion to the average density of spawning salmon. Concentrations of brominated flame retardants (PBDEs), DDT metabolites and chlordane compounds were related in part to the  $\delta^{13}\text{C}$  measure of salmon spawner density but mercury, chlorobenzenes and PCBs were explained better by dipper trophic level. We conclude that spawning Pacific salmon increase the availability of salmon fry as dipper prey and are a significant source of PBDEs, DDTs and chlordanes to river ecosystems. However, contrary to lake studies, post-spawn concentrations of legacy PCBs in river birds, even in salmon-rich rivers, were not significantly higher than would be expected from atmospheric deposition alone.

**PS2.94 Morse, Joshua,** (Oberlin College, Wellesley, United States); Garvin, Mary (Oberlin College Department of Biology, Oberlin, OH, United States); Whelan, Rebecca (Oberlin College Department of Chemistry, Oberlin, OH, United States); Bonner, Stephanie (Oberlin College Department of Biology, Newark, DE, United States); Halperin, Abby (Oberlin College Department of Biology, Berkley, CA, United States)

#### VOLATILE COMPOUNDS IN GRAY CATBIRD (*DUMETELLA CAROLINENSIS*) UROPYGIAL SECRETION INFLUENCE ATTRACTION OF THE MOSQUITO *CULEX PAPIENS*

Avian chemical defenses are poorly understood but may serve important functions in protection against predators and arthropod vectors of disease. If chemical defenses protect birds from environmental factors that can decrease fitness, then they are traits on which natural selection may act. The uropygial gland is one source of volatile chemicals that may influence

these interspecific interactions. We characterized the volatile components of Gray Catbird (*Dumetella carolinensis*) uropygial secretions and identified five abundant compounds that could be involved in interspecific communication: acetic acid, propanoic acid, butanoic acid, 2-methylpropanoic, and 3-methylbutanoic acid. We hypothesized that these five volatiles mediate interactions between catbirds and *Cx. pipiens*, and tested the prediction they would influence attraction of *Cx. pipiens* in food choice bioassays. We compared the number of landings by female mosquitoes between feeding surfaces treated with a given volatile compound at nano-molar, micro-molar, or milli-molar concentration, and a de-ionized water control. We found that surfaces treated with acetic acid attracted more mosquitoes than control surfaces. We also found that propanoic acid, butanoic acid, 2-methylpropanoic, and 3-methylbutanoic acid attracted fewer mosquitoes relative to controls. The degree of attraction varied with volatile concentration. As a metabolic by-product, acetic acid may serve as a cue used by mosquitoes to locate an avian blood meal. The other four acids may serve to repel *Cx. pipiens*. Whether the remaining acids are produced in response to selective pressures or are obtained through the diet is the focus of future research.

**W13.6 Mortensen, Jennifer,** (Tufts University, Medford, United States); Reed, Michael (Tufts University, Medford, MA, United States)

#### THE ROLE OF SOCIAL BEHAVIOR IN BUFFERING POPULATIONS FROM EXTINCTION: PERSISTENCE OF THE ENDANGERED COOPERATIVELY BREEDING WHITE-BREASTED THRASHER ON ST. LUCIA

In small populations, aspects of species' behaviors are directly relevant to extinction risk. For example, some social behaviors can accelerate the extinction of small populations (i.e., Allee effect). In contrast, little attention has been paid to the possibility that some social behaviors could ameliorate effects of population decline and help buffer small populations from extinction. Cooperative breeding may be one such social behavior because (1) cooperation may minimize density dependent feedback when adult numbers increase and (2) helpers are a pool of potential breeders. Here we propose that cooperative breeding buffers the short-term population dynamics of the endangered White-breasted Thrasher after significant habitat loss. We tested our hypothesis by comparing demographic and behavioral data collected before, immediately after, and five years after habitat loss. Nest success did not change significantly over time, with success rates of 37%, 31%, and 35% in the three time periods, respectively. A similar pattern was seen in other measures of reproductive success. Conversely, cooperative breeding behavior significantly increased after habitat loss. Although groups did become significantly larger, the increase in sociality was mainly driven by a shift from a population comprised largely of territorial pairs to one comprised largely of cooperative groups. Our results suggest that facultative cooperative breeders may be buffered from the negative demographic effects typically experienced in crowded populations after large-scale habitat loss. These results will aid in understanding the buffering capacity of social behaviors and ultimately lead to improvements in extinction risk assessments of small populations.

**SAT13.2 Moseley, Dana,** (UMass Amherst, Amherst, United States);

#### FEMALE PREFERENCES ARE INFLUENCED BY EARLY EXPERIENCE AND MALE VOCAL PERFORMANCE

Female mating preferences are a crucial component of sexual selection, yet we have limited knowledge of how female

preferences develop. Multiple factors may shape female mate choice including experiential learning, social copying, and a sexually selected bias for certain male traits such as the performance level of displays. The first factor seems particularly likely for bird species in which males learn their songs. Moreover, adult, wild-caught females of this species are known to prefer songs of relatively high-performance, i.e. songs that are physically difficult to produce. I here studied female preference development in the swamp sparrow (*Melospiza georgiana*), using a new method to elicit preferences from lab-raised birds. In 2009, I hand-raised females and tutored them with songs of normal-performance levels. As further training in their first spring, I presented songs again but this time coupled with videos of adult females responding with a copulation solicitation display (CSD). This method successfully led hand-reared females to give CSDs the following summer. I was thus able to use the CSD assay to test female preferences for songs they had experienced during ontogeny, against these same songs altered to higher and lower performance levels. Females gave significantly fewer CSDs to low-performance songs than to the trained (normal-performance) songs. Females also responded with the most CSDs to trained songs overall, but this value did not differ significantly in pairwise comparison to the high-performance songs, responses to which were intermediate. A greater response to trained songs implies a strong influence of early experience in shaping female preference, although this preference can also be biased in favor of high-performance songs. It thus appears that both experiential learning and a bias for high-performance guide female preference development.

**PS2.224 Mota-Vargas, Claudio**, (Instituto de Ecología, Xalapa, Veracruz, Canada); **Gonzales-Garcia, Fernando** (Instituto de Ecología, Xalapa, Canada)

#### FREQUENCY OF RESPONSE, RELATIVE ABUNDANCE AND DENSITY ESTIMATES OF *DENDRORTYX BARBATUS* IN COATEPEC, VERACRUZ, MEXICO

*Dendrortyx barbatus* is a bird endemic of the Eastern Sierra Madre in Mexico and is classified as "Vulnerable" by the IUCN. This species is difficult to observe in the field, complicating its study and explaining why there is little information pertaining to its life history and biology. However, it is known that this species responds to "playback". The objective of the present study was to determine the frequency of response, and to estimate its abundance and density. The study was completed in Coatepec, Veracruz, Mexico (July 2004 - June 2005), using two sampling methods for the species' detection: 1) 12 distinct localities were visited, covering different distance between 300 and 1800m in length and 2) two localities (permanent) were visited covering distances of 1km in length. In both methods, the localities was visited at monthly intervals and applying the playback technique every 100m. In all cases the type of vegetation was identified. We obtained a frequency of response of 0.2 responses per sampling point, during the year, (the 67% of responses was obtained between July and October). A relative abundance of 2.75 groups/km and an average density of 0.024. groups/ha. We obtained a 63.8% of the responses in Cloud Forest. We suggest to search this species in summer and autumn. *D. barbatus* is less conspicuous than other species of the same family (Odontophoridae) and the estimated density is the lowest when comparing with other similar species. The preservation of Cloud Forest is indispensable for the survival of the species.

**PS1.89 Moulton, Colleen**, (Idaho Department of Fish and Game, Boise, United States);

#### ASSESSMENT OF PEAK DETECTION PERIODS FOR SURVEYING SECRETIVE MARSH BIRDS IN IDAHO

Wetland loss and degradation has resulted in growing concern about the group of species that are dependent upon emergent marsh habitat. Secretive marsh birds are arguably one of the least understood and least studied group of waterbirds. Their secretive nature makes them difficult to observe and even harder to measure population sizes or trends. To ensure sufficient detection rates of marsh birds for assessing population sizes and trends, as well as to make the most efficient use of limited resources, it is important to determine the appropriate timing to conduct surveys for target species in the region of interest. However, this type of assessment is rarely done prior to launching a marsh bird monitoring program. As Idaho considers establishing a statewide monitoring program for secretive marsh birds, we analyzed data collected from 57 survey routes within 30 wetlands throughout the state between 2005 and 2010 to determine the peak detection periods for the target species sora, Virginia rail, American bittern, pied-billed grebe, and Wilson's snipe. For each species, we assessed whether detectability was influenced by season, time of day, or survey zone. The results of this project will be used to guide future monitoring of secretive marsh birds in Idaho.

**W11.4 Moulton, Laurel**, (University of Manitoba, Winnipeg, Canada); **Vallender, Rachel** (Environment Canada, Gatineau, PQ, Canada)

#### EVIDENCE OF GENETIC INTROGRESSION FOUND IN LAST REMAINING "PURE" POPULATION OF GOLDEN-WINGED WARBLERS

Extinction by hybridization and genetic introgression has been implicated across a range of taxa. Habitat modification, climate change, and species introductions have increased rates of hybridization worldwide. The Golden- and Blue-winged Warbler hybridization complex is a system in which genetic introgression results in the replacement and subsequent local extirpation of Golden- by Blue-winged Warblers within 50 years of secondary contact. The purpose of our study was to screen the final remaining genetically "pure" populations that occur in Manitoba, Canada. A 3.0% (cytochrome- b ) to 4.5% (NDII) mitochondrial sequence divergence has been documented between the ancestral mitochondrial genomes of these species. We used PCR and fragment digest with a restriction endonuclease to assign individuals to their ancestral haplotype group. A mismatching phenotype and mitochondrial genotype indicated a past female-line hybridization events in the individual's ancestry. We screened 57 individuals from SE Manitoba and 12 from W Manitoba, all sampled in 2011. Two individuals were identified as Brewster's Warblers, therefore by definition were introgressed. In addition, one individual from W Manitoba showed mtDNA introgression as revealed by a mismatch between the phenotype and mitochondrial haplotype. All sampled birds from Manitoba were found to be "pure" as recently as 2010, but our results reveal that genetic introgression has begun. It remains to be seen if and how quickly a hybrid swarm will develop, but if the same pattern of rapid Golden-winged Warbler replacement that has been observed in many other locations also occurs here, this species may be facing genetic extinction in Canada.

**PS1.74 Mounce, Hanna**, (Maui Forest Bird Recovery Project, Makawao, United States); **Raisen, Claire** (DICE, University of Kent, Canterbury, United Kingdom); **Leonard, David** (Pacific Cooperative Studies Unit, Honolulu, HI, United States);

Groombridge, Jim (DICE University of Kent, Canterbury, United Kingdom)

CONTEMPORARY GENETIC DIVERSITY AND TRANSLOCATION PLANS FOR AN ENDANGERED HAWAIIAN HONEYCREEPER, THE KIWIKIU (MAUI PARROTBILL; PSEUDONESTOR XANTHOPHRYS)

The Kiwikiu (Maui Parrotbill; *Pseudonestor xanthophrys*), with a population of ~500 individuals, is currently restricted to 40 km<sup>2</sup> of wet rainforest on the windward side of east Maui, Hawaii. Historical records indicate that a drier, koa dominated forest was preferred habitat for Kiwikiu. Establishing a second population is a high priority recovery action and habitat management of the Kahikinui area of leeward east Maui is ongoing to support this action. While translocation is an important conservation tool which has contributed to the recovery of endangered species, it is important to consider the genetics of the founders used to establish new populations. To this end, blood samples were taken from 120 Kiwikiu to evaluate the current genetic structure of the population. To evaluate nuclear DNA, we developed a species specific microsatellite library and genotyped individuals across 14 polymorphic loci. Heterozygosity was examined for individuals captured east and west of the Koolau gap to determine whether this dominant landscape feature is a dispersal barrier. To evaluate mtDNA, we sequenced a section of the control region to examine nucleotide and haplotype diversity. The current genetic diversity in the population will inform the following: 1) how many individuals are needed for translocation, and 2) what individuals should be selected. Measuring genetic parameters before undertaking intensive management efforts is crucial to understanding their potential effects on translocation success. Kiwikiu proved to have higher levels of heterozygosity east of the Koolau gap and individuals from this area will be given a higher value for translocations.

**T13.12 Moyle, Robert**, (University of Kansas, Lawrence, United States); Andersen, Michael (University of Kansas, Lawrence, KS, United States); Filardi, Christopher (American Museum of Natural History, New York, NY, United States)

DENSER SAMPLING OF PACIFIC MONARCHS REVEALS UNEXPECTED RELATIONSHIPS BUT CLEARER BIOGEOGRAPHIC PATTERNS.

Monarchine flycatchers have colonized widespread archipelagos across the tropical Pacific, and diversified into a variety of body sizes and shapes. Using sparse taxon sampling, we previously showed that the genus *Monarcha* was paraphyletic, and in fact comprised several distinctive Pacific endemic genera. Using denser taxon and character sampling and expanding the taxonomic scope to include all Pacific monarchines, we revisited phylogenetic relationships in the family and recovered a well-resolved phylogeny that clarified several outstanding issues in monarch evolution. Australo-Papuan taxa were sister to all major clades, suggesting Australasian origins and identifying three major, independent radiations that colonized the Pacific to varying extents. Surprisingly, the genetic data did not support monophyly of the homogeneous genus *Mayrornis* and raised a number of additional systematic issues. This more complete phylogeny of monarchs also allowed analysis of morphological and phylogenetic community structure, which indicated a diverse yet closely related radiation centered around Fiji, and allows comparison to organisms with differing life histories, such as frogs and lizards.

**PS2.51 Murphy, Sean**, (USGS - Forest and Rangeland Ecosystem Science Center, Corvallis, United States); Haig,

Susan (USGS - Forest and Rangeland Ecosystem Science Center, Corvallis, OR, United States); Matthews, John (Conservation International, Corvallis, OR, United States); Miller, Mark (USGS - Forest and Rangeland Ecosystem Science Center, Corvallis, OR, United States); Schmidt, Travis (USGS - Fort Collins Science Center, Fort Collins, CO, United States)

PREDICTING AND MANAGING CLIMATE CHANGE IMPACTS ON SEMI-ARIDLAND WETLANDS, SHOREBIRDS, AND THEIR PREY

Anthropogenic climate change is altering aquatic ecosystems worldwide. As a result of these abiotic changes, shorebirds and their aquatic prey that depend on such wetlands are likely to experience significant shifts in range, phenology, and population structure, particularly in arid and semi-arid regions and thus already limited in water quantity and quality. We are developing a modeling framework to determine landscape-level impacts of climate change on wetlands and wetland-dependent species in semi-arid areas of North America's Great Basin. The assessment of these impacts is not straightforward and requires a broad, integrative approach. We will determine the scope of abiotic impacts from climate change using remote sensing and ground-level monitoring to create models of the relationships between water volume, water quality, weather, and climate. We will assess the scale of wetland connectivity by using landscape-level population genetics of aquatic invertebrates that serve as key prey species for Great Basin shorebirds. Subsequently, we can use projections of future climate conditions to model how wetland habitat quality and species connectivity will change in the coming decades and ultimately link these to shorebirds that depend on these wetlands. The Great Basin is critically important to several waterbird species and contains five sites that surpass Western Hemisphere Shorebird Reserve Network (WHSRN) Hemispheric Importance status. Our approach may serve as a general model for understanding population- and community-level climate impacts and provide a sound base for conservation planning and adaptive management by resource managers at several WHSRN sites.

**PS2.229 Murphy, Troy**, (Trinity University, San Antonio, United States); Pham, Tiffany (Trinity University, San Antonio, TX, United States)

CONDITION AND BRIGHTNESS OF STRUCTURAL BLUE-GREEN: MOTMOT TAIL-RACKET BRIGHTNESS IS RELATED TO SPEED OF FEATHER GROWTH IN MALES, BUT NOT IN FEMALES

In many avian species, both males and females maintain elaborate coloration. There is strong support for the hypothesis that elaborate female color can be maintained by sexual or social selection; however, most research on female coloration has focused on pigmentary-based colors, and less is known about how structural colors are maintained. Both sexes of the Turquoise-browed Motmot (*Eumomota superciliosa*) have a blue-green racket-tipped tail, and it remains unknown if tail coloration serves as a sexual or social signal in one or both sexes. Here, we describe sexual dichromatism in the blue-green portion of the tail racket, and we test for a relationship between coloration and condition, as indicated by growth bars. Tail color of both sexes has a similar spectral shape, and there is significant, although moderate, sexual dichromatism: males are brighter than females, and males have marginally greater blue-green saturation than females. The amount of feather grown per day is positively related to overall feather brightness, but this relationship is only present in males. The relationship between male coloration and condition suggests that tail color has the potential to convey information about individual quality during



mate choice or contest competition. The lack of a similar relationship in females suggests that female tail color does not convey the same condition-dependent information that we suggest may be reflected by male color. Female tail color may therefore reflect other aspects of condition, be involved in other (non-condition dependent) forms of communication, or be expressed as a non-functional byproduct of genetic correlation between the sexes.

**PS2.148 Murray, Les**, (Penn State Abington, Abington, United States); Best, Louis (Iowa State University, Ames, IA, United States)

#### QUANTITATIVE ANALYSIS OF NEST-SITE SELECTION BY COMMON YELLOWTHROATS (*GEOTHYLPISTRICHAS*) IN SWITCHGRASS FIELDS IN IOWA.

The Common Yellowthroat (*Geothlypis trichas*) is an abundant species that breeds in a variety of habitats in North America. Nest sites for this species are described as areas with dense vegetation, but quantitative descriptions of nest-site selection are scarce. We quantified nest-site selection for 137 nests in switchgrass fields in Iowa in 1999 and 2000. The fields used were assigned to one of three harvest treatments (nonharvest, complete harvest, partial harvest) to study the effects of harvesting switchgrass as a biofuel on birds. Vegetation variables were measured at the nest within three days of the failure or fledging and at random points in each 0.5 ha of the field every two weeks. Each nest was matched with the nearest vegetation point and vegetation variables were compared using conditional logistic regression. Vegetation variables considered were the forb-grass ratio, amount of standing dead vegetation, litter depth, amount of switchgrass, and visual obstruction (a measure of vegetation height and density). We also used interactions between harvest treatment and vegetation to examine the effects of biomass harvest on nest-site selection. If a model including an interaction of harvest type and a vegetation variable had more support than a model with only the vegetation variable the interaction term was used in future modeling. Vegetation and date interactions also were tested but were not important explanatory variables. The logistic model with the most support included the forb-grass ratio by harvest interaction, amount of dead vegetation by harvest interaction, litter depth, proportion of vegetation in switchgrass, and visual obstruction as explanatory variables. Akaike variable weights ( $w$ ) supported the forb-grass ratio by harvest interaction ( $w=1.00$ ) and the dead vegetation by harvest interaction ( $w=0.99$ ) as the two most important variables in nest-site selection. Visual obstruction ( $w=0.78$ ), litter depth ( $w=0.75$ ), and proportion of switchgrass ( $w=0.63$ ) also were important nest-site selection variables. Common Yellowthroats selected for areas with more forbs and dead vegetation in areas with dense vegetation, deep litter, and more switchgrass. Harvesting of the fields changed nest-site locations with stronger selection for areas with more forbs and dead vegetation used more in nonharvested and partial harvested fields than in completely harvested fields.

**W13.3 Myles, Falconer**, (Bird Studies Canada, Port Rowan, Canada);

#### ARE BANK SWALLOW POPULATIONS ERODING AWAY?

Declines of aerial insectivorous birds are of growing conservation concern. The Bank Swallow (*Riparia riparia*) population in Canada has declined substantially over the last several decades (-8.9% annually), especially in eastern Canada and the cause of the decline is still mostly speculative. Monitoring large numbers of Bank Swallows on a large regional scale can be difficult because of the species' clustered colonial

distribution and since breeding habitat is dynamic over space and time (e.g., eroding riverbanks). We studied a relatively stable (i.e., annually present) Bank Swallow population along the north shore of Lake Erie to estimate the size and distribution of the breeding population and determine factors affecting nest success and habitat selection. We estimated over 100,000 individuals breeding in our study area in 2010 and 2011; the largest reported concentration of breeding Bank Swallows worldwide. However, the number of breeders decreased substantially (-34%) between the two years of our study. Breeding habitat was characterized by reduced tree cover above banks and colony size was positively related to vertical bank height. Daily nest survival rates were exceptionally high (0.987), but most nest failures were attributed to bank collapse. Our results suggest that the dynamic processes of bluff erosion govern both habitat suitability and fitness for breeding Bank Swallows. Thus, managing bluff erosion processes according to habitat requirements of Bank Swallows may be effective for conservation purposes.

**YIA1 Naka, Luciano**, (Universidade Federal de Roraima, Boa Vista, Roraima, Brazil);

#### TIMING OF AVIAN DIVERSIFICATION AND THE ROLE OF AMAZONIAN RIVERS IN THE SPECIATION PROCESS

Large Amazonian rivers are known as important biogeographical barriers since Wallace returned from the Amazon in 1852. Some of these rivers are now known to delimit the boundaries of dozens of primate and hundreds of avian taxa. Whereas it is quite clear that Amazonian rivers act as biogeographical barriers, their role in the diversification process remains uncertain. To address this question, we collected mtDNA sequence data from 60 avian taxon pairs, from 22 different avian families, whose distributions are delineated by the lower Rio Negro and the Rio Branco. We used a combination of distributional, phylogeographic, and phylogenetic data to evaluate the role of these rivers in the speciation process. Against the predictions, we show that although the upper portions of large Amazonian rivers represent a much weaker biogeographical barrier for birds than its wider lower stretches, the headwaters of the Rio Negro do not represent areas of widespread gene flow and species homogenization as previously suggested. We also show the lack of evidence of simultaneous divergence among 44 pairs of taxa that replace across the lower Rio Negro. Furthermore, our data from these pairs suggest that the separation of these pairs spanned through several geological ages, including the Pleistocene, the Pliocene, and even the Late Miocene, rejecting the idea that a single vicariant was responsible for the many pairs of taxa divided by the Lower Rio Negro. Our approach to test for simultaneous divergence among pairs of co-distributed taxa using Approximate Bayesian Computation also rejects the role of the Rio Branco as a primary barrier. On the other hand, our results support the idea that 14 pairs of taxa divided by the upper Rio Negro are the result of a common diversification event. Finally, we show that most pairs of taxa divided by the Rio Branco are not each other's closest relatives, but on the contrary, most pairs divided by the upper Rio Negro are mostly sister taxa. Together, our results downplay the role of rivers as a diversification mechanism capable of explaining the formation of the rich Amazonian avifauna, suggesting that they may represent yet another possible mechanism in a more complex history of Amazonian diversification.

**SAT13.8 Narango, Desiree**, (The Ohio State University, Columbus, United States); Rodewald, Amanda (The Ohio State University, Columbus, OH, United States)

## VARIATION IN SIGNAL INFORMATION WITHIN URBAN BIRD SONG

Communication systems, which rely upon specific social contexts and environments that permit effective transmission, are particularly vulnerable to disruption by anthropogenic disturbance. Indeed, recent studies have implicated anthropogenic noise as a cause of changing bird song in urban areas. Urban-associated variation in the transmission or reception of song can profoundly influence conspecific interactions in ways that ultimately affect fitness; however, the evolutionary and ecological consequences of altered songs remain poorly understood. We hypothesized that relationships between song attributes, morphology and annual reproductive output would change with urbanization. We investigated this hypothesis by measuring vocalizations and monitoring the breeding behavior of 45 individually-marked male Northern Cardinals (*Cardinalis cardinalis*) at eight sites distributed across a rural to urban gradient in Columbus, Ohio in 2011. At each site, we measured the amount of development within 1 km and created ambient noise profiles which confirmed that noise increased with surrounding urbanization. We found that the relationship between morphometrics and song attributes varied across landscapes for some, but not all, song characteristics. Relationships between body size/condition and song length were consistent, such that the largest males in the best condition sang the shortest songs with the fewest syllables. On the other hand, relationships between size/condition and syllable rate or minimum frequency appeared to be landscape-dependent. In urban landscapes alone, larger males in the best condition sang songs with higher minimum frequencies and faster rates. The association between song attributes and reproduction also varied with landscape, such that males with the shortest songs and the least number of syllables fledged more young, but only in rural landscapes; In urban landscapes, greater numbers of young were fledged by birds with the longest songs. Our results indicate that, in addition to favoring modifications that promote effective transmission in noisy environments, cities may also change the usefulness of song as a signal of quality or reproductive potential. To our knowledge, ours is the first study to investigate potential fitness and information consequences of song variation in urban systems and give new insight into micro-evolutionary processes operating within novel environments.

**SS.1 Navarro-Sigüenza, Adolfo G.**, (Museo de Zoología, Departamento de Biología Evolutiva, Universidad Nacional Autónoma de México, Mexico City, Mexico);

### ORNITHOLOGY IN MEXICO: WHERE HAVE WE BEEN AND WHERE SHOULD WE GO

Mexican Ornithology represents an excellent example of the development of Biodiversity studies in Latin America, from the analysis of culture-rich traditional knowledge to the application modern frontier science. Here I present an evaluation of avian studies conducted in Mexico, stressing in surveying scientific publications and collections, indicating the main fields of research, most-studied avian groups, and the regions where most work has been conducted. I also analyze the impact of Mexican participation in scientific literature through time and compare how the proportion of publications in which local scientists participate has been increasing to a very significant level to the present. This serves to highlight the most important research areas for which Mexican scientists contribute, as well as avian groups and regions which require greater attention in tropical ornithology in general.

**F14.10 Neal, Mike**, (HawkWatch International, Glenwood, United States);

## PROJECT BLACK HAWK: YEAR 1 RESULTS OF AN UNCONVENTIONAL STUDY FOCUSED ON THE BREEDING SEASON HABITAT USE BY MIGRATORY COMMON BLACK HAWK (*BUTEOGALLUS ANTHRACINUS*) IN SOUTHWEST NEW MEXICO

In 2010 HawkWatch International (HWI) initiated a pilot study to assess the efficacy of establishing a long-term research endeavor focused on the Common Black Hawk (*Buteogallus anthracinus*) population of southwest New Mexico. We documented an initial nest success rate ( $n=9$ ) of .67 and common anthropogenic causes of nest failure. In 2011 we instituted Year 1 of Project Black Hawk, designed to encompass HWI's three mission driven departments: Conservation, Science, and Education. Our objectives were to employ this three-pronged approach to: gain a better understanding of the species' seasonal habitat use, assist wildlife and land managers in achieving recommended Common Black Hawk (CBHA) vital rates and conservation goals, assess regional population trends, and teach young people the importance of umbrella species. Conservation efforts included: fencing a 20 acre livestock exclosure of riparian foraging habitat, planting of 50 mature Arizona Alder trees, and employing mitigation measures directed at reducing the proximate human disturbance of CBHA monitoring nests. Education programs ( $n = 15$ ) reached 450 4th and 5th grade students and over 100 adults in a two county area. The combination of these efforts resulted in a 19 percent increase in the observed nest success rate ( $n=11$ ) to .86. An expanded raptor inventory survey, encompassing 209 km of the Gila and San Francisco Rivers, established a baseline CBHA territory occupancy rate ( $n=29$ ) of .83. As a riparian obligate species, we theorized that local landscape scale components of in-stream and riparian structure relative to prey abundance and/or accessibility might drive nest site selection and fidelity. We conducted Rapid Bioassessment Protocol (Barbour et al.1999) stations at active, inactive, and randomly selected points ( $n = 30$ ) to begin assessing correlations between habitat characteristics and CBHA nest use. The full logistic model ( $AIC = 30.32$ ) indicated the potential importance of channel flow status and geomorphic complexity ( $AIC = 26.23$ ). The parameter estimates indicate a slight negative effect of channel flow status on the odds of finding a nest and a stronger positive effect of geomorphic complexity on the odds of finding a nest. Project Black Hawk illustrates how an unconventional approach to long-term study design can deliver short-term success.

**PS2.200 Negro, Juan Jose**, (Estación Biológica de Doñana, Sevilla, Spain);

### MONITORING OF BIRD POPULATIONS AND THEIR HABITATS USING SMALL UAS

We will describe aerial surveys using small UAS (unmanned aerial systems) for monitoring birds and their habitats in Doñana National Park, southern Spain, and surrounding areas. The equipment used for these applications, (mainly low-cost UAS incorporating different cameras and guiding technologies for each misión), the methodology used in different types of flight and the qualification and the training needs of the staff employed in different tasks will be thoroughly explained. Examples of surveys based on SUAS technology will include: 1. Lesser Kestrel's (*Falco naumanni*) foraging habitat selection: the track obtained from animals equipped with gps-dataloggers was replicated with SUAS in order to characterize the foraging habits of this bird of prey, which have some important implications to preserve the species. 2. Black Ibis (*Plegadis falcinellus*) and Slender-billed Gull (*Larus genei*) colony monitoring: nest mapping in inaccessible areas. 3. Habitat characterization of Baillon's Crake (*Porzana pusilla*): spatial

analysis of the habitat preferences of this cryptic species. 4. Monitoring of mass mortality events: collaboration with the forest service of Doñana National Park for the location of dead birds in remote lagoons and marshlands. We will also include recommendations on flight altitude and direction in order to minimize the possible impact of SUAS in areas of high environmental value.

**PS2.64 Nelson, G. H.**, (North Georgia College and State University, Dahlonega, United States); Crook-Hill, J. R. (North Georgia College and State University, Dahlonega, GA, United States)

#### MONITORING OF A GOLDEN-WINGED WARBLER RESTORATION PROJECT IN GEORGIA

Golden-winged Warbler (*Vermivora chrysoptera*) populations are declining throughout much of their range, and the decline has been especially extreme in Georgia where the species has been close to extirpation. Habitat loss is thought to be a major factor in the species' decline in the Southeast, and in 2010, the U.S. Forest Service and the Georgia Department of Natural Resources began a habitat enhancement project involving selective logging and controlled burns on Brawley Mountain, the only location in Georgia where Golden-winged Warblers are currently known to breed. We have established a monitoring program of the Brawley Mountain population in an effort to assess the effectiveness of the habitat manipulations. Here we report the early results of the monitoring program. We will continue to report on the status of the population in subsequent years.

**PS1.138 Nelson, S. Kim**, (Oregon Cooperative Fish and Wildlife Research Unit, Corvallis, United States); Barbaree, Blake; Dugger, Bruce (Oregon State University, Corvallis, OR, United States); Newman, Scott (Food and Agricultural Organization, Rome, Italy)

#### BREEDING ECOLOGY OF MARBLED MURRELETS IN PORT SNETTISHAM, SOUTHEAST ALASKA

Little is known about the reproductive biology of Marbled Murrelets (*Brachyramphus marmoratus*) in Alaska and new data on nest location and breeding success are important to understanding the life-history strategies and conservation needs of this elusive seabird. In the southern portion of its range, a combination of ground-based forest surveys, radio-telemetry, and roads have allowed researchers to locate and gain access to Marbled Murrelet nests. In largely inaccessible areas, such as Port Snettisham, a mainland fjord in Southeast Alaska, a combination of radio-telemetry survey methods was necessary to locate nesting areas, monitor breeding behavior, and determine nesting success. During 2006-2008, we captured and radio-marked 119 Marbled Murrelets at Port Snettisham. Thirty-seven inland nest locations were identified during aerial surveys; 16 in trees, 19 on cliffs, and 2 in unknown habitat types. Hatching success was 43.9% ( $n = 41$ ; includes 4 re-nest attempts) and fledging success was 35.7% ( $n = 14$ ; 4 nest attempts with unknown fate not included). Overall breeding success was 0.15 chicks fledged per breeding pair per year ( $n = 33$ ). Our estimate of breeding success is the first for Alaska and is similar to estimates from other areas, but is lower than expected for an area with limited anthropogenic disturbance. A low reproductive rate within relatively pristine and remote nesting habitat indicates the need for further research investigating marine resource trends, predation, and causes of low breeding success, including comparisons with murrelets in other parts of Southeast Alaska.

**PS2.211 Nemeth, Zoltan**, (University of California Davis, Davis, United States); Krause, Jesse; Campion, Andrew (University of California Davis, Davis, CA, United States); Ramenofsky, Marilyn (University of California Davis, Davis, United States)

#### PHYSIOLOGICAL MECHANISMS ASSOCIATED WITH MIGRATORY TRAITS IN THE WHITE-CROWNED SPARROW, *ZONOTRICHIA LEUCOPHRYS*: A COMPARATIVE STUDY

Every spring billions of birds migrate north to breed then return to the south to overwinter, each site offering seasonal resources that increase overall fitness. The energy to fuel migratory flight is stored, used and replenished repeatedly in the form of lipids and protein throughout the migratory periods. The physiological mechanisms associated with energy metabolism during preparation for migration and arrival at the breeding and wintering grounds however, are poorly understood. In order to identify specific traits associated with migration, we compared two subspecies of White-crowned Sparrow: a long distance migrant, *Z.l. gambelii* and a resident, *Z.l. nuttalli*. For migrants, we sampled at both the wintering (Davis, CA) and breeding (Fairbanks, AK) grounds during the periods of (a) preparation for spring migration, (b) arrival at the breeding ground, (c) preparation for fall migration and (d) arrival at the wintering ground and commensurate times for the resident birds (Bodega Bay, CA). Here, we present seasonal profiles for steroid hormones (corticosterone, testosterone and  $5\alpha$  dihydrotestosterone) as well as morphological and histological data of lipid and muscle stores. Our study shows that migrant profiles exhibit seasonal accretion and utilization of mass and protein associated with seasonal migratory departure and arrival; whereas, the residents show little change throughout. This has led to the suggestion that the physiological traits associated with migration have been lost with resident life history.

**PS2.250 Neudorf, Diane**, (Sam Houston State University, Huntsville, United States); Bogrand, Ashley; Brent, Tyler; Horstman, Elisabeth (Sam Houston State University, Huntsville, TX, United States)

#### DO CAROLINA WREN FLEDGLINGS EXPERIENCE LOWER SURVIVAL IN AN URBAN ECOSYSTEM?

Fledgling songbirds experience high levels of mortality the first week they leave the nest because they are unable to fly well and they are inexperienced with predators. Urbanized habitats may present additional challenges to survival such as reduced cover and introduced predators. Carolina Wrens (*Thyothorus ludovicianus*) are resident songbirds of the eastern United States in which pairs stay together and guard a territory throughout the year. They are found in a wide variety of forested habitats including residential areas with mature trees and shrubs making them an ideal species in which to investigate fledgling survival in urbanized ecosystems. We compared Carolina Wren fledgling survival, movement and habitat use in a forested (natural) compared with an urbanized ecosystem. We predicted that fledgling survival would be lower in the urbanized ecosystem due to the presence of non-native predators and due to the lower availability of desirable habitat for fledglings to occupy. We radio-tracked fledglings for up to two weeks post-fledge and mapped their movements. Preliminary findings suggest that fledgling survival is lower and their movements much more limited in the urban ecosystem. High predation on fledglings from domestic and feral cats may explain the lower success in the urban ecosystem but further investigation is needed.

**PS1.118 Newberry, Gretchen**, (Oregon State University, Philomath, United States);

#### DIFFERENCES IN DIET COMPOSITION OF COEXISTING VIOLET-GREEN AND TREE SWALLOWS DURING OFFSPRING PROVISIONING

Closely-related species that are ecologically similar may coexist because of partitioning in the types of food resources they use. We studied the sympatric and ecologically similar Violet-green Swallow (*Tachycineta thalassina*) and Tree Swallow (*T. bicolor*) to assess whether these species diverged in the food resources they provision to their offspring. Diet samples were collected from 41 adults (34 Violet-green Swallows and 7 Tree Swallows) that were captured in nest boxes while provisioning offspring during the first half of the nestling stage. Diet samples were analyzed to assess the size and taxonomic affiliation of prey items. Overall, 16 invertebrate orders were found in diet samples, with most orders being provisioned to offspring in both species. Our analysis found that the two swallow species diverged in the relative contribution of Hymenoptera they provisioned to offspring, but the contribution of Diptera was similar between the two species. Based upon our data, these coexisting *Tachycineta* swallows appear to diverge little in the composition of the diet they provision to their offspring, perhaps because of food resource availability at our study area.

**T12.1 Newbrey, Jennifer**, (Columbus State University, Columbus, United States); Paszkowski, Cynthia (University of Alberta, Edmonton, AB, Canada)

#### A COMPARISON OF BREEDING BIRD HABITAT QUALITY BETWEEN NATURAL AND RESTORED WETLANDS USING A NOVEL YOLK CAROTENOID APPROACH

In an effort to mitigate the loss of wetlands and the corresponding impact on wetland-dependent bird populations, many prairie wetlands have been restored and recreated throughout North America. While most studies assess the quality of restored wetlands using bird surveys, more detailed data on reproductive parameters are needed to fully understand how restoration ultimately affects bird populations. We compared levels of an important egg constituent, yolk carotenoids, of Red-winged (*Agelaius phoeniceus*) and Yellow-headed Blackbirds (*Xanthocephalus xanthocephalus*) breeding on natural and restored wetlands in central Alberta to determine if restored wetlands provided female blackbirds with critical reproductive resources at levels similar to those at natural sites. We also conducted breeding bird surveys, collected emerging aquatic insects, quantified water chemistry and landscape-level parameters of each wetland, and determined the carotenoid content of damselflies, an important food source for both species of blackbird. In 2008, female Red-winged Blackbirds breeding on natural wetlands had the highest concentrations of carotenoids in their eggs, suggesting that natural wetlands provided better breeding habitats than restored sites. In 2009, there was a severe drought and we found contrasting results with female Red-winged Blackbirds breeding on restored wetlands having the highest concentrations of carotenoids. Using our survey data, we found no difference in avian species richness, avian abundance, total insect abundance, or damselfly abundance between recently restored, restored, and natural wetlands. However, both avian species richness and abundance were positively correlated with wetland size and avian abundance was positively correlated with total nitrogen concentration, a measure of wetland productivity. The results of our study indicate that natural wetlands provided birds with

better reproductive resources than restored wetlands during non-drought conditions.

**PS2.152 Newell, Felicity**, (Klamath Bird Observatory, Ashland, United States); Stephens, Jaime (Klamath Bird Observatory, Ashland, United States); Sean, Mohren; Sarr, Daniel (National Park Service, Ashland, United States); Alexander, John (Klamath Bird Observatory, Ashland, United States)

#### PROVIDING A REFERENCE FOR THE FUTURE: LANDBIRD ABUNDANCE AT NATIONAL PARKS IN SOUTHERN OREGON AND NORTHERN CALIFORNIA

Long-term monitoring of protected areas can provide a reference for altered environments, and contribute to understanding dynamics of natural ecosystems. As part of the national inventory and monitoring program of the National Park Service, the NPS Klamath Network and Klamath Bird Observatory established a protocol to monitor long-term landbird population trends at six parks in southern Oregon and northern California. Parks in the region include a diversity of ecosystems from high elevation coniferous forest to shrub-steppe, temperate rainforest, chaparral, and oak woodlands. At the five larger parks 25–35 sites were established using a stratified random approach within a designated sampling frame. The first sequence of breeding season point count and vegetation surveys were completed at each park from 2008–2010. We estimated breeding density and population size for top species at each park using distance sampling. We examined current spatial distribution of species within each park in relation to habitat features, such as plant communities and elevation. We highlight some examples of how species abundance could change in relation to possible future scenarios, such as climate change.

**F11.10 Newell, Patti**, (University of Georgia, Athens, United States); Foss, Carol (New Hampshire Audubon, Concord, NH, United States); Cooper, Robert (Smithsonian Migratory Bird Center, Washington, DC, United States); Greenberg, Russell (University of Georgia, Athens, United States)

#### SURVIVORSHIP AND LANDSCAPE USE OF BREEDING AND POST-BREEDING RUSTY BLACKBIRDS IN NORTHERN NEW HAMPSHIRE

The Rusty Blackbird (*Euphagus carolinus*) winters in the southeastern United States and breeds in the boreal and Acadian forests of New England, Canada and Alaska. The species has experienced a possible 85-95% overall decline continent-wide with accelerated rates of population decline during the 1970s. The reason for the decline trend remains unclear but determining landscape requirements to increase survivorship during breeding and post-breeding may be critical for long-term management of the species. We studied Rusty Blackbird nest success, adult and fledgling post-breeding survivorship, adult between-year survivorship and landscape use in New Hampshire from 2009 to 2012 via radio-telemetry and banding efforts. We developed a species distribution model using ARCMAP and logistic regression in R. We used program MARK to calculate estimates for daily nest survival, within-season daily fledgling and adult survivorship, and between-year adult survivorship. We used an information-theoretic approach to evaluate the relative plausibility of a nested set of models using Akaike's Information Criterion. The most parsimonious model included slope, drainclass, and habitat for predicting Rusty Blackbird landscape use. Survivorship estimates indicate between year adult success and within season fledgling success are relatively low. Our results suggest that landscapes with more coniferous saplings, and lower slope and drainclass increases the probability of a Rusty Blackbird using a habitat within 500 m of a stream

system. Landscape variables and nest, adult and fledgling success should be considered when managing for breeding Rusty Blackbirds.

**SAT16.11 Newhouse, Michael**, (New Jersey Meadowlands Commission, Lyndhurst, United States); Farnsworth, Andrew (Cornell Lab of Ornithology, Ithaca, NY, United States)  
MIGRATION MONITORING IN AN URBAN ECOSYSTEM: A COMPARISON OF TWO YEARS OF ACOUSTIC AND BANDING DATA

Few studies examine relationships between bird banding data and acoustic monitoring of nocturnal migrants passing over the banding locations. Here, we present results from two years of simultaneous banding and acoustic monitoring in The New Jersey Meadowlands, Hackensack, NJ. This location is a diverse mosaic of habitats that includes tidal, brackish, freshwater and forested wetlands, first successional meadows, and scrubland within an urban landscape. The Erie landfill and the surrounding restored wetland provide multiple habitats that are beneficial to North American migratory birds. The Erie landfill, only 5 miles from New York City, is 37 acres of four distinct early successional microhabitats. Harrier Meadow, a newly restored 77 acre marsh, contains a significant stand of scrub/shrub habitat that provides several resources for migrants. We captured 3,173 and 4,716 birds in 2010 and 2011, respectively. In 2010, we banded 77 species and in 2011 82 species were found. In total, 91 species have been captured over the 2 years of study. During the two years we recorded more than 42,000 flight calls of 46 species, 24,540 and 18,500 in 2010 and 2011, respectively. Preliminary analysis suggests that these two methods of monitoring show some strong correlations for banding days closest to nights with the biggest call counts; however, the effects of weather and artificial lighting may be potential sources of extreme variation between high nocturnal call counts and low apparent captures.

**S10.8 Newman, Amy**, (University of Guelph, Guelph, Canada); Mitchell, Greg (University of Guelph, Guelph, Canada); Norris, Ryan (University of Guelph, Guelph, ON, Canada)  
EFFECTS OF EARLY-LIFE CONDITIONS DURING NESTLING DEVELOPMENT ON ADULT PLASMA CORTICOSTERONE LEVELS AND ANNUAL REPRODUCTIVE SUCCESS IN WILD SAVANNAH SPARROWS

Early-life conditions can have profound and lasting effects on physiology and behaviour throughout an individual's lifetime. For example, in captive songbirds, nutritional stress or corticosterone treatment during early-life has been related to changes in hypothalamic-pituitary-adrenal (HPA) axis function, brain development and behavior during adulthood. However, how the effects of early-life stress are manifested in the wild are not well described. Using a long-term marked population of migratory Savannah sparrows (*Passerculus sandwichensis*) on Kent Island (Bay of Fundy, NB) with high natal philopatry, we examined the effect of early-life conditions (number of nestlings per nest, nestling condition, fledge date) on HPA axis function during adulthood, and subsequent reproductive success. We monitored breeding success and return rates between 2008-2011. To evaluate the effect of early-life conditions on HPA axis function during adulthood, blood samples were collected at baseline and after acute restraint (30 min) from 52 yearlings that were born on the study site the previous year and for which the number of nest-mates was known (range 2-5 nestlings per nest). For these yearlings, we then monitored the timing of breeding and the number of young fledged, as well as reproductive

success in subsequent years. Controlling for environmental variables, we describe the relationship between early-life conditions, plasma corticosterone concentrations and annual reproductive success. This is the first study to comprehensively evaluate the long-term effects of early-life conditions in a wild population.

**W13.10 Newstead, David**, (Coastal Bend Bays & Estuaries Program, Corpus Christi, Texas, United States); Niles, Larry (Conserve Wildlife Foundation of New Jersey, Greenwich, NJ, United States); Dey, Amanda (New Jersey Department of Environmental Protection, Trenton, New Jersey, Canada)  
A UNIQUE POPULATION OF RED KNOTS WINTERING IN SOUTH TEXAS AND USING CENTRAL FLYWAY

Red Knots (*Calidris canutus*) have been considered common in migration along the Texas coast, and uncommon in winter though some records refer to groups of 1,000 or more. The sharp decline in the *rufa* subspecies that utilizes western Atlantic migratory stopovers and wintering areas has been the subject of much research especially in the past fifteen years. Despite a substantial proportion of those birds having been marked with leg flags, virtually none were noted on the Texas coast either during migratory or wintering months. A research and survey effort was begun in October 2009 to mark knots on Texas beaches and use geolocators to determine wintering areas and migratory connectivity. This research has shed light on a population of Red Knots that appears to migrate through the mid-continent (not Atlantic coast). All birds "wintered" in Texas, spending over nine months of the year there, and a bird marked as a juvenile spent the full year in Texas. Migratory stopovers in the Great Plains and Nelson River (Hudson Bay) were used by all breeding-age birds. In fall 2011/12, 10 Red Knots were tracked using radio telemetry to determine specific areas of high usage. Radio signals from marked birds led researchers to discover several key wintering areas in remote parts of the Laguna Madre, and provide a better estimate of a minimum population size. A WHSRN wetland of hemispheric importance, the vastness and remoteness of shorebird habitat makes study of this and other species challenging. Pending research will further explore the nonbreeding life history of, and threats to, this unique population.

**W6.3 Ng, Janet**, (University of Alberta, Edmonton, Canada); Bayne, Erin; Wellicome, Troy (University of Alberta, Edmonton, AB, Canada)  
INFLUENCE OF ENVIRONMENTAL AND ANTHROPOGENIC FACTORS ON FERRUGINOUS HAWK HOME RANGE SELECTION

Ferruginous hawks (*Buteo regalis*) may be threatened by habitat loss to cropland and petroleum development. Previous research has shown they are highly associated with grassland habitat and negatively affected by human disturbance. While grassland conversion to cropland has stabilized in Canada, petroleum development continues to increase and related infrastructure, such as wells, roads, and facilities, can alter the suitability of the landscape for ferruginous hawks. Our study investigates the influence of environmental and anthropogenic factors on home-range selection across a gradient of landcover types and densities of industrial development. We developed a home range habitat selection model using historical nests (n=2,845 nests) located in Alberta and Saskatchewan, Canada and examined selection at three spatial levels, including within the core area (0.4-km radius), home range (2.5-km radius), and landscape (10-km radius) surrounding each nest. Preliminary analyses suggest that amount of grassland or density of human footprint did not influence habitat selection at local spatial

scales. Model validation results from our 2012 field season will also be presented. Understanding how environmental and anthropogenic features influence habitat selection, particularly for species at risk, is necessary for understanding and reducing the potential impact of continued petroleum development.

**PS1.147 Niccoli, Morgan,** (The College of William and Mary, Williamsburg, United States); Leu, Matthias (The College of William and Mary, Williamsburg, United States)

#### ARE OCCUPANCY MODELS FEASIBLE ALTERNATIVES TO COLLECTING DEMOGRAPHY DATA?

As the human population continues to grow, urban land cover will become the dominate land cover world-wide. Unfortunately, habitat loss is detrimental to wildlife populations. In order to support human and wildlife, conservation biologists must find ways to maximize biodiversity while having the least impact on humans' social and economic needs. Tools such as Geographic Information Systems (GIS) and satellite imagery allow researchers to delineate optimal conditions for conservation by identifying land cover types most important for long-term conservation. Land cover types important for conservation can be identified by developing species distribution models. Species distribution models are based on relating species occurrence against environmental variables and human stressors. An occupancy model is a type of species distribution model that measures a species' presence or absence with the assumption that organisms are imperfectly detected. However, to my knowledge, no study has examined whether the probability of occurrence positively correlates with productivity of the species. The objective of this study is to create an occupancy model for a Neotropical migrant bird species and correlate the probability of occurrence with demography data collected during the summers of 2011 and 2012. I predict the a negative correlation will exist between the probability of occurrence and productivity of the Wood Thrush (*Hylocichla mustelina*) because unpaired males tend to sing at higher rates compared to paired males and maybe more likely to be detected.

**W12.1 Nichols, K. Samantha,** (University of Minnesota, Saint Paul, United States);

#### BIRD COLLISIONS FROM AN ARCHITECTURAL PERSPECTIVE: AN ANALYSIS OF A LONG-TERM CITIZEN SCIENCE MONITORING PROJECT

Collisions with windows and buildings are one of the major sources of avian mortality in North America. Estimates of annual mortality from building collisions range from 0.1 to 1.0 billion birds, and one building in New York City had over 900 birds fly into it in one year. In an effort to decrease the rate of avian collisions, various local governments as well as the US Green Building Council are developing standards for bird-friendly buildings that will hopefully minimize avian mortality from collisions. However, the scientific support for these guidelines is poorly established, making it imperative that we understand which architectural features of buildings most strongly affect rates of bird collisions. This study analyzes the results of a citizen-science monitoring program started in 2007 to help answer this question. Volunteers with Project BirdSafe have collected data about bird collisions daily during spring and fall migration in downtown Saint Paul and Minneapolis, Minnesota since the Spring of 2007. To date, more than 2200 collisions have been reported including more than 2000 avian mortalities from the monitoring of 117 buildings. A preliminary analysis of the data shows that buildings, even when adjacent to one another, have sharply different collision and mortality rates. Additionally, some species are more prone to collisions than others. In this talk, I will present a full analysis of these bird-

building collisions and discuss what architectural features are consistent with bird-friendly building.

**PS2.130 Nielsen, Lindsey,** (College of the Atlantic, Bar Harbor, United States);

#### USE OF MID-WATER REGION BY RESIDENT AND TRANSIENT BIRDS ON GREAT DUCK ISLAND: POTENTIAL IMPLICATIONS FOR THE DEVELOPMENT OF OFFSHORE WIND POWER

There is increasing concern in the North Eastern United States about the impact off shore wind power development may have on migratory and resident birds. Risk models that assume a single passage by birds through a given area on migration in spring and fall may under-estimate threats posed to foraging seabirds that may cycle through a portion of ocean multiple times while foraging from a nesting site or during pre- and post breeding dispersal. By assessing the diversity of species, their abundance, and peak times of area use in the mid-water region currently favored by wind development, mitigation strategies can be suggested to reduce the potential "take" or disturbance to local and transitory birds. Seabirds on the water and flying past were recorded every 30 minutes from Great Duck Island Lighthouse, ME between June 10 and July 30, 2010 for a total of 400.5 hours of observation during the hours of 0600-1800. This study provides data on species diversity and population density of the area. Great Duck Island has five resident seabird species: Herring Gull, Greater black-back Gull, Black Guillemot, Leach's storm-petrels, and Common Eiders. In addition 20 transient species were observed. Trends in the abundance of resident and transitory species observed in the mid-water region were significantly influenced by temporal and/or seasonal factors. Of the resident species, the Black Guillemot population showed a negative linear trend, ( $r^2 = 0.789$ ,  $F = 18.75$ ,  $F_{crit} = 5.57$ ,  $p < 0.05$ ). The population of Common Eiders showed a significant seasonal quadratic trend; higher counts observed at the beginning and end of the season, ( $r^2 = 0.88$ ;  $F = 6.12$ ,  $F_{crit} = 4.07$ ,  $p < 0.05$ ). Species diversity through the study period followed a linear trend ( $r^2 = 0.5985$ ;  $F = 7.45$ ,  $F_{crit} = 5.59$ ,  $p < 0.05$ ). Peak species diversity ( $n = 20$ ) was observed between the July 12 – 18.

**PS2.135 Nielson, Ryan,** (Western EcoSystems Technology, Inc, Cheyenne, United States); LeBeau, Chad (Western EcoSystems Technology, Inc, Cheyenne, WY, United States); Young, Dave; Hallingstad, Eric (Western EcoSystems Technology, Inc, Cheyenne, United States)

#### ESTIMATING SPATIAL USE BY GOLDEN EAGLES NEAR A PROPOSED WIND ENERGY DEVELOPMENT

Wind energy development is increasing across the western range of golden eagles (*Aquila chrysaetos*). There is concern over golden eagles being indirectly impacted through displacement and directly impacted by collisions within wind turbines. Collision impacts have been previously documented; however, little is known about the indirect impacts to golden eagles inhabiting areas in close proximity to wind energy development. The United States Fish and Wildlife Service have set forth guidelines to assist wind energy developers in project placement and micro-siting actions to avoid or minimize risks to golden eagles by wind energy projects. A major component of these guidelines is to document golden eagle spatial use near each project site before development. Developing unbiased estimates of spatial use (resource selection) of the proposed project area by golden eagles is possible with location data collected by GPS units attached to eagles. During the winter of 2011, we deployed four GPS/Argos units on adult golden eagles maintaining

territories near a proposed wind project in southern Idaho. We developed seasonal resource selection functions (RSFs) to predict relative probability of selection by golden eagles within the project area. The top models contained predictor variables for distance to nest, terrain ruggedness, and slope, among others. A k-fold cross validation indicated the seasonal models accurately predicted eagle use within the project area.

**W3.2 Niemi, Gerald,** (University of Minnesota-Duluth, Duluth, United States); Howe, Robert (Department of Natural and Applied Sciences, Green Bay, United States); Grinde, Alexis (University of Minnesota-Duluth, Duluth, United States); Danz, Nick (Department of Natural Sciences, Superior, United States); Etterson, Matthew (US EPA, Duluth, United States); Sauer, John (USGS Patuxent Wildlife Research Center, Laurel, United States)

#### BREEDING BIRD COMMUNITIES AND POPULATION TRENDS IN THE WESTERN GREAT LAKES REGION, USA

We sampled breeding bird populations in over 450 forest stands annually from 1995-2011 in three US National Forests: Chequamegon-Nicolet, Chippewa, and Superior of Minnesota and Wisconsin. Methodology included 10-minute, unlimited distance point counts gathered in a randomly, stratified design in proportion to the available forest cover types. Cluster analysis of these data revealed 22 distinct and interpretable forest bird communities. We tested for trends in 87 species of which over half were stable, 38 % increased and only 8% had decreasing trends. Detectability analyses were consistent with trend estimates using raw counts. Comparisons of trends with the USGS Breeding Bird Survey (BBS) for 31 species among 21 routes that broadly overlap with the National Forests produced mixed results. Loud common species were most consistent, while caution is suggested for more secretive species. Positive trends were also noted for most permanent residents using both data sets. Increased over-winter survival, increased number of bird feeders, and potentially the earlier spring emergence of food sources may partly explain their increasing trends.

**PS1.2 Nightingale, Ann,** (Rocky Point Bird Observatory, Saanichton, Canada); Melcer, Ronald (Rocky Point Bird Observatory, Sacramento, CA, United States)

#### NEST AGGRESSION IN PACIFIC WREN (TROGLODYTES PACIFICUS) ON VANCOUVER ISLAND, BC

Several species of wren are known to destroy nests of conspecifics. These include Cactus Wren, Bewick's Wren, Sedge Wren, Marsh Wren, and House Wren in North America. However, none of the recently split Winter Wren complex, now Winter Wren (*Troglodytes hiemali*), Pacific Wren (*Troglodytes pacificus*) and Eurasian Wren (*Troglodytes troglodytes*) have been documented to do so in experiments or by natural behavior observation. Here we present a detailed chronology of a Pacific Wren nesting event, including an instance of conspecific nest aggression. On May 15 2011, in Victoria, BC, Canada, a Pacific Wren nest under surveillance was approached by a non-parental conspecific which was video recorded removing two nine-day-old chicks from the nest. The non-parental adult returned to enter the nest to peck the remaining two chicks several times over a four and three-quarter hour period, but was not successful in removing or killing them. While our findings are limited to the documentation of a single event, we find they are consistent with those of other species, especially within the family Troglodytidae. We hypothesize that both competition for an optimal nest site and/or food resources may have played a role in the observed behaviors.

**PS2.111 Nikofoeruk, Natalie,** (University of Saskatchewan, Saskatoon, Canada); Morrissey, Christy (University of Saskatchewan, Saskatoon, SK, Canada)

#### AGRICULTURAL PESTICIDE USE AND CHANGES IN ABUNDANCE OF GRASSLAND BIRDS IN THE CANADIAN PRAIRIES

Over the past 25 years, grassland birds have shown dramatic and widespread decline in North America. Although explanations have mainly focused on habitat loss; exposure to agricultural pesticides has been found to cause adverse direct and indirect effects on avian populations. We evaluated temporal changes in agriculture, agricultural pesticide use and grassland bird populations in the Canadian prairies between 1966 and 2006. The study involved interpolation and interpretation of GIS maps of Statistics Canada's Census of Agriculture (CCoA) and standardized count data for 22 species of grassland birds using historical data from the North American Breeding Bird Survey (BBS). The project identified overall trends between existing 1966-2003 BBS population trend maps and 1971-2006 CCoA data. Most of the seventeen CCoA variables including use of pesticides increased between 1971 and 2006 which is consistent with the intensification of agriculture over time, while the area of summerfallow with tillage-only decreased over time. Statistically significant ( $p < 0.05$ ) trends were found between changes in CCoA variables such as chemical expenditures and cropland area with BBS declining bird population trends for species such as the McCowan's Longspur. Results from this project indicate that changes in agriculture and agricultural pesticide use are contributing to population declines but are not the only factors influencing grassland birds in the Canadian prairies. This work is a first attempt to understand whether changes in Canadian agriculture and pesticide use are playing a role in grassland bird population declines and will act as a valuable step in assisting future research efforts for this important guild.

**T16.11 Nocera, Joe,** (OMNR - Trent Univ., Peterborough, Canada); Blais, Jules (University of Ottawa, Ottawa, ON, Canada); Beresford, David; Finity, Leah (Trent University, Peterborough, ON, Canada); Grooms, Chris (Queens University, Kingston, ON, Canada); Kimpe, Lynda (University of Ottawa, Ottawa, ON, Canada); Kyser, Kurt; Michelutti, Neal (Queens University, Kingston, ON, Canada); Reudink, Matt (Thompson Rivers University, Kamloops, BC, Canada); Smol, John (Queens University, Kingston, ON, Canada)

#### HISTORICAL INSECTICIDE APPLICATIONS DRAMATICALLY ALTERED THE DIET OF AERIALY-FORAGING INSECTIVOROUS CHIMNEY SWIFTS

A wide spectrum of recent environmental stressors, such as climate change, altered prey abundance, habitat loss, and pesticide use have negatively affected populations of many insectivorous birds and insects. In particular, population levels of aerially-foraging insectivorous birds such as Chimney Swifts (*Chaetura pelagica*) have been declining for several decades. However, the reasons for shifting population abundance of aerial insectivores remain speculative, largely due to the general absence of long-term monitoring data of insects and the diets of birds. Nonetheless, because insectivory is a feature common to all these bird species, it is likely that historical changes in prey populations affected aerial insectivore populations. Here, we report on a 48-year history of dietary composition in the Chimney Swift as determined from examining a guano deposit dating back to 1944. A steep rise in dichlorodiphenyltrichloroethane (DDT) and its metabolites was preserved in this core and coincided with a decline in the

abundance of Coleoptera remains, an increase in Hemiptera remains, and a marked decrease in  $\delta^{15}\text{N}$  values in the guano deposit, suggesting for the first time that insecticide applications altered the diets of insectivorous birds, corroborating evidence that DDT applications decimated Coleoptera populations in the early 1960s. This study presents new insights in discerning population dynamics of aerially-foraging insectivorous populations.

**T17.3 Noel, Brandon,** (Georgia Southern University, Statesboro, United States); James, Bednarz (Arkansas State University, State University, AR, United States)

#### DOES HIGH ANNUAL SURVIVORSHIP RESULT IN HABITAT SATURATION, AND ULTIMATELY DELAYED DISPERSAL OF PILEATED WOODPECKERS?

We present findings on Pileated Woodpecker (*Dryocopus pileatus*; PIWO)

survivorship rates and spatial use dynamics in bottomland hardwood forests of eastern Arkansas. From 2007–2010, we captured, processed, and color-banded 73 PIWOs, and re-sighted individuals through 2011. High mortality rates during the first 2 years of our research influenced our potential to re-sight birds, but we were able to use Program MARK to estimate between year survival rates for 48 adult PIWOs. Our top models suggested that survivorship exceeded 0.80, which represent the highest survivorship estimates reported for any woodpecker to date. In addition, spatial use patterns of PIWOs suggested a mean overlap of 37.5% during the breeding season. Moreover, breeding territories of radio-marked individuals were relatively small ( $\bar{x}$  = 47.1 ha) and did not change between years, suggesting stability in territory occupancy and possible habitat saturation. We documented three dispersal movements by second-year woodpeckers that all occurred during the breeding season. We suspect four additional individuals were in the process of dispersing; three of these were third-year individuals. While more study on delayed dispersal is needed, our evidence suggests that PIWOs have high annual survival, employ delayed dispersal in bottomland hardwood forests habitats, which may be influenced by habitat saturation.

**F16.6 Nol, Erica,** (Trent University, Peterborough, Canada); Falconer, Myles (Bird Studies Canada, Port Rowan, ON, Canada)

#### EASTERN WOOD-PEWEE NEST SURVIVAL IN PINE PLANTATIONS AND DECIDUOUS FORESTS

Approximately 71% of land cover in the Midwest is in agriculture production, with rowcrops being the most prevalent. Most of these rowcrops have replaced grasslands, resulting in declines of their constituent bird communities. Previous research has shown that tillage regimes can affect the suitability of rowcrop fields as wildlife habitat. Originally created as a soil conservation measure, use of no-till agriculture is increasing in areas of intensive rowcrop production. However, it is not yet clear whether this practice benefits wildlife compared to conventional tillage methods. We compared the nesting success, nest predators, and avian communities in tilled and no-till soybean fields. We found 56 nests in no-till soybean fields but only 4 nests in tilled fields. Nest densities were an order of magnitude greater in no-till fields than tilled fields. Our most common nesting species overall were American Robins (*Turdus migratorius*), Mourning Doves (*Zenaidura macroura*), and Red-winged Blackbirds (*Agelaius phoeniceus*), and all were more common in no-till fields. Of the 56 nests found in no-till, 26.8% fledged at least one chick, 57.1% were depredated, and 16.1% failed due to farming practices. These nest success rates agree favorably with published accounts of nesting success in

Midwestern grasslands. Predators observed on camera included Coyotes (*Canis latrans*) and Thirteen-lined Ground Squirrels (*Spermophilus tridecemlineatus*). We counted 14 bird species on no-till survey transects compared to 11 species on tilled transects. Our results identify an important effect of tillage practices on grassland bird breeding success and habitat use. Nonetheless, the management implications of tillage are not straightforward, and more work is needed to determine the potential of no-till fields as ecological traps.

**W16.5 Nolte, Eric G.,** (Dept. Biological Sciences and Raptor Research Center, Boise State University, Boise, United States); Heath, Julie (Dept. Biological Sciences and Raptor Research Center, Boise State University, Boise, ID, United States); Kaltenecker, Gregory (Idaho Bird Observatory, Boise, United States)

#### RAPTORS PRESENT, YET UNOBSERVED: DETECTABILITY AT A WESTERN MIGRATION WATCH-SITE AND ITS EFFECT ON TREND ANALYSIS

Annual counts of migrating raptors are used as indices of population size. Variation in the proportion of the population counted may be a result of varying numbers of raptors available, or varying probability of detection. Accounting for unexplained variation caused by imperfect detection may improve power of trend analyses. We used a dependent double-observer survey at the annual fall raptor migration count at Lucky Peak, Idaho, to estimate the magnitude of variation in detectability. We fitted Huggins closed-capture removal models to estimate the effects of covariates. The model with the lowest AICC included effects of observer identity, distance, wingspan, genus, and day of the season. Competitive models ( $\Delta\text{AICC} < 2$ ) also included wind-speed, cloud cover, and hour of the day. We simulated 30 years of counts of Sharp-shinned Hawks (*Accipiter striatus*) and Northern Harriers (*Circus cyaneus*) with heterogeneous detectability, a 3.6% annual population decline, and a degree of unexplained random variation in the number of available birds to estimate the loss of power attributable to imperfect detectability. Results from the double-observer study demonstrate the importance of controlling observer effort and training at watch-sites, and the potential utility of adjusting counts to account for differences in flight distance. However, in simulations detectability-correction did little to improve power of trend regression when there was realistically high variation in the number of raptors available. Therefore, accounting for detectability by means of double-observer or distance sampling may not be warranted for the purpose of long-term population monitoring. Research efforts should focus on examining the causes of change in the number of migrating raptors available. Analyses of raptor migration counts should address the regional-scale dynamics of migration to enable more timely and precise trend estimation.

**W1.1 Norris, Andrea,\*** (University of British Columbia, Vancouver, Canada); Martin, Kathy (UBC, Vancouver, BC, Canada)

#### A DOUBLE RESOURCE PULSE OF FOOD AND NEST CAVITIES INCREASES INTRA- AND INTER-SPECIFIC COMPETITION IN CAVITY-DEPENDENT INSECTIVORES IN INTERIOR BRITISH COLUMBIA, CANADA

In communities where species interactions are centered on insectivorous excavators providing tree cavities for reproduction (nestwebs), large-scale insect outbreaks can lead to dual pulses of food and nest-sites that may influence species interactions among cavity-dependent insectivores. Resource pulses may either increase direct competition for territories by increasing



energy and potential reproductive benefits for individuals to defend high quality sites (Territory Investment Hypothesis; TIH) or decrease indirect competition by increasing niche overlap, and reducing interspecific dominance of resource specialists over generalists (Ecological Niche Hypothesis; ENH). We monitored reproduction, food and cavity availability, and a large-scale outbreak of mountain pine beetle (*Dendroctonus ponderosae*), during a 15-year study of nestwebs (1995-2009), in interior forests of British Columbia, Canada. We simulated conspecific and heterospecific territorial intrusions using 487 model presentations with song playbacks to examine how resource supply (food and nest-sites) influenced patterns in intra- and inter-specific interactions and fecundity of two insectivores that compete for cavities, at 25 sites, during and after the beetle outbreak. Of 342 responses elicited from the typically subordinate, bark beetle generalists, Mountain chickadees (*Poecile gambeli*), 28% attacked model intruders, but only 10% of 299 Red-breasted nuthatches (*Sitta canadensis*; dominant, bark beetle specialists) attacked the model. Mixed-effects models suggested that both species showed increasing fecundity, and aggression to territorial intruders with increasing beetle abundance, but at highest beetle abundance chickadees shifted to an inter-specific resource defence strategy, and showed higher aggression to nuthatch intruders than to conspecifics. Thus, insectivores increased defence of high quality territories despite expanded niches, providing evidence to reject the ENH but not the TIH. The reversal in the interspecific dominance hierarchy suggests that behavioural mechanisms governing community structure may change dramatically during resource pulses that increase disparity in territory quality.

**S2.10 Norris, Ryan**, (University of Guelph, Guelph, Canada); Taylor, Caz (Tulane University, New Orleans, LA, United States); Winkler, David (Cornell University, Ithaca, NY, United States); Dunn, Peter (University of Wisconsin-Milwaukee, Milwaukee, WI, Canada); Whittingham, Linda (University of Wisconsin-Milwaukee, Milwaukee, WI, United States); Hussell, David (Ontario Ministry of Natural Resources, Peterborough, ON, Canada); Shutler, Dave (Acadia University, Wolfville, NS, Canada); Dawson, Russ (University of Northern British Columbia, Prince George, BC, Canada); Leonard, Marty L (Dalhousie University, Halifax, NS, Canada); Clark, Robert (Environment Canada, Saskatoon, SK, Canada); Horn, Andrew (Dalhousie University, Halifax, NS, Canada); LeClair, Dayna (University of Guelph, Guelph, ON, Canada)

#### MIGRATORY CONNECTIVITY AND LONG-TERM DEMOGRAPHICS IN TREE SWALLOWS

Knowledge of how individuals and populations are spatially connected between different periods of annual cycle is critical for predicting changes in population size and developing effective conservation policies. To date, patterns of migratory connectivity have rarely been used to infer large-scale variation in population dynamics of migratory birds. We undertook a collaborative effort to understand patterns of migratory connectivity in Tree swallows (*Tachycineta bicolor*) using light-logging geolocators with the goal of linking this information to trends in population abundance. Tree swallows nest in human-made boxes and overwinter in large roosts in the southeastern U.S. and Central America. We deployed geolocators on Tree swallows at six breeding populations that have been monitored for multiple decades and that ranged from British Columbia to Nova Scotia. We report linkages between breeding and wintering sites and then show how these patterns of connectivity

provide valuable information to explain long-term annual variation in nest box occupancy.

**PS1.27 Novitch, Nancy**, \*U (University of Minnesota, Twin Cities, Stillwater, United States); Zink, Robert (University of Minnesota, Department of Ecology, Evolution, and Behavior, St. Paul, MN, United States)

#### MIGRATION OF WILLOW FLYCATCHER (*EMPIDONAX TRAILLII*) AND ALDER FLYCATCHER (*E. ALNORUM*) THROUGH THE TUXTLA MOUNTAINS, VERACRUZ MEXICO

Most bird species can be identified by their plumage characteristics. However, there are some species, termed sibling species, for which field identification can only be made with certainty by voice. Two such sibling species are the Alder Flycatcher (*Empidonax alnorum*) and Willow Flycatcher (*E. traillii*). For many years, they were considered the same species, not only because of their similar appearance, but also because the habitat and foraging ecology of both species overlap extensively. However, studies by R. Stein revealed diagnostic vocal differences suggesting they were separate species. Species status was subsequently confirmed by DNA comparisons. Because of difficulty of field identification, the migration biology of these species is relatively unclear. We recently discovered a collection of 150 frozen flycatchers identified as "Traill's flycatchers" that researchers from the Bell Museum, University of Minnesota, collected during spring and fall migration in the mid 1970's in the Tuxtla Mountains of southern, coastal Veracruz, Mexico. We sequenced the mitochondrial cytochrome b gene to identify each specimen to species. Our goal is to determine the relative ratios of each species during spring and fall migration, and the dates of passage. In addition, we are sequencing the same gene from toe pads of study skins to verify identifications provided by collectors and preparators. We will determine what, if any, errors were made by *Empidonax* experts in specimen identification, which will have implications for use of identified museum skins in understanding the migratory biology of these species.

**W17.2 Nuse, Bryan**, (University of Georgia, Athens, United States); Robert, Cooper (University of Georgia, Athens, GA, United States)

#### ON THE FEASIBILITY OF PREDICTING EFFECTS OF SEA LEVEL RISE ON TIDAL WETLAND BIRDS: EXAMPLES FROM THE GEORGIA COAST.

Tidal wetlands along the Atlantic coast of the southeastern U.S. provide unique bird habitats that are characterized by high species turnover along a compressed and often spatially complex salinity gradient. We surveyed breeding marsh and forest birds and coincident vegetation in Georgia's Altamaha River estuary, to identify important habitat predictors of species' distributions within the tidal wetland mosaic. In particular, we sought information necessary to predict changes to bird populations with the onset of accelerated sea level rise (SLR), which is predicted to significantly modify tidal wetland systems. Using occupancy modeling, we found that although some breeding species such as the Clapper Rail (*Rallus longirostris*) appear to occupy almost all available areas within their general habitat types (salt and brackish marsh), others occur in restricted ranges nested within those broader types. Occupancy patterns of the Seaside Sparrow (*Ammodramus maritimus*), for instance, are better predicted by importance values of smooth cordgrass (*Spartina alterniflora*) and distance to nearest upland, than by vegetation class; its range is nested within the full extent of salt

marsh. Least Bitterns (*Ixobrychus exilis*) occur primarily within brackish marsh in our system, but their occupancy patterns are volatile across years. Popular SLR landscape change models such as the Sea Level Affects Marshes Model (SLAMM) predict changes to general vegetation communities. Thus, attempts to interface SLR models with bird habitat associations will vary in feasibility depending on how closely species' distributions correspond to those of broad vegetation types, and how consistent their distributions prove through time.

**T4.3 O'Brien, Erin**, (Edward Grey Institute, Department of Zoology, Oxford, United Kingdom); Dawson, Russell (University of Northern British Columbia, Prince George, BC, Canada)

#### HOST SEX PREDICTS SUSCEPTIBILITY TO PARASITISM AND INFLUENCES PARASITE POPULATION SIZE WITHIN AVIAN BROODS

The intensity of ectoparasite infestations in bird nests often increases with increasing host brood size, suggesting that parasites inhabiting bird nests are resource limited, such that nests containing more hosts provide sufficient resources to support a larger population of parasites. However, there is considerable variation in the intensity of parasite infestation among nests containing the same number of hosts, and the reasons for this variation are not well understood. Individual hosts may vary in their susceptibility to parasitism as a function of their sex and/or immunity. One of the implications of this variation in susceptibility is that the proportion of hosts in a brood that are most susceptible to parasite feeding may limit the resources effectively available to parasites, independent of the actual brood size. We studied sex differences in susceptibility to parasitism and consequences of experimentally enhanced immunity via methionine supplementation, and the implications of effective host availability for parasite population size within nests, using a population of mountain bluebirds (*Sialia currucoides*) parasitized by larval blow flies (*Protocalliphora* spp.). Only female nestlings showed an increase in the rate of mass gain following supplementation, suggesting the benefits of enhanced immunity in the presence of parasites were disproportionately experienced by females. In experimental feeding trials, blow fly larvae consumed larger blood meals when feeding on female hosts, which similarly suggested that female nestlings are more susceptible to parasitism in this system. Blow flies also extracted larger blood meals from control nestlings than those that had received supplemental methionine, indicating that enhanced immunity can deter parasite feeding, but this effect was independent of host sex. The final number of blow flies detected in nests at the end of the brood-rearing period was predicted only by the brood sex ratio: broods that contained more female hosts supported larger final populations of parasites. In combination, these results suggest that female nestling bluebirds may be disproportionately susceptible to ectoparasitism in this system, although this appears to be unrelated to sex differences in immune defense, and that the availability of female hosts may limit parasite population size in nests of some bird species.

**F8.5 O'Brien, Erin**, (Edward Grey Institute of Field Ornithology, University of Oxford, Oxford, United Kingdom); Sheldon, Ben; Hinde, Camilla (Edward Grey Institute of Field Ornithology, University of Oxford, Oxford, United Kingdom)

#### TEMPORAL PARTITIONING OF ENVIRONMENTAL EFFECTS ON THE QUALITY AND PLASTICITY OF A MELANIN-BASED PLUMAGE SIGNAL IN GREAT TITS

Individuals of high genetic quality may be expected to encounter more favourable environmental conditions over their lifetime compared to lower quality individuals. Hence, traits that are responsive to these conditions can function as reliable composite signals of individual genome-wide quality. Plumage ornaments in birds are renewed annually through moult, and so they have the potential to reflect recent conditions such as reproductive effort or social status. There is also increasing evidence that the early natal environment has persistent effects on plumage in adulthood; the degree of plasticity of these traits over the lifetime of an individual will therefore influence the nature and temporal precision of the information that they convey. We studied plasticity and environmental influences on the size of the black ventral breast stripe in great tits (*Parus major*) breeding near Oxford, UK, over two years. This plumage trait has been shown to be heritable and may influence individual social dominance status, as well as female mate choice, and its expression appears to vary in different environments. However, the relative importance of environmental conditions encountered in early life on the expression of this trait in adulthood, and the degree to which individuals modify their investment in this trait between years in response to varying environmental and social contexts, are poorly understood. We will present results of analyses investigating the effects of early natal environment, recent reproductive investment and social context on breast stripe size in male and female great tits, and the fitness consequences of plasticity in the expression of this plumage trait between successive breeding seasons. We will discuss these results in the context of plumage signal reliability and the evolution of female mate preference.

**T11.9 Olalla, Alina**, (Universidad Autónoma de Nuevo León / FCB, San Nicolas de los Garza, Mexico); Ruiz, Gabriel; González, Jose Ignacio (Universidad Autónoma de Nuevo León / FCB, San Nicolas de los Garza, Mexico); CANALES, RICARDO (Universidad Autónoma de Nuevo León / FCB, San Nicolas de los Garza, NL, Mexico); Guerrero, mario (Universidad Autónoma de Nuevo León, saltillo, Coahuila, Mexico)

#### WINTER ECOLOGY OF THE LONG-BILLED CURLEW (*NUMENIUS AMERICANUS*) IN THE SOUTHEAST PORTION OF THE CHIHUAHUAN DESERT, MÉXICO: FIRST STEP TOWARDS ITS CONSERVATION.

Grasslands in our country have been deteriorated because of agriculture and cattle raising and in consequence the loss of many species habitat included the Long-billed Curlew. El Tokio prairie-complex (South-East portion of the Chihuahuan Desert) is ractically one of the last areas of well preserved grasslands in Mexico and supports a large number of wintering Long-billed Curlews, but the little information of their migration patterns and the few studies on the species in our country, does not allow effective conservation measures at North America level. From October 2007 to date we have obtained the following results: a) winter surveys, reporting up to 3,500 individuals in a single sighting. b) winter diet and food availability, 552 pellets were collected and analyzed 145, identification of 17 food items from four groups: invertebrates, reptiles, plants and rocks, pitfall trapping in 3 habitat types for values of biomass. c) capture of 10 specimens for color/metal banding, blood samples (molecular sexing and identification of subspecies), morphometric measures and tagging of 5 satellite transmitters. d) satellite tracking to determine winter habitat use and migratory connectivity, for local movements (Mexico), readings were divided into foraging and roosting sites being the agricultural fields and fallow land the most used as foraging sites (48.2%), we identified 14

roosting sites being the most used the tumbleweed (54%), followed by the rocket or arugula (21.5%). Connectivity between grasslands in Canada, United States and Mexico was established. Two threats to the species in the area were identified: cattle and pesticides.

**PS2.42 Olbert, Jean,** (University of Florida, Gainesville, United States); Olbert, Jean (University of Florida, Gainesville, FL, United States)

#### DETERMINING REASONS OF NESTING FAILURE AND BROOD REDUCTION AT SNAIL KITE (*ROSTRHAMUS SOCIABILIS PLUMBEUS*) NESTS ON THE KISSIMMEE CHAIN OF LAKES IN FLORIDA

When attempting to set up a management plan for an endangered avian species such as the Everglades snail kite (*Rostrhamus sociabilis plumbeus*), it is important to identify both the proximate and ultimate causes of the endangerment. An integral part of determining the proximate causes of a species decline is determining causes of reproductive failure as well as assessing reproductive success. Along with factors of juvenile survival and recruitment, nest success plays a fundamental part in affecting population growth. Documentation of snail kite nesting failure occurred during the 2010 and 2011 breeding season within the Kissimmee Chain of Lakes with a focus on Lake Tohopekaliga, Florida. Throughout the breeding season thirteen causes of nesting failure and brood reduction were documented along with several other potential predators using game cameras. The leading causes of nest failure were abandonment by the adults and predation by yellow rat snakes (*Elaphe obsoleta quadrivittata*). Understanding the causes of nesting failure is essential for the conservation of this increasingly endangered species.

**PS1.215 Oliveros, Carl,** (University of Kansas Biodiversity Institute, Lawrence, United States); Moyle, Robert (University of Kansas Biodiversity Institute, Lawrence, KS, United States)

#### RECONSTRUCTING THE BIOGEOGRAPHIC HISTORY OF PHILIPPINE WHISTLERS REVEALS COMPLEX SCENARIOS OF COLONIZATION HISTORY AND A DISTINCT PALAWAN TAXON

The Philippine archipelago presents an ideal system to study historical biogeographic patterns in birds because of its high rate of endemism, its complex geological history and its strategic location between the species-rich Oriental and Australasian faunal regions. The whistlers (genus *Pachycephala*), a group of insectivorous passerines distributed throughout Oceania, Australia, and southeast Asia, are represented by three endemic species and one non-endemic species in the Philippines. We use a 5-locus dataset and model-based phylogenetic methods to reconstruct the evolutionary history of Philippine whistlers to illuminate patterns of diversification in the archipelago. Analyses using different software and program settings for ancestral area reconstruction reveal different patterns of whistler colonizations in the Philippines. It is uncertain whether the Philippines served as a biogeographic dead end for whistlers, or as a pathway to the rest of Southeast Asia. We detect considerable genetic structure in some populations of the widespread *Pachycephala philippinensis*. Our study also shows that the Palawan population of *Pachycephala cinerea* is distantly related to its putative conspecifics on the Sunda Shelf and merits recognition as a full species.

**PS1.16 Olsen, Aaron,** (University of Chicago, Chicago, United States); Westneat, Mark (Field Museum of Natural History, Chicago, IL, United States)

#### PREDICTING BEAK DYNAMICS: TESTING HYPOTHESES ON THE RELATIONSHIP BETWEEN SKULL SHAPE AND BEAK BEHAVIORS IN ANSERIFORMES

Many birds have a kinetic upper bill in which the upper bill rotates at a hinge with the braincase, termed cranial kinesis. Cranial kinesis depends on kinetic bones behind the upper bill (the quadrate, pterygoid, palatine and jugal) that form four- and five-bar linkage mechanisms, or closed loops of interjointed bones. In human-engineered systems, the dynamic properties of a linkage mechanism depend on the linkage geometry. Applying this principle to biological linkage mechanisms, previous work in fishes has shown that the geometries of biological linkages are informative for inferring the dynamic properties of musculoskeletal systems, however this has yet to be tested in birds. Our most in-depth knowledge of cranial kinesis in birds comes from the mallard, a member of an order, Anseriformes, with a diversity of cranial morphology and pronounced upper bill kinesis. Given this, we have begun a multi-order survey of avian morphology with the order Anseriformes to ultimately test the hypothesis that the geometry of the linkage bones in the avian skull is related to beak dynamics. We collected 3D cranial landmarks of Anseriforms, including semilandmarks of the upper bill that describe the curvature of the culmen and tomium. Adjusting for centroid size, principal component analysis shows correlations among neurocranium shape, linkage geometry and upper bill morphology. Anseriforms with shorter and deeper upper bills (e.g. Cape Barren Goose) have larger nasal apertures, rounder skulls, and a more ventrally oriented occipital region relative to Anseriforms with more elongate upper bills (e.g. Red-breasted Merganser). This variation is also correlated with the geometry of the linkage bones underlying the upper bill: Anseriforms with a more elongate upper bill and flatter neurocranium also have a flatter, or more planar, linkage geometry. Previous studies by other authors have found that, across orders of birds, rounder skulls have a foramen magnum oriented more ventrally than caudally, attributing this reorientation of the skull to expansion of the brain relative to the cranial base. Our preliminary results are consistent with these findings and additionally suggest a broader relationship among neurocranium shape, beak shape and beak dynamics. Using a new 3D computational model of avian cranial kinesis we compare predictions of beak dynamics against behavioral data from the literature to test for patterns between predicted beak dynamics and beak behaviors.

**PS1.51 Olsen, Brian,** (University of Maine, Orono, United States); Evers, David (BioDiversity Research Institute, Gorham, ME, United States); Byrd, Allison (University of Maine, Orono, ME, United States)

#### TOXIN LOAD DECREASES THE CAPACITY OF COMMON LOONS TO ADAPT TO CLIMATE CHANGE

In the face of environmental change, the viability of wildlife populations is continually challenged. Thus a central goal for conservation biologists and evolutionary ecologists is to determine the adaptive capacity of populations. Adaptive capacity is the ability of populations to evolve adaptations to new environmental conditions (genetic change), the ability of individuals to adjust phenotypes adaptively (plasticity), or the ability of populations to evolve plasticity (reaction norm evolution). Slowly reproducing birds with long generation times should possess adaptive reaction norms to deal with historically common environmental variability, like interannual weather differences. The ability of individuals to exhibit these reaction norms, however, may be limited by new changes to the environment. We examined reproductive success in the Common Loon, *Gavia immer*, under a wide variety of weather

conditions for adults that experienced a blood mercury burden that was or was not above the Lowest Observed Adverse Effect Level (3.0 µg/g ww) for the species. For adult loons with low mercury burdens, reproductive success was not predicted by interannual variability in weather conditions (i.e. individuals were able to succeed equally across different environmental conditions). For adult loons with high mercury burdens, however, interannual reproductive success was predicted by interannual weather variability. Birds carrying a significant mercury load were unable to adjust their phenotype adaptively to maintain reproductive success in years with poor weather, although their reproductive success was similar to birds with low mercury burdens in good years. This interaction highlights an important additional impact of environmental toxins, mainly that they have the potential to limit the adaptive capacity of wildlife populations for changes in climate or other environmental characteristics.

**PS2.143 Olsen, Tiffany**, (Rocky Point bird observatory, Victoria, Canada); Pittman, Eric; Lam, Christina; Moran, Alison (Rocky Point bird observatory, Victoria, BC, Canada)  
NEST COMPOSITION AND INTERSPECIFIC COMPETITION FOR NEST SITE IN ANNA'S AND RUFIOUS HUMMINGBIRDS

Anna's hummingbirds (*Calypte anna*) are relatively new to the Southern tip of Vancouver Island (first documented in 1944) and in recent years have become year-round residents in many locations throughout Southern British Columbia. On Vancouver Island, Anna's have been observed breeding successfully at least ten months of the year. These birds are positively influenced by habitat disturbance, and nest in high numbers within urbanized areas. Rufous hummingbirds are smaller, seasonal migrants that breed in Washington State, British Columbia and Coastal Alaska, travelling to these locations in the spring from wintering grounds in Mexico and the Gulf States of the U.S.A. There is little known about interactions between the two species on Southern Vancouver Island during breeding season and there may be significant competition occurring on breeding grounds.

Anna's have been observed reusing abandoned Rufous nests and although this is documented as a rare event, it implies that these species are using similar sites and materials. There is also anecdotal evidence indicating that Rufous hummingbirds no longer breed in several locations where Anna's have become established. This study will look at possible competition by comparing the three dimensional placement and general composition of nests from both species in allopatric and sympatric sites on Southern Vancouver Island.

**SAT16.10 Olson, Bridget**, (United States Fish and Wildlife Service, Litchfield, United States); Sullivan, Kimberly (Utah State University, Logan, United States)  
MIGRATION ECOLOGY OF THE MARBLED GODWIT IN NORTH AMERICA

We equipped 28 Marbled Godwits from four locations in North America with miniature satellite transmitters to determine migration routes, strategy, and connectivity. Godwits captured in Utah (n=13) went to breeding sites in Alberta, Saskatchewan, Montana and North Dakota and wintered along the Baja Peninsula and west coast of mainland Mexico. They used Bear River Migratory Bird Refuge (BRMBR), Utah as a stopover during both north and southbound migration. Godwits captured on Akimiski Island, Nunavut, Canada (n=7) migrated through the midcontinent USA and wintered at sites along the Gulf of California, Sonora, Mexico. Birds captured at Akimiski Island and Utah shared wintering and stopover habitats. Godwits

captured in Georgia on the Atlantic coast (n=6) migrated to breeding grounds in North and South Dakota. Godwits wintering along the Atlantic coast bred in close proximity to those originating from Mexico wintering sites and using BRMBR as a stopover. Godwits tagged on Akimiski Island traveled significantly farther during southbound migration (3862 km) than did godwits tagged in Utah (2533 km) and Georgia (2204 km). Godwits tagged in Utah traveled the shortest distance to the first stopover during southbound migration (670 km). This pattern is characteristic of a "hopping" migration strategy and unlike the intermediate "skipping" distances traveled by godwits from Canada (1925 km) and Georgia (2204 km), to their first stopover. Migration distances affect residence periods with Utah godwits having the shortest residency in winter habitats and Georgia godwits the shortest residency in breeding habitats.

**PS2.195 Ortega-Álvarez, Rubén**, (Iniciativa para la Conservación de las Aves de América del Norte (NABCI-México), Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, Mexico City, Mexico); Sánchez-González, Luis Antonio; Berlanga, Humberto; Vargas, Víctor; Rodríguez-Contreras, Vicente (Iniciativa para la Conservación de las Aves de América del Norte (NABCI-México), Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, Mexico City, Mexico)

BIRDS, PEOPLE, AND CONSERVATION: EXPERIENCES AND OPPORTUNITIES ON THE INTEGRATION OF LOCAL HUMAN COMMUNITIES IN AVIAN MONITORING PROGRAMS IN MEXICO

Avian monitoring is an essential tool to determine strategies for managing ecosystems and conserving biodiversity. Participation of local human communities in bird monitoring programs is decisive as they coexist with birds, have a precise knowledge of the region, and are directly in charge of natural resources use and conservation. The North American Bird Conservation Initiative-Mexico (NABCI-Mexico) together with other federal institutions, have established bird monitoring programs performed by local human communities within important biological areas in southern Mexico. Avian community-based monitoring activities have been focused to: 1) train local people for monitoring birds, 2) assess local bird species distribution, 3) analyze the effects of different productive ecosystems on bird communities, 4) determine management strategies for productive ecosystems, and 5) identify and analyze population trends of indicator species. Currently, about 75 local people have been trained for bird monitoring activities. Success of monitoring activities has been widely variable throughout the region, mostly depending on social factors. Knowledge of local birds has increased regionally as a result of community-based bird monitoring activities. Such information will be crucial in the near future for achieving monitoring goals. Although the network of local bird monitors is growing, there is still a need to acquaint for specific local human necessities to successfully accomplish the objectives of these monitoring programs. Integrating local communities in avian monitoring programs could be a great opportunity to assess the conservation status of bird species and promote human welfare in important biodiversity areas.

**PS2.87 Ortega-Pimienta, Joel F.**, (CICY, Merida, Yucatan, Mexico); Ortiz-Pulido, Raúl (Universidad Autónoma de Hidalgo, Pachuca, Mexico); Leyequien, Euridice (CICY, Merida, Yucatan, Mexico)  
MEXICAN SHEARTAIL (DORICHA ELIZA): IS DECLINING ONE OF ITS POPULATION?

Mexican Sheartail (*Doricha Eliza*) is an endemic, hummingbird inhabiting Mexico. It has two disjunct populations, one in Central Veracruz and another in the North of Yucatan Peninsula. Almost all our knowledge about the species came from the Veracruz population. Here we report recent information gathered from the Yucatan Peninsula population. Preliminary data allow us to say that the Yucatan population: 1) appears to be restricted to a small area (500 km<sup>2</sup>); 2) the half of its main distribution is now impacted by human activities (mainly hotel and residential develops); 3) there area near of 7500 individuals (taking into account optimistic estimates); 4) both populations have similar sexual displays and nest establishment conditions. It is urgent to assess reproductive activities of the species in the Yucatan population, as also determine net population increasing. It is possible that we are witnessing a serious decline in the *Doricha eliza* Yucatan population.

**F11.4 Ortiz-Maciel, Sonia Gabriela**, (ITESM, Monterrey, Mexico); Salinas-Melgoza, Alejandro (UNAM, Uruapan, Michoacan, Mexico); Enkerlin-Hoeflich, Ernesto (ITESM, Monterrey, NL, Mexico)

**MAROON-FRONTED PARROT (*RHYNCHOPSITTA TERRISI*) PRODUCTIVITY AT THE TWO MAIN NESTING COLONIES IN THE SIERRA MADRE ORIENTAL, MEXICO: 1997-2011.**

The Maroon-fronted Parrot (*Rhynchopsitta terrisi*) is an endemic and endangered species that inhabits temperate forests of the Sierra Madre Oriental in Mexico. The species nests colonially, using cavities and crevices in limestone cliffs of several hundred meters high in the northernmost region of its distribution range. Since the interior of the nest cavities is inaccessible, we applied an indirect method based on behavioral observations to obtain parrot's productivity. From 1997 to 2011, we determined reproductive output of nesting parrots at the two most important nesting colonies, as the number of fledglings per successful nest at each colony. These colonies produced an average 1.6 fledglings per successful nest on 562 registered nests. Maroon-fronted Parrot productivity has been linked to forest fires along the breeding range. Since inaccessibility of nesting cliffs reduces the possibility of nests being poached, we consider that species conservation efforts should be focused on habitat conservation. Long-term monitoring has enabled us to understand how the Maroon-fronted Parrot population faces natural disasters. By continuing monitoring, we may be able to detect factors or variations in reproductive output that may impact the entire parrot population and the forests in which they inhabit.

**PS1.128 O'Shaughnessy, Ryan**, (Southern Illinois University Carbondale, Carbondale, United States);

**TESTING THE IDEAL FREE DISTRIBUTION OF SPRING MIGRATORY WATERFOWL ALONG THE WABASH RIVER, ILLINOIS.**

Under the theory of Ideal Free Distribution (IFD) animals are assumed to distribute themselves based on the factor that most limits their fitness. Factors preventing access to available foods include; predation risk, habitat structure, competition, and individual physiology. To help meet the goals of the Upper Mississippi River and Great Lakes Joint Venture, the Illinois Department of Natural Resources is striving to provide sufficient foraging habitat to support the needs of migratory waterfowl. In this light, the objective of the study is to test the level to which waterfowl conform to, or deviate from, an IFD during the spring migration. At the level of the feeding patch and foraging area, we are experimentally manipulating food availability with the addition of corn in 0, or 2000 kg/ha treatments. Duck

abundances on treatment plots are being recorded, as well as habitat features that could possibly deter waterfowl from gaining access to all available foods. Our study will focus on mallards, blue-winged teal, wood duck, ring-necked duck, and lesser scaup. Preliminary results indicate that of the five focal species, blue-winged teal showed the strongest tendency to select habitats based primarily on available food. Mallards were more generalist in their selection of habitats. Food availability, habitat type, distance to vegetation, vegetation type, and the basal coverage of vegetation were important to habitat selection by mallards. Predominant vegetation type was most important to wood ducks when selecting habitats. The distance to the edge of the wetland and the vegetation type of the wetland were the most important variables to lesser scaup habitat selection. When selecting habitats, basal cover and the level of visual obstruction were important to ring-necked ducks.

The continuing loss of wetlands in the United States of America poses immense challenges for waterfowl, other wetland birds, and many other wildlife species. Accurately predicting regional duck distribution and understanding the links among food availability, predation risk, and distribution during spring migration is critical for ensuring that existing habitats are adequate to support desired populations of ducks. By filling important information gaps, this type of study allows wildlife managers to ensure that the limited resources available for wildlife management and habitat restoration are used in a wise and efficient manner.

**T1.4 Oswald, Jessica**, (University of Florida, Gainesville, United States);

**THE EFFECT OF ANDEAN UPLIFT AND PLEISTOCENE CLIMATE CHANGE ON DISTRIBUTIONS OF PASSERINES IN TROPICAL DRY FORESTS**

Neotropical dry forests are characterized by their fragmented distributions, low diversity, and high endemism. Nowhere is bird species endemism higher than in the dry forests in northwestern Peru. This research is focused on understanding the role of abiotic processes i.e. Pleistocene climate fluctuations and the pre-Pleistocene (Neogene) uplift of the Andes, in shaping modern species distributions in Peruvian dry forests using an integrative approach that combines paleontology, ecology, and genetics. I am identifying ca. 2,000 passerine fossils (14,000 years B.P.; late Pleistocene) to determine the role of Pleistocene climatic fluctuations on species distributions. These passerine fossils are the first to be identified from tropical South America and serve as important bioindicators, which aid in the reconstruction of fine-scale climatic conditions and species distributions. I am also combining presence data and ecological niche modeling to determine the abiotic factors that predict species modern distributions. Identifying these abiotic factors allows me to create distribution models for these species during the late Pleistocene that are being validated with fossils. Identification of fossils of dry forest species, *Thamnophilus bernardi*, and semi-deciduous forest species, *Amblycercus holosericeus*, indicates that forests were present at the now arid, depauperate fossil site in the past. Niche model predictions also indicate more extensive forest tracts in NW Peru during Pleistocene glacial periods. Lastly, the patchily distributed dry forests in northwestern Peru contain unique subspecies; I am using genetic data and coalescent analyses to determine if divergence is due to late Pleistocene climate change or older, due to Neogene Andean mountain uplift. Relevance: Neotropical dry forests are little studied and understanding the historical abiotic processes responsible for modern levels of extreme endemism in the region allows for unique insights into mechanisms playing evolutionary roles in dry forests across the Neotropics. Understanding how these endemic species

responded to past climatic change will help predict future responses to anthropogenic climate change and ultimately will inform conservation efforts in NW Peru, an area hyper sensitive to climate perturbations.

**PS2.163 Oteyza, Juan C.**, (University of Montana, Missoula, United States); Martin, Thomas E. (USGS, MT Coop. Wildlife Res. Unit. The University of Montana, Missoula, MT, United States)

#### DO HELPERS INFLUENCE OFFSPRING SIZE? A TEST OF THE CONCEALED HELPER EFFECTS HYPOTHESIS IN A COOPERATIVELY BREEDING TROPICAL PASSERINE.

Offspring size is a critical trait because it has important consequences for survival and reproductive success. Traditionally one of the main factors thought to influence size of dependent offspring (i.e., those that depend on parents for care) is parental food delivery rate, because parental food delivery rate alone determines food available to young. Food availability and size of dependent offspring may be influenced by the number of adults contributing to care. The number of adults caring for young is particularly variable in cooperatively breeding birds, where parents may be aided in parental duties by helpers. However, many studies of cooperative breeding birds have failed to detect an increase in offspring size with an increase in number of helpers. One possibility to explain this paradox, where number of helpers seems to have no effect on offspring size, is the concealed helper effects hypothesis. This hypothesis posits that females in large breeding groups may reduce egg investment which leads to smaller chicks, thus concealing the benefits of the increased feeding rate provided by helpers. We tested the concealed helper effects hypothesis in the Chestnut-crested Yuhina (*Yuhina everetti*), a species endemic to Borneo that breeds cooperatively in groups ranging from 3 to 9 individuals. Preliminary data for this species does not support the concealed helper effects hypothesis. In Chestnut-crested Yuhina females in groups with more helpers did not lay smaller eggs. Moreover, final offspring size (taken prior to fledging) was not strongly correlated with egg size, nestling feeding rates or group size. These results indicate that there may be factors other than egg size or feeding rate that may determine offspring size. We are currently analyzing alternative explanations, including incubation attentiveness and female condition, which may be more important in explaining offspring size in this species.

**PS2.46 Ouedraogo, Alexandra**, (Saint Mary's University, Halifax, Canada); Worth, Kerry; Frasier, Timothy; Barber, Colleen (Saint Mary's University, Halifax, NS, Canada)

#### ROLE OF PARENTAL AGE ON EUROPEAN STARLING (*STURNUS VULGARIS*) BROOD SEX RATIOS

In many avian species, reproductive success increases with age. Several studies have found that females selectively mate with older males when given the opportunity. Others have shown that parental quality had an effect on the primary brood sex ratio; high-quality mates produced a male-biased sex ratio. In European starlings (*Sturnus vulgaris*), throat feathers (hackles) continue to grow over time, and appear to reliably indicate age. Courting males display their hackles to females while singing. Our objective was to determine if brood sex ratio varies with parental age. Specifically, we predicted that older parents would be in better condition than younger parents, and would produce a male-biased brood sex ratio. We found no significant differences in brood sex ratio among first-time breeding pairs and more experienced pairs. Over two years, we found evidence of assortative mating with respect to age. This result may be

explained by mate choice, or by availability of mates. We found that there were significantly more young males and females breeding in the nestboxes in 2007, the first year of our study, than in 2011. Further results will be discussed.

**S11.9 Owen, Jen**, (Michigan State University, East Lansing, United States); Jankowski, Mark (Lewis-Clark State College, Lewiston, ID, United States)

#### AVIAN DISEASE ECOLOGY: FROM THE INDIVIDUAL TO THE LANDSCAPE

In the last century, there has been an unprecedented increase in the numbers of emerging infectious diseases which pose significant risks to wild and domestic animal and human populations and wild birds are considered one of the leading hosts for many of these emerging zoonotic diseases. Disease dynamics are complex, with processes occurring at one level influencing processes occurring at other levels, e.g., individual <-> community <-> landscape. To accurately predict the occurrence and spread of bird-borne pathogens in both avian and non-avian populations we need to employ a multiscale approach. This cross-cutting symposium will showcase research conducted at the various scales on a variety of host-parasite systems, including Hawaiian Passeriformes and avian malaria, Charadriiformes and avian influenza, blood parasites and Vietnamese avifauna, *Mycoplasma gallisepticum* and the House Finch (*Carpodacus mexicanus*), and arthropod-borne viruses and North American Passeriformes. These intrascale presentations will be complemented with those that address the interscale problem of explicitly linking processes at multiple levels using both theoretical and empirical approaches.

**W6.5 Ozelski, Ashley**, (City University of New York Graduate Center, Staten Island, United States); Nott, M. Philip (Institute for Bird Populations, Point Reyes, CA, United States); Manne, Lisa (CUNY College of Staten Island, Staten Island, NY, United States)

#### LANDSCAPE COMPOSITION DIFFERS WITH AGE STRUCTURE IN POPULATIONS OF YELLOW WARBLERS (*SETOPHAGA PETECHIA*) IN THE MIDWEST UNITED STATES

At higher population densities, territorial birds may be distributed according to an ideal-despotic model, in which more competitive individuals secure the best territories. If more competitive individuals occupy larger territories and exclude others from the area, this may skew measures of habitat quality assessed via population density or occupancy. Here, we test the scales at which despotism can be detected in Yellow Warblers (*Setophaga petechia*) of the Midwest United States by utilizing data from the Monitoring Avian Productivity and Survivorship (MAPS) program. We characterized sites as competitive and non-competitive based on bird age and tested differences in relevant landcover types (using two sample t-tests and Wilcoxon rank tests). Proportions of habitat differed significantly between younger and older birds, suggesting either a) competitive exclusion by older individuals or b) lack of experience results in naïve birds settling in sub-optimal breeding habitat. Regardless of mechanism, these results suggest that demographic data are important to include in modeling habitat suitability. Although theoretically reproductive success correlates with bird age and experience, further work is needed to determine if this is empirically true, or if ecological traps confound this proxy for habitat quality. Identifying how landscapes and social dynamics interact with reproductive success provides further insight on

how land management decisions might best be targeted to conserve territorial species.

**PS2.157 Padilla Rangel, Hernaldo**, (Facultad de Ciencias Forestales, Universidad Autónoma de Nuevo León, Linares, Mexico); José Ignacio, González Rojas (de Ciencias Biológicas, UANL, San Nicolas de los Garza, NL, Mexico); Enrique, Jurado Ybarra; Oscar Alberto, Aguirre Calderón (Facultad de Ciencias Forestales, UANL, Linares, NL, Mexico)

#### BIRDS OF THREE FRAGMENTS OF TAMAULIPAN THORN SCRUB AND THE EFFECT OF ANTHROPOGENIC USE HISTORY ON ITS DIVERSITY AND RICHNESS, IN LINARES, NUEVO LEÓN, MEXICO.

In Northwestern Mexico the native vegetation and biodiversity losses are caused by change in land use for agriculture and livestock. The Tamaulipan Thorn Scrub (MET) is the most affected ecosystem. Therefore, the objective of this research was to determine the effect of anthropogenic use on birds by evaluating sites with agriculture (AG), intensive livestock (GI) and pristine conditions (PR). Nine fixed point counts were established per site, spaced at 100m, where every bird observed and/or heard in 25m radius was recorded. Bird abundance, diversity ( $H'$ ), richness of species ( $S$ ) and the composition of feeding guilds was determined. It also developed an analysis of Jacard and Sorensen to see the similarity between sites. For sites AG and GI *Cardinalis cardinalis* was dominant (AG= 13.3%, GI= 25.8%), while in PR *Arremonops rufivirgatus* is the dominant species (18.51%). Diversity and richness are higher in AG ( $H'$ = 2.87,  $S$ = 21) and relatively lower at GI ( $H'$  = 2.25,  $S$ = 14). Terrestrial Insectivores was dominant in all sites. The Jacard's similarity analysis regarding species composition explains that the site PR does not show statistical similarity with the other sites, the Sorensen's analysis for shared abundances shows PR as non similar too. We conclude that site AG is richer and more diverse due to the agricultural matrix surrounding the area, while the GI site shows more guilds because his heterogeneous vegetative structure. There is no similarity of PR site avifauna with the rest, which is due to the strong impact and change in the vegetation.

**S8.5 Palacios, Eduardo**, (CICESE, La Paz, Baja California Sur, Mexico);

#### CHALLENGES AND PERSPECTIVES IN SHOREBIRD RESEARCH AND CONSERVATION IN MEXICO

Northwest Mexico is one of the most important regions for migratory shorebirds in the western hemisphere. Out of 16 WHSRN sites in Mexico, 11 are located in this region. The main conservation problems are habitat loss and disturbance due to tourist and aquaculture development. Mudflat is the principal habitat used by migratory shorebirds during the non-breeding season, whereas sandy beaches, saltflats and rocky shores on islands are important for resident shorebirds during the breeding season. A network of institutions in 2009 developed the shorebird recovery plan. The main conservation targets were three priority habitats and the main strategies were management of priority areas, long term monitoring at WHSRN sites, and species legal protections. The assessment of distribution and abundance of resident and migratory shorebirds through a monitoring program coordinated by the Grupo de Aves del Noroeste (GANO) provided that four species were recently legally listed in Mexico. This legal protection status promotes the conservation of these and other species that share the same habitats. Research priorities should include testing hypotheses that could explain population decline of shorebirds in the Western Hemisphere. A long term and standardized shorebird

monitoring program is currently underway at a regional and continental scale and should provide the basis to research and adaptive management of priority areas. Due to a dearth of financial and human resources in Mexico, the future of shorebird research and conservation will depend on international and interinstitutional coordination and cooperation.

**PS1.122 Paleczny, Nicole**, (Trent University, Peterborough, Canada); Ridgway, Mark (Ontario Ministry of Natural Resources, Peterborough, ON, Canada)

#### ESTIMATING ABUNDANCE AND PREY DEMAND OF COMMON LOON (GAVIA IMMER) USING DISTANCE SAMPLING ON LAKE OPEONGO, ALGONQUIN PROVINCIAL PARK, CANADA

Estimating the abundance of species comprising predatory guilds is important in understanding the relative strength of prey demand by top predators in aquatic food webs. This is especially the case when assessing the relative demand for fish production in ecosystems with avian and anthropogenic prey demand. This study estimates prey demand for a guild of avian piscivores and anglers on a large lake system where extensive background information on the recreational fishery is available. The Common Loon (*Gavia immer*) was the most abundant avian piscivore; a top predator that depends primarily on fish during and after their breeding season on North American lakes. Density and abundance of Common Loons were modeled using line transect distance sampling throughout the spring and summer season. The double observer method was applied on multiple surveys to assess both detection and observer bias. Daily energetic expenditure of the Common Loon was determined from a bioenergetic model for field metabolic rate as a function of mass (Ellis and Gabrielsen. 2002), and used to predict population-level prey demand across the season. Fishing effort of anglers was documented based on an access point creel survey to estimate annual harvest by anglers. The results of this study will provide insight into a number of areas in applied ecology; 1) application of distance sampling to estimate Common Loon abundance on large lakes (vs accepting simple counts as abundance), and 2) the relative role of avian vs angler prey demand within the context of total fish productivity for a large lake ecosystem.

**PS2.8 Palestis, Brian**, (Wagner College, Staten Island, United States); Stanton, Michael (Wagner College, Staten Island, NY, United States)

#### BEHAVIORAL RESPONSES OF COMMON TERN CHICKS TO FEATHER SAMPLE REMOVAL

Feather samples taken from live birds have a variety of uses, such as providing DNA for genetic studies and molecular sexing and providing material for studies of ptilochronology, stable isotopes and heavy metal contaminants. Feather sampling is assumed to be harmless, but this assumption has not been adequately tested. Even if removal of feathers does not directly affect survival, behavioral responses to feather sampling could indirectly increase mortality. For example, young that flee after sampling may become separated from parents. While removing a pinch of breast feathers from each of 315 Common Tern (*Sterna hirundo*) chicks across four years, we recorded the behavior of the chicks. Approximately 68% of these chicks showed no visible reaction to sampling and only 12% ran after sampling. Other reactions included changing position, calling, and biting. The probability of a chick running away increased with age. We therefore recommend that sampling be conducted as soon as possible after true feathers develop. There was evidence for individual differences in behavior: 65% of chicks

that ran after feather sampling also ran away when reencountered on later dates, while other chicks rarely did so. We found no evidence that removal of feather samples increased chick mortality, supporting the assumption that this technique is relatively noninvasive, but small differences in mortality rates would have been difficult to detect.

**PS1.266 Palmer, Charlie**, (Hemmera, Vancouver, Canada); Hindmarch, Sofi (Environment Canada, Delta, BC, Canada)  
USE OF BARN OWL NEST / ROOST SITE OCCUPANCY AND PRODUCTIVITY DATA TO DESIGN MITIGATIONS AGAINST HIGHWAY COLLISION EFFECTS, DELTA, BC.

This presentation will describe the results of a barn owl (*Tyto alba*) research program associated with design and implementation of mitigation to address the potential effects of highway development.

Delta, British Columbia is at the north edge of barn owl breeding range. Land-use has changed dramatically over the last 100+ years; where agriculture allowed barn owl range expansion, urbanization, agricultural practice changes, and vehicle collisions now threaten their presence.

As part of the development of the South Fraser Perimeter Road (SFPR) through Delta, a barn owl research program was instituted to design mitigation, and monitor its effectiveness. The route has 5-22% of the Lower Mainland breeding population.

We collected baseline data on nest/roost site availability, occupancy and productivity in an area three-km from each side of the SFPR. In addition, the availability of foraging habitat and seasonal weather variables, which influence barn owl demographics and could confound the results, were collected. Pre-construction results were used to implement mitigations; barriers to increase flight altitudes over the SFPR. Long-term monitoring will assess the efficacy of these and other operational mitigations, and may identify alterations. To date, just prior to opening, the number of occupied barn owl nest sites has remained relatively stable ( $n \approx 22$ ), with slight annual fluctuations in productivity (2.1 to 2.7 fledglings per nest). We will discuss these results; how they are being used in ongoing mitigation design, how configuration and availability of habitats influence fledgling, and, ultimately how the program will evaluate the efficacy of mitigation to address potential project-related effects on barn owl.

**F13.6 PANJABI, ARVIND**, (ROCKY MOUNTAIN BIRD OBSERVATORY, FORT COLLINS, United States); Macias Duarte, Alberto; Pool, Duane; Levandoski, Greg (Rocky Mountain Bird Observatory, Fort Collins, CO, United States)  
HABITAT USE AND CAPACITY ESTIMATES FOR WINTERING GRASSLAND BIRDS

Recent research has allowed advances in evaluating habitat needs and developing conservation strategies for wintering grassland birds. We used data from line-transects at 1159 grassland sites to estimate wintering bird densities and characterize vegetation in 15 Grassland Priority Conservation Areas (GPCAs) in the Chihuahuan Desert from 2009-2011. We used Bayesian hierarchical models to examine relationships between vegetation structure and bird density for five high-priority grassland species and estimate current capacity for each species in each GPCA based on available habitat conditions. Sprague's Pipit (*Anthus spragueii*) and Baird's Sparrow (*Ammodramus bairdii*) densities showed similar responses to grass cover (GC), grass height (GH), shrub cover (SC) and forb height (FH), whereas Chestnut-collared Longspur (*Calcarius ornatus*) density was affected by SC, FH and shrub height (SH). Lark Bunting (*Calamospiza melanocorys*) and Loggerhead

Shrike (*Lanius ludovicianus*) densities were both influenced by SH, and *L. ludovicianus* was weakly affected by GC and SC. We present the first available wintering habitat capacity estimates for Chihuahuan Desert GPCAs for these five species. Habitat relationships and spatially-explicit capacity estimates provide a starting point for strategic habitat conservation and management for these five grassland bird species in their core wintering grounds. Conservation efforts should aim to engage private ranchers, communities, range managers, and educators, especially in Mexico, and assist them in implementing best management practices for birds and livestock.

**PS1.152 Paprocki, Neil A**, (Boise State University and Raptor Research Center, Boise, United States); Heath, Julie A (Boise State University and Raptor Research Center, Boise, United States)

MAKING REGIONAL MANAGEMENT DECISIONS IN A TIME OF GLOBAL CHANGE: WHAT CAN WE LEARN FROM A HISTORICAL COMPARISON OF WINTERING RAPTORS IN SOUTHWEST IDAHO?

Regional management decisions by land-use agencies are typically based on local studies and populations. However, studies on a regional scale are often dramatically more difficult to accomplish successfully and results may be difficult to interpret for local actions. Regional change, such as exotic grass invasion in the shrub-steppe ecosystems intermountain west, and global patterns like climate change may be tested locally with important adaptive management decisions derived from the results. The goal of this project was to determine whether climate change, habitat change, or both affected wintering raptor distributions in the Morley Nelson Snake River Birds of Prey National Conservation Area (NCA) and how the relative effects of each driver may be used to influence management decisions going into the future. We compared current patterns of wintering raptor distribution to historic (1991-1994) raptor occupancy and distribution data. We also collected information on habitat and climate change and compared these to the historical record. Raptor species observed during the 2010 and 2011 winters showed changes in abundance: American Kestrels (*Falco sparverius*), Northern Harriers (*Circus cyaneus*), Prairie Falcons (*Falco mexicanus*), and Rough-Legged Hawks (*Buteo lagopus*) all increased in abundance, while Golden Eagles (*Aquila chrysaetos*) and Red-Tailed Hawks (*Buteo jamaicensis*) have stayed similar to the historical record. This was mostly confirmed at a broader regional scale by analyzing Christmas Bird Count data for the state of Idaho over the last 40-50 years. Results also show there has been very little habitat change in the NCA over the last 20 years, while the local climate of the NCA is moving towards significantly warmer, less severe winters ( $F_{1,27}=11.75$ ,  $P=0.002$ ), with less snow cover ( $F_{1,27}=8.45$ ,  $P=0.007$ ). Regional wintering temperatures on species breeding grounds are also increasing, possibly facilitating increased winter residency in some species, and decreased migration distances in others. These results, without the framework of climate change, could lead land managers to think that invasive grasses are good for biodiversity and ecosystems health. However, in the framework of climate change these areas may be becoming increasingly more important for population persistence.

**PS2.7 Parker, Lori**, (Queen's University, Saskatoon, Canada); Montgomerie, Robert (Queen's University, Kingston, ON, Canada); English, Philina (Simon Fraser University, Burnaby, BC, Canada)



## FEMALE ORNAMENTATION AND EGG COLOUR SIGNAL MATERNAL REPRODUCTIVE INVESTMENT IN THE AMERICAN ROBIN

The function of ornamental traits in male birds has been subject to research for decades, and sexual selection is recognized as the foremost explanation for their evolution. The expression of colourful traits in females has received much less study. Models predict the evolution of honest signals in female birds under certain circumstances, especially where male post-hatch investment is high and female quality is variable. Male and female American robins (*Turdus migratorius*) both invest heavily into offspring care, and both display conspicuous breast plumage and carotenoid-based bill coloration. Although female robins show a subdued expression of these traits, considerable variation exists. We assessed whether female ornamentation could act as a signal of individual quality, and whether variation in ornamentation is correlated with reproductive investment in this socially monogamous species. We analyzed clutch size, egg size, yolk androgen deposition and yolk carotenoid deposition as proxies of maternal investment. Models suggest female bill colour (saturation and brightness) reflects individual female ability to lay larger eggs with more carotenoid deposited into yolks, especially early in the egg laying season. A previous study by our research group demonstrated that eggshell colour may function as a sexual signal in this species. We further investigated a pathway relationship between female bill colouration, egg colour, and yolk carotenoid deposition in the present study.

**F8.6 Parker, Timothy**, (Whitman College, Walla Walla, United States);

## WHAT DO WE REALLY KNOW ABOUT THE SIGNALING ROLE OF PLUMAGE COLOR IN BLUE TITS? A CASE STUDY OF IMPEDIMENTS TO PROGRESS IN EVOLUTIONARY BIOLOGY

Evolutionary biologists seek to explain the origin and maintenance of phenotypes, and a substantial portion of this research is accomplished by thorough study of individual species. Thus progress in evolutionary biology depends in large part on drawing appropriate inferences in studies of individual species. However, obstacles to sound inferences may be common. I present here a case study of such obstacles to progress in evolutionary biology. I located all published papers examining plumage color and variables related to sexual selection hypotheses in a well-studied European songbird, the blue tit (*Cyanistes caeruleus*). Researchers have estimated over 1200 statistical relationships with plumage color of blue tits in 53 studies. More than 400 of the ~1000 main-effect relationships from the 49 studies that are candidates for inclusion in this meta-analysis were reported without details of strength and direction, and evidence suggests that many other effects remain unpublished. These hidden results appear to be a biased sample of all effects, especially for comparisons of plumage color to age and individual quality, and possibly also to measures of mate choice. Further, type I error was elevated by the large number of statistical comparisons evaluated, the frequent use of iterative model building procedures, and a willingness to interpret a wide variety of results as support for a hypothesis. Type I errors were made more problematic because blue tit plumage researchers only rarely have attempted to replicate important findings. Last, researchers studying blue tit plumage have often developed ad hoc explanations for unexpected results. Revising hypotheses in light of data is appropriate, but these revised hypotheses were rarely tested with new data. The only robust biological conclusion supported by my analyses is the relatively trivial observation male blue tits

have more colorful plumage patches than do females. Various other effects, including condition-dependence of plumage color expression, remain uncertain. These obstacles to progress in the blue tit plumage literature are likely common in evolutionary biology and beyond, and so I recommend changes which may improve progress towards scientific understanding in this discipline.

**PS1.76 Parrish, Clinton**, (Plymouth State University, Plymouth, United States); Reitsma, Len (Plymouth State University, Canaan, NH, United States)

## ASSESSING POTENTIAL IMPACTS OF WIND DEVELOPMENT ON BREEDING POPULATIONS OF THE BICKNELL'S THRUSH IN NORTHERN NEW HAMPSHIRE

The wind industry has undergone significant growth in recent years expanding operations into previously undeveloped regions, particularly along the Atlantic seaboard. Land-based facilities are often sited along high elevation ridges in unique habitats causing concern for avian species of elevated conservation status. Due to marked declines in the global population, Bicknell's Thrush is listed as a species of concern in the US and as endangered in Canada. Mountain top development within the breeding range is suspected to impact the species' reproductive success. We implemented a three-year study using point counts and radio telemetry to quantify the potential impact of the construction and operation of 15 wind turbines. Thirty transmitters were deployed over the three-year period to determine spatial use of habitat and response to turbines by breeding males. Spatially explicit point count data were analyzed using the R package "unmarked" to account for detectability and generate population densities. The landscape was characterized based on historic land use to quantify the amount of quality habitat provided by dense stands of successional fir found within old clear cuts. Point counts indicated highest densities occurred in regenerating stands following disturbance, regardless of proximity to the turbine string. Telemetry data illustrated that roads became a boundary for some individual's ranges while others would freely cross. Cleared areas associated with the turbines were avoided. Given the amount of quality habitat present, it does not appear that the 25ha of forest removed for construction within the study area will have deleterious effects on the population.

**S3.3 Paton, Peter**, (University of Rhode Island, Kingston, United States); McWilliams, Scott; Winiarski, Kristopher (University of Rhode Island, Kingston, RI, United States); Miller, David (University of Rhode Island, Kingston, RI, United States)

## ASSESSING THE POTENTIAL IMPACTS OF OFFSHORE WIND FACILITIES ON BIRDS: IN THE BEGINNING

The marine renewable energy industry (MREI) has seen dramatic growth in Europe, particularly the expansion of offshore wind energy. In North America, onshore wind facilities been developed rapidly, while there still are no offshore wind facilities. This is expected to change, as a number of large-scale offshore wind projects are in the final stages of approval. Thus, there is a pressing need for North American ornithologists to understand the potential impacts of MREI on avian populations, and how to use the latest technology and quantitative methods to assess these potential impacts. Since 2009, we have been conducting a baseline assessment of avian use of marine waters for the Rhode Island Special Area Management Plan (SAMP). Our primary objective was to assess seasonal variation in the spatial distribution and abundance of birds in our study area. We used five primary survey methods to assess avian use of the

Ocean SAMP area: (1) land-based seawatches; (2) ship-based line-transect surveys; (3) aerial line-transect surveys; and (4) boat-based line transect surveys in nearshore waters to survey Roseate Terns. We used ship-based and aerial line transects to develop density surface models for the more common marine birds using a Program DISTANCE framework. We estimated seasonal and annual variation in the spatial distribution and abundance of birds using our Ocean SAMP study area and will present density surface models for loons, shearwaters, storm-petrels, gannets, seabirds, gulls, and alcids. This baseline information will be useful to assess the influence of the MREI on avian use in the marine waters off of Rhode Island.

**PS1.20 Patterson, Allison**, (Oregon State University, Corvallis, United States); Roby, Daniel (US Geological Survey - Oregon Cooperative Fish and Wildlife Research Unit, Corvallis, OR, United States); Lyons, Donald (Oregon State University, Corvallis, OR, United States)

#### ASSESSING FORAGING CONDITIONS AT CASPIAN TERN RESTORATION SITES

Foraging conditions can be an important factor limiting colonial waterbird restoration efforts. We investigated the importance of local foraging conditions for Caspian terns (*Hydroprogne caspia*) breeding at two newly established colonies in the Upper Klamath Basin, California (Sheepy Lake and Tule Lake), using measures of adult foraging behavior, chick provisioning rates, and chick body condition. Caspian terns breeding at Sheepy Lake used a regional foraging strategy: they traveled further from the colony, (median 24 km, range: 18 - 53 km) and had longer foraging trips (median 210 min, range: 72 - 416 min). Terns breeding at Tule Lake used a local foraging strategy: they stayed close to the colony (median 6 km, range: 1 - 11 km) and made shorter foraging trips (median 54 min, range: 16 - 288 min). Caspian terns foraging at a regional scale (>15 km from the colony) spent more time commuting, more time loafing away from the colony, and less time attending the nest. These differences in foraging behavior corresponded to differences between the two colonies in chick provisioning rates (g/hr) and size-adjusted body mass of chicks. Selected comparisons between performance measures for the two newly established colonies and four older colonies within the Pacific region indicated that foraging conditions around Sheepy Lake and Tule Lake are likely sufficient to allow these nascent colonies to persist and potentially grow. Local foraging conditions around the colony should be an important consideration in restoration and management of Caspian terns and other colonial nesting waterbirds. Assessment of foraging conditions at restoration sites immediately following colonization can potentially predict long term site potential and inform decisions regarding other factors potentially limiting restoration efforts, such as predation and human disturbance.

**T9.6 Pavlacky, David**, (Rocky Mountain Bird Observatory, Brighton, United States); Possingham, Hugh (University of Queensland, Brisbane, Q, Australia); Lowe, Andrew (University of Adelaide, Adelaide, SA, Australia); Prentis, Peter (Queensland University of Technology, Brisbane, Q, Australia); Green, David (Simon Fraser University, Burnaby, BC, Canada); Goldizen, Anne (University of Queensland, Brisbane, Q, Australia)

#### LANDSCAPE CHANGE PROMOTES ASYMMETRIC DISPERSAL AND LIMITS REGIONAL PATCH OCCUPANCY IN A SPATIALLY STRUCTURED RAINFOREST BIRD POPULATION

Local extinctions in habitat patches and dispersal between patches are key processes structuring animal populations in heterogeneous environments. Effective landscape conservation requires an understanding of how habitat loss and fragmentation influence demographic processes within populations and movement between populations. We studied patch occupancy and genetic migration rates of an Australian rainforest bird, the logrunner (*Orthonyx temminckii*), to determine 1) the effects of landscape change and patch structure on patch occupancy, 2) the relative influence of local and matrix landscapes on asymmetric dispersal, and 3) the relative contributions of habitat loss and habitat fragmentation to asymmetric dispersal. Whether or not a patch was occupied was primarily determined by the isolation of that patch. After controlling for patch isolation, patch occupancy declined in landscapes experiencing high levels of rainforest loss and fragmentation. Dispersal between logrunner populations was highly asymmetric. Emigration rates were 39% lower when local landscapes were fragmented, but emigration was not limited by the structure of the matrix landscapes. In contrast, immigration was 37% greater when local landscapes were fragmented and was lower when the matrix landscapes were fragmented. Rainforest fragmentation influenced asymmetric dispersal to a greater extent than did rainforest loss and a 60% reduction in mean patch size was capable of switching a population from being a net exporter to a net importer of dispersing logrunners. Conservation measures that maintain large patch sizes may promote asymmetric dispersal from intact to fragmented landscapes and allow bird populations to persist in fragmented and degraded landscapes. These sink populations could form the kernel of source populations given sufficient habitat restoration. However, the success of the rescue effect will depend on the quality of the matrix landscapes.

**PS2.80 Pavlacky, David**, (Rocky Mountain Bird Observatory, Brighton, United States); Laura, Quattrini; Seth, Gallagher; Jennifer, Blakesley; David, Hanni; Tammy, VerCauteren (Rocky Mountain Bird Observatory, Brighton, CO, United States)

#### HIERARCHICAL OCCUPANCY ESTIMATION AND THE CONSERVATION OF SAGEBRUSH-DEPENDENT BIRDS AT MULTIPLE SCALES

The apparent long-term population declines of sagebrush-dependent birds have elevated the recovery of sagebrush avifauna to among the highest conservation priorities in North America. The Greater Sage-grouse (*Centrocercus urophasianus*) was recently found warranted, but precluded for listing under the US Endangered Species Act. Other sagebrush obligates, such as the Brewer's Sparrow (*Spizella breweri*) and Sage Thrasher (*Oreoscoptes montanus*), are species of conservation concern in the western states and provinces of the US and Canada. Sage-grouse recovery efforts are currently underway to prioritize the location of habitat management at large scales and to initiate conservation actions to improve habitat quality at local scales. These conservation strategies will likely increase the population sizes of other sagebrush obligates, yet sagebrush management that considers habitat requirements for the suite of sagebrush bird species may be an effective conservation strategy. Our objectives were to 1) estimate the population sizes of Brewer's Sparrows, Sage Sparrows (*Amphispiza belli*) and Sage Thrashers, 2) predict species distributions to help prioritize sagebrush management at large scales and 3) quantify habitat relationships to inform habitat management at local scales. We used data collected in the Integrated Monitoring in Bird Conservation Regions program, and used Distance sampling to estimate population sizes and hierarchical occupancy modeling

to estimate occupancy rates at the landscape scale and territory occupancy rates at the local scale. We estimated 2011 breeding season population sizes for Brewer's Sparrows ( $N = 13,945,300$ ; 90% CI = 11,036,600 - 16,854,100), Sage Sparrows ( $N = 1,609,000$ ; 90% CI = 1,104,000 - 2,113,900) and Sage Thrashers ( $N = 777,800$ ; 90% CI = 574,300 - 981,500) for a three state area including Colorado, Montana and Wyoming. The large-scale predicted distributions were useful for evaluating the effects of habitat loss and fragmentation on species occurrence and for prioritizing conservation efforts on the landscape. We used the local-scale habitat relationships to predict the effects of management actions, such as conifer removal, grazing management and sagebrush treatment, on the territory occupancy of the three sagebrush obligates. We propose a structured decision making framework to determine the most cost effective management actions for the proactive conservation of Sage-grouse and other sagebrush-dependent bird species.

**F14.2 Paxton, Eben**, (USGS Pacific Islands Ecosystems Res Cent, Hawaii National Park, United States);

#### KOA RESTORATION FORESTS: QUALITY HABITAT FOR NATIVE HAWAIIAN FOREST BIRDS?

Hawaii's native forest birds have experienced severe declines or extinctions over the last two hundred years. Numerous factors have contributed to their plight, but loss of high quality forest is one major cause. Recent efforts to reforest pastureland using Hawaii's endemic koa tree (*Acacia koa*), a fast growing tree with economically valuable wood, has led to the hope of an efficient conservation tool for increasing forest habitat. Avian surveys of 10-30 year old koa forest stands document many native forest birds using the koa reforestations, and for some species at some sites, densities are higher than neighboring intact old growth forest. Despite these positive findings, equal or higher density does not equate equal or higher habitat quality, and very little work has been done to evaluate the habitat quality of these monotypic forest stands. As a first step, I used the spatial behavior of two species, Hawaii Amakihi (*Hemignathus virens*) and Hawaii Elepaio (*Hasiempis sandwichensis*), to compare home range size and movement patterns in paired koa reforestation versus intact old-growth forests at two sites on Hawaii Island. Larger home range sizes can indicate inferior habitat, and movement patterns inform us on where resources are located. Additionally, behavioral observations (e.g., foraging, breeding, singing) can provide important insights into how the birds are using the habitats. The results of this study will be presented in light of what they tell us about the quality of koa reforestations, and how managers can use this information to help guide future reforestation efforts.

**PS1.160 Paxton, Kristina\*** (University of Southern Mississippi, Hattiesburg, United States); Moore, Frank (University of Southern Mississippi, Hattiesburg, United States)

#### CONNECTING THE DOTS: UNDERSTANDING MIGRATION IN THE CONTEXT OF OTHER PERIODS OF THE ANNUAL CYCLE

We incorporated winter habitat quality (measured via stable carbon isotopes,  $\delta^{13}C$ , from claw samples) along with breeding area destination (measured via stable hydrogen isotopes,  $\delta D$ , from feather samples) of black-and-white warblers (BAWW) (*Mniotilta varia*) captured during spring migration to examine how conditions prior to the onset of migration influence migration success. We hypothesized that habitat quality on non-breeding, over-winter sites will carry-over to affect an individual's success during migration, measured in terms of time and condition. BAWW arriving late to the stopover site had

significantly enriched  $\delta^{13}C$  values compared to conspecifics migrating to the same breeding area, indicating birds arriving late to the stopover site over-wintered in lower quality habitat such as dry scrub forests. In addition, individuals arriving late to the stopover site were in the poorer condition compared to conspecifics migrating to the same breeding area. These results suggest that over-winter habitat quality strongly influences migration success. However, the quality of a bird's over-winter habitat may not buffer an individual from all the challenges faced during migration. For example, individuals arriving early at the stopover site had  $\delta^{13}C$  values similar to birds arriving during mid migration, indicating both groups originated from more mesic forest habitats (e.g. higher quality) than individuals arriving at the stopover site late. However, BAWW arriving early were in poorer condition than individuals arriving at the stopover site during mid migration, suggesting there may be a cost to arriving at stopover sites too early. Understanding how the consequences associated with habitat quality on non-breeding sites carry-over to affect an individual's success during migration is critical given the growing evidence that migration may be the limiting phase of the annual cycle for migratory bird populations.

**PS1.237 Pearce, Aaron**, (US Geological Survey, Jamestown, United States); Brandt, David; Krapu, Gary; Post van der Burg, Max (US Geological Survey, Jamestown, ND, United States)

#### EVALUATING TRANSMITTER EFFECTS ON SANDHILL CRANES: IMPLICATIONS FOR WHOOPING CRANE RESEARCH

Remote tracking of endangered migratory birds can provide beneficial information for management and recovery activities. Before capturing and marking endangered species, researchers should have reasonable evidence that transmitters will have minimal negative impacts. Studies using surrogate species can provide needed support for this assumption. We used data from a long-term study of midcontinent sandhill cranes (*Grus canadensis*), a surrogate for whooping cranes (*Grus americana*), fitted with multiple transmitter types to determine if leg-band mounted transmitters negatively affected breeding success and survival. Yearly breeding success of 319 cranes fitted with transmitters during 2003-2006 was similar to or greater than unmarked birds using the same fall-staging areas and past published estimates from the same regions. Furthermore, we summarized banding data from 1,514 cranes fitted with aluminum leg bands during the study, 651 of which also carried a leg-mounted transmitter. Hunters reported a similar percentage of band recoveries between 1998 and 2009 for birds with (6.4%) and without transmitters (5.7%). Additional band recovery analyses estimated negligible differential survival for birds fitted with transmitters. These results represent useful information for considering use of transmitters attached by the same method and techniques for whooping cranes.

**W10.4 Peele, Ashley**, (Tulane University, New Orleans, United States); Marra, Peter (Smithsonian Migratory Bird Center, Washington D.C., United States); Sherry, Tom (Tulane University, New Orleans, LA, United States)

#### CALIBRATING POINT-COUNT SURVEYS USING INTENSIVE TERRITORY MAPPING: ESTIMATING DENSITY OF MIGRATORY PASSERINE POPULATIONS IN WINTERING HABITATS

Unbiased population density estimation is critical for diverse purposes, but is particularly challenging in mobile taxa such as migratory birds, and in non-breeding periods when these animals often use a variety of habitats inconspicuously. Here,

we present and assess a method to estimate density of non-breeding songbirds that combines point count-based distance sampling with the flexibility of UnMarked software (R package). We calibrated the method using intensive concurrent mark-recapture analyses of American Redstarts (*Setophaga ruticilla*) in multiple years and in four diverse habitats with varying abundances of territorial and floater individuals. Our analyses indicate that point count-generated estimates are accurate to within 2 birds/hectare of territorial densities for all habitats and years (mean = 7-16 birds/ha, depending on year and habitat). The one exception was one year in one habitat (black mangroves) with excessive non-territorial floater individuals, when point counts indicated 3-4 more birds/hectare than mark-recapture efforts. We also used conspecific vocalization playbacks with point counts, and although these did not enhance accuracy estimating redstart density, playbacks enhanced ability to identify and detect other species present. We argue that our point-count method generally estimates unbiased densities of birds across sites by accounting for the presence of floaters and can be applied in diverse winter habitats without requiring more intensive methods. The most efficient population-monitoring tools are becoming increasingly important as we recognize migrant bird populations' year-round sensitivity to global change phenomena.

**F6.4 Peer, Brian**, (Western Illinois University, Macomb, United States); McCleery, Robert (University of Florida, Gainesville, FL, United States)

#### ADAPTIVE MODULATION OF COWBIRD HOST DEFENSIVE BEHAVIOR IN RELATION TO ITS COSTS AND LIKELIHOOD OF PARASITISM

Natural selection should favor adaptive modulation of host defenses against avian brood parasitism in response to their costs. In North America, hosts of the parasitic Brown-headed Cowbird (*Molothrus ater*) demonstrate an astonishing lack of defenses and most evidence to date has suggested that this is a consequence of evolutionary lag. We evaluated how the Dickcissel (*Spiza americana*), an ancient cowbird host, responded to natural and experimental parasitism using an information theoretic approach to evaluate a suite of nine candidate models. Parasitism frequencies varied significantly over the three year study from 24%-44% (n = 301 nests) and Dickcissels were more likely to attempt to eject cowbird eggs in years when parasitism was higher. The best candidate model consisted of three parameters: treatment, cost, and an interactive effect between treatment and cost. Dickcissels were more likely to reject naturally laid cowbird eggs and plaster cowbird eggs than real cowbird eggs we added to nests. Dickcissels damaged and accidentally ejected their own eggs when attempting to eject cowbird eggs; they incurred more costs when attempting to eject real cowbird eggs we added to nests than naturally laid, or plaster cowbird eggs. To our knowledge, this is the first study to demonstrate that a cowbird host is more likely to accept rather than attempting to eject a cowbird egg when the costs of doing so are prohibitively high.

**PS2.2 Peluc, Susana**, (CONICET, Cordoba, Argentina); Vergara Tabares, David; Luczywo, Ayelen; Diaz, Agustin (Universidad Nacional de Cordoba, Cordoba, Argentina)

#### FOOD AVAILABILITY OR NEST PREDATION RISK DURING INCUBATION AND NESTLING STAGES. CAN A SINGLE FACTOR EXPLAIN ALL THE VARIABILITY IN REPRODUCTIVE BEHAVIOR?

Nest predation has been extensively recognized as an important force in avian life history evolution, shaping life history traits.

Food availability has also been proposed as another selective force affecting life history trait diversification. Yet although nest predation risk and food availability often covary in nature and may even have interacting effects, they are frequently studied as mutually exclusive drivers of life history diversification. Using two open cup nesting passerines from the southern hemisphere as model systems (*Turdus chiguanco*, *Saltator aurantirostris*) we test two classic hypotheses for the causes of divergence in avian life histories with a robust 2 x 2 factorial design experiment. 24 Nests of each species were randomly assigned to one of four treatments: Predator presentation (taxidermic mounts and vocalizations in the vicinity of the nest), food supplementation, Predator presentation + food supplementation or control. Predator presentations as well as food supplementation were administered during 12 days for at least 5 hours, during both incubation and nestling stages. On each nest we examined the effect of treatments on incubation patterns, feeding rates, and nestling growth rate. Our results suggest that non of the factors tested is likely to explain variation in all life history and behavioral traits by itself. We will discuss how these two strong ecological factors rather interact to shape reproductive behavior and investment in passerine species from the southern hemisphere.

**F16.8 Percy, Katie**, (University of Tennessee, Knoxville, United States); Buehler, David (University of Tennessee, Knoxville, United States)

#### EFFECTS OF PRESCRIBED BURNING ON GOLDEN-WINGED WARBLER (*VERMIVORA CHRYSOPTERA*) HABITAT AND POPULATIONS IN THE CUMBERLAND MOUNTAINS, TENNESSEE

The Golden-winged Warbler (*Vermivora chrysoptera*) is a Nearctic-Neotropical migratory songbird. The southernmost portion of its breeding range extends into northeastern Tennessee. According to the most recent estimates from Breeding Bird Survey data, the Golden-winged Warbler population in Tennessee is declining by 7.7% per year (Sauer et al. 2011). Beginning in 2003, the population in the North Cumberland Wildlife Management Area (NCWMA) of Tennessee has been monitored throughout the breeding season, via nest searching and presence-absence surveys. Mean nest success across all years is 38.4 percent (range 12.2 – 62.6 percent). Mean number of young fledged per successful nest is 4.01 (range 1 – 6). Where management action (i.e. prescribed burning) is being implemented, the population has remained stable, if not increased. Conversely, the population has decreased on our study sites where no management is occurring. Golden-winged Warbler nesting habitat is a patchy mosaic of early succession grasses, forbs, shrubs, and trees (Confer 1992). We find this to hold true on our study sites in the NCWMA. Vegetation data were collected following both a nested-plot design and territory-transect protocol. Analysis confirms the dominance of forbs (~79 – 88% cover), grasses (~65 – 70% cover), and shrub cover (~36 – 48% cover *Rubus* spp.) within a 0.04 acre plot surrounding the nest. Relative to availability, nest site selection was strongest for woody cover (P = 0.01), as measured by a density board, which encompassed both shrub and sapling cover on our study sites. Indeed, on our study sites where the Golden-winged population is decreasing we measured a significant reduction in percent shrub cover. We are continuing to measure the effectiveness of prescribed burning at maintaining Golden-winged Warbler nesting habitat, with the intent to develop a long-term conservation strategy for the sustainability of their population in the Cumberland Mountains.

**PS1.40 Pérez Sánchez, Clara Elena,** (Universidad Veracruzana/Instituto de Ecología A.C., Xalapa, Mexico); Villegas Patraca, Rafael (Instituto de Ecología, A. C., Xalapa, Canada); MacGregor Fors, Ian (Instituto de Ecología, A. C., Xalapa, Mexico)

DETAIL DESCRIPTION OF THE NEST, EGGS, AND NESTING HABITAT OF THE MICRO-ENDEMIC, NEAR THREATENED ROSEBELLIED BUNTING (PASSERINA ROSITAE)

The near-threatened Rose-bellied Bunting (*Passerina rositae*) is micro-endemic to the Isthmus of Tehuantepec, Mexico. In this research we describe the nest, eggs, and nesting habitat of the Rose-bellied Bunting in 15 nesting locations. All nests were found in tropical dry semideciduous forest along ravines. Nests were located at a height of 0.3–2.5 m from the ground, and were constructed of tree bark, thin twigs, and spider webs. Average dimensions of the measured nests were: external diameter 120 × 30 mm, external height 124 mm, internal depth 48.5 mm, and internal diameter 53.5 mm. The number of eggs we found per nest oscillated from two to four. The eggs were plain white with reddish-brown spots, mostly concentrated at the large end. The size of the measured eggs varied from 18.8 mm × 13.6 mm to 20.1 mm × 15.3 mm. Nest dimensions and egg characteristics of the Rose-bellied Bunting were similar to other species of the *Passerina* genus. The nests we found resembles that of species that are not that closely related. Our observations allowed us to record Rose-bellied Bunting use different habitats, a large numbers feeding in croplands throughout the non-breeding season, and nests concentrated along ravines immerse in native forests. Although Rose bellied Buntings seem to take advantage of human-disturbed landscapes, forest habitats have been transformed dramatically in the region due to human activities. We suggest that conservation plans and efforts focused on this species should include hilly areas of rough terrain and well-preserved ravines

**S3.6 Perez-Lapena, Blanca,** (Southern Illinois University Carbondale, Carbondale, United States); Wijnberg, Kathelijne (University of Twente, Enschede, The Netherlands)

STATISTICAL POWER IN TESTING SEABIRD DISPLACEMENT DUE TO AN OFFSHORE WIND FARM: A CASE STUDY OFF THE COAST OF RHODE ISLAND

Assessing and monitoring the impacts on marine fauna is an essential part of ecologically sustainable development of offshore wind farms. Concerning seabirds, it is a great challenge to detect their possible displacement due to wind farm presence, because of the complexity of seabird behaviour, the influence of other environmental factors, and the logistical limitations in collecting seabird data at sea. The Precautionary Principle recognizes that hypothesis tests applied in impact assessments, which aim to prevent type I errors – i.e. falsely concluding that an impact has occurred – are in conflict with species conservation interests, which aim to prevent type II errors – i.e. falsely failing to conclude that an impact has occurred. We implement the Precautionary Principle by means of a statistical power analysis, which provides the probability to detect change in bird abundance if a displacement impact has occurred. Our power analysis is based on geostatistical simulation of seabird surveys (count data), accommodating spatio-temporal variability in species abundance at various scales as well as the presence of zero-inflation in count data. First, we use a simulation study to rank the relative importance of different factors that influence our ability to detect an existing impact. Next, we apply the proposed methodology to seabird count data collected off the coast of Rhode Island.

**T13.2 Perktas, Utku,** (American Museum of Natural History, New York, United States); Barrowclough, George F.; Groth, Jeff (American Museum of Natural History, New York, United States)

PHYLOGENY, PHYLOGEOGRAPHY AND SPECIES LIMITS IN THE TURACOS (MUSOPHAGIDAE)

We investigated the phylogenetic and phylogeographic structure of the family Musophagidae throughout their distribution in the montane and lowland forest biomes of Africa. We inferred the phylogeny of all the species within the family using the mitochondrial ND2 gene and several nuclear loci. Our results confirm the existence of 3 subfamilies and support previous results based on the mitochondrial *cyt-b* gene. Within the Musophaginae, *Tauraco porphyreolophus* and *Ruwenzorornis johnstoni* were sister taxa and basal to the other green turacos. The genus *Tauraco* was paraphyletic due to the inclusion of the genera *Musophaga* and *Ruwenzorornis*.

We also investigated the phylogeographic structure and species limits in the subfamily Musophaginae. Based on 607 bp of the mitochondrial ND2 gene, there appear to be more differentiated taxa than previously recognized. We identified 24 distinct clades, and these do not agree with prior hypotheses concerning species limits. In particular, the *T. persa* complex showed a pattern of weak differentiation among a large number of geographically separated clades or species. The high elevation taxa, *T. leucotis* and *T. hartlaubi*, showed extensive differentiation among geographic isolates.

**PS2.205 Perktas, Utku,** (American Museum of Natural History, New York, United States); Quintero, Esther (American Museum of Natural History, NEW YORK, NY, United States); Gur, Hakan (Ahi Evran University, Kirsehir, Turkey)

ONCE UPON A TIME IN ANATOLIA: POPULATION HISTORY OF THE ANATOLIAN NUTHATCH (*S. KRUEPERI*)

In this study, the aim was to understand how Anatolian nuthatches (*Sitta krueperi*) have responded to global climate changes through the latest Quaternary glacial-interglacial cycles. For this, we used a molecular phylogeography, together with ecological niche modelling. Using previously published and new sequences of the mitochondrial COI gene, we investigated phylogeographic structure in Anatolian nuthatches. In addition, using the maximum entropy machine learning algorithm in MAXENT software, we developed an ecological niche model (ENM) to predict the potential geographic distribution of *S. krueperi* under reconstructed past [the last glacial maximum (LGM), 21 000 years ago] and present (1950 to 2000) bioclimatic conditions. This study represents a first attempt combining molecular phylogeography and ecological niche modelling for a bird species in Anatolia, in which high levels of intraspecific genetic differentiation are observed and which is also an important source and refugium of genetic diversity for European biota.

**T13.6 Peters, Jeffrey,** (Wright State University, Dayton, United States); Lavretsky, Philip; Millam, Kendra (Wright State University, Dayton, OH, United States); Winker, Kevin (University of Alaska Museum, Fairbanks, AK, United States); McCracken, Kevin (University of Alaska, Fairbanks, Fairbanks, AK, United States)

POPULATION STRUCTURE AND GENE FLOW IN HOLARCTIC DUCKS: EVIDENCE FROM A GENOMIC TRANSECT

Over 100 species of birds have Holarctic distributions extending across Eurasia and North America. In some cases, individuals from different continents are morphologically distinguishable and classified as different subspecies. However, other species lack diagnostic morphological variation across their range, suggesting recent divergence, high gene flow, or cryptic genetic divergence. To examine the relationship between morphological, mitochondrial (mt), and nuclear (nu) DNA differentiation, we sequenced the mtDNA control region and 20 nuclear introns from six pairs of Eurasian and North American duck (genus *Anas*) populations, and we used coalescent analyses to simultaneously estimate divergence times and gene flow. The “Northern” Wigeon complex (*A. penelope* & *A. americana*) and Green-winged Teal (*A. crecca*) exhibit diagnostic morphological divergence and deeply divergent mtDNA lineages between continents, although in both cases there was gene flow. NuDNA genotypes are also diagnostic between the pairs of continental populations, despite moderate gene flow. The Gadwall (*A. strepera*) lacks morphological differentiation, but both mtDNA and nuDNA haplotype frequencies differ between continents. In contrast, the Mallard (*A. platyrhynchos*) and Northern Shoveler (*A. clypeata*), which also lack morphological differentiation between continents, exhibit pronounced mtDNA structure, but patterns in nuDNA are consistent with male-biased gene flow inhibiting population divergence. Finally, the Northern Pintail (*A. acuta*) lacks morphological, mtDNA, and nuDNA differentiation between Eurasia and North America, suggesting high levels of intercontinental gene flow. Thus, patterns of population structure and gene flow vary considerably among these species, despite shared biogeographic and life history characteristics.

**PS1.142 Peterson, Suzanne**, (University of Tennessee at Chattanooga, Chattanooga, United States); Aborn, David (University of Tennessee at Chattanooga, Chattanooga, United States)

#### NEST SITE CHARACTERISTICS OF LEAST BITTERN IN AN URBAN WETLAND

We examined nest site characteristics of Least Bitterns at a wetland in Chattanooga, TN. We measured the height of the nest above the water, the height of the nest canopy, the height of the vegetation around the nest, and water depth. Nests were placed in cattail "islands" in the center of the wetland about 60 cm above the water, with a water depth of about 30 cm deep. There was no difference in the characteristics of successful and unsuccessful nests. Results are similar to nest sites found elsewhere.

**PS2.235 Phillips, Jennifer**, (California State University, Fresno, Sanger, United States); Katti, Madhusudan (California State University, Fresno, Fresno, CA, United States)

#### THE EFFECTS OF URBAN NOISE ON SONG STRUCTURE IN A LONG DISTANCE MIGRANT, GAMBEL'S WHITE-CROWNED SPARROW (*ZONOTRICHIA LEUCOPHRYS GAMBELII*)

Song is a primary mode of communication in birds, both during the breeding and the non-breeding seasons. The sensory drive concept suggests that environmental conditions such as ambient sound influence the evolution of vocal behavior. Thus, background noise levels may have a profound effect on communication. Urbanization and associated vehicular traffic present the biggest modern source of noise, and offer a novel context in which to study the effects of noise on birdsongs. Here we examine how urban noise affects song structure in the migratory Gambel's White-crowned Sparrow (*Zonotrichia*

*leucophrys gambelii*) in the rapidly urbanizing Central Valley of California. The white-crowned sparrow winters in the region in both urban and rural habitats. Song is an important territorial signal during non-breeding season, and juvenile males practice singing in their first year before crystallizing one song. We measured ambient noise levels concurrently while recording bird song in the field, and then measured frequency and temporal components of song. Preliminary results have shown no significant difference in the variation of the temporal components of song between noisy and quiet locations. Birds in noisy territories do have higher minimum frequencies than those in quiet territories. Urban noise tends to resonate at low frequencies, so high pitched song may allow for better transmission. Further, birds may be shifting songs for metabolic reasons. Our results may be one of the first examples of a wintering migrants' communication system being affected by urban noise.

**PS2.120 Pias, Kyle**, (University of Florida, Gainesville, United States); Kitchens, Wiley (Florida Fish and Wildlife Cooperative Research Unit, Gainesville, FL, United States)

#### FORAGING ECOLOGY OF BREEDING SNAIL KITES (*ROSTRHAMUS SOCIABILIS PLUMBEUS*) ON THE KISSIMMEE CHAIN OF LAKES, FLORIDA

In the United States the Snail Kite (*Rostrhamus sociabilis plumbeus*) is a federally endangered species whose population in Florida has recently undergone precipitous declines. The remaining population remains heavily dependent upon the Kissimmee Chain of Lakes (KCOL), a group of lakes in central-Florida that is subject to many anthropogenic influences, including water and vegetation management. It is therefore crucial to gain an understanding of how the habitat on these lakes influences Snail Kite foraging. We studied habitat use and foraging behavior of breeding snail kites on the KCOL by radio-tagging and observing birds by airboat. We calculated 90% home ranges using a kernel density estimator and quantified foraging effectiveness through time activity budgets. Our results indicate a relationship between home range size and kite foraging. Kites that have smaller home ranges have higher foraging rates and forage closer to the nest. Additionally, kites that utilized wetlands off the main body of Lake Tohopekaliga had relatively smaller amounts of foraging substrate within their home ranges. These results indicate the need for a holistic approach towards managing foraging areas and nesting patches.

**PS2.121 Pias, Kyle**, (University of Florida, Gainesville, United States); Welch, Zach (Florida Fish and Wildlife Conservation Commission, Ocala, United States); Kitchens, Wiley (Florida Fish and Wildlife Cooperative Research Unit, Gainesville, FL, United States)

#### AN ARTIFICIAL PLATFORM TO HELP SNAIL KITES HANDLE AN INTRODUCED PREY SPECIES

In the United States, the Snail Kite (*Rostrhamus sociabilis plumbeus*) is a federally endangered species and is restricted to the wetlands of south-central Florida. The Snail Kite is an extreme dietary specialist, previously feeding almost exclusively on one species of snail, the Florida Apple Snail (*Pomacea paludosa*). The Snail Kite population in Florida has recently undergone precipitous declines and the remaining population remains heavily dependent upon the Kissimmee Chain of Lakes (KCOL), a group of lakes in central-Florida. An exotic species of apple snail, the Island Apple Snail (*Pomacea insularum*), has recently become established on these lakes. The Island Apple Snails are larger than the native Florida Apple Snails, and Snail Kites handle the exotic snails less efficiently. An inexpensive,

easy-to-construct platform was developed that would provide kites with a flat, stable surface on which to extract exotic snails, potentially reducing the handling difficulties. These platforms were placed near Snail Kite foraging areas on two lakes in central Florida, and initial observations indicate that kites use the platforms frequently, and use them for extracting larger size classes of the Island Apple Snail.

**PS1.46 Pinney, Tracy,** (Baylor University, Waco, United States); Gutzwiller, Kevin (Baylor University, Waco, TX, United States)

#### PREDATOR ABUNDANCE, HOST ABUNDANCE, AND LANDSCAPE VARIABLES ARE NOT CONSISTENT PREDICTORS OF BROWN-HEADED COWBIRD PRESENCE ACROSS YEARS

The Brown-headed Cowbird (*Molothrus ater*) is a management concern due to its potential influence on the reproductive success of its avian hosts. We hypothesized that the presence of Brown-headed Cowbirds was most related to landscape conditions because of basic food and cover requirements, but that host abundance and diurnal avian predator abundance also would influence Brown-headed Cowbird presence. Summer resident birds were studied at sites in the Oaks and Prairies Region of Texas during 2008 and 2009. Predator abundance was summed for six diurnal bird species that prey on nests and adult birds. Host abundance was summed for ten species that are known to be parasitized by the cowbird. Landscape variables included percent landcover, edge density, mean patch area, and fractal dimension for six cover types (woodland, grassland, agriculture, developed area, shrub, and wetland) within a 1-km radius around each study site; these landscape metrics were derived from the 2001 National Land Cover Data. We used logistic regression to relate cowbird presence to these three sets of variables. The amount of variation in cowbird presence explained, and the significant predictors of cowbird presence, differed between years. In 2008, the final model (AUC = 0.89) explained 43% of the variation in the data. Contrary to our hypothesis, the abundance of diurnal avian predators was most important in predicting the presence of cowbirds. Cowbird presence also was related to agricultural area and grassland area. In 2009, the final model (AUC = 0.67) explained only 10.5% of the variation in the data. Cowbird presence was positively associated with host abundance and negatively associated with developed area; the relative strengths of these predictors were similar. Neither the 2008 model (tested with 2009 data) nor the 2009 model (tested with 2008 data) predicted cowbird presence for the other year better than expected by chance (AUC = 0.48 and 0.55 for the 2008 and 2009 models, respectively). Our results suggested that, even for the same sites, models developed for one year may not accurately predict cowbird presence for other years. Conservationists that rely on predictive cowbird distribution models to assess potential parasitism pressure on host communities, or to decide where cowbirds may require direct control, should base such decisions on more than just a couple of years of data.

**T6.4 Poesel, Angelika,** (The Ohio State University, Columbus, United States); Nelson, Douglas (The Ohio State University, Columbus, OH, United States)

#### DELAYED SONG MATURATION AND TERRITORIAL AGGRESSION IN A SONGBIRD

Asymmetries in competitive ability can determine the outcome of social interactions in animals and are often expressed through differences in sexual traits. Competitive ability (resource

holding potential, RHP), trait expression and ultimately reproductive success may vary with an individual's age or experience. In some species, reproductively mature males delay acquisition of some adult traits and thereby signal their young age. Theory on animal contests predicts that individuals assess the RHP of an opponent relative to their own, such that escalation is more common between evenly matched opponents. Here, we test predictions from this hypothesis that males respond to a territorial intruder based on their RHP relative to the intruder's RHP. We simulated white-crowned sparrows (*Zonotrichia leucophrys*) intruding into the territory of a recruit or return. Playback of a song repertoire simulating a young male (recruit) elicited a weaker response from established territory holders (return), but a stronger response from recruits. Playback of a single song type simulating an older male elicited the opposite responses. This indicates that males distinguished between simulated young and old intruders based on song, and responded differently depending on their own experience. Our study highlights the possibility that receiver as well as sender traits should be considered when interpreting animal interactions.

**PS2.123 Pomfret, James,** (Society of Canadian Ornithologists, Roberts Creek, Canada); Nocera, Joseph (Ontario Ministry of Natural Resources, Peterborough, ON, Canada); Kyser, Kurt; Smol, John; Grooms, Chris (Queen's University, Kingston, ON, Canada); Reudink, Matthew (Thompson Rivers University, Kamloops, BC, Canada)

#### RELATIONSHIP BETWEEN HISTORIC DIETARY PATTERNS AND POPULATION CHANGES IN VAUX'S SWIFT

Over the past 50 years, aerial insectivorous birds throughout North America have experienced population declines across their entire guild, for reasons such as habitat loss and resource limitations. Vaux's Swifts (*Chaetura vauxi*) are a small species of swift seeing declines in each province and state of their wintering grounds except for Oregon. Many studies attribute the swift's current decline to a loss in nesting habitat. Here we explore whether fluctuations in diet quality can offer an alternative explanation for the swifts experienced declines. For instance, recent work on the closely related Chimney Swift (*Chaetura pelagica*) indicates that over the past several decades, declines in Chimney Swift populations have been strongly correlated with declines in diet quality – a pattern that appears to be driven by the heavy use of pesticides, such as DDT. We aim to examine whether changes in diet, potentially driven by pesticide use, explain shifts in Vaux's Swift populations as well. Vaux's Swifts are a neotropical migratory bird. During migration they exhibit a unique behaviour of roosting communally within decommissioned brick chimneys, often with thousands of individuals occupying a single stack. This results in a guano pile, often several feet high, accumulating at the base of the roost. These guano piles present a unique opportunity to explore historic changes in diet over the entire period in which swifts have roosted and deposited guano in these chimneys. We utilize the bird's behaviour by obtaining vertical core samples from roosting sites located at several locations throughout the Pacific Northwest. These chronostatified samples allow us to monitor historic diet trends from the beginning of the roost sites use through the exploitation of stable isotope analysis. We stratified the samples into 1 cm layers and isolated parts from undigested arthropod exoskeletons. Using isotope analysis of  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$ , we assess diet quality for each 1 cm sample. We analyze Breeding Bird Survey population data to determine if our data correlates with swift population trends. Though loss of nesting habitat is certainly an important factor in swift

declines, we suggest that diet fluctuation may be a factor of both Vaux's Swift and other aerial insectivore population declines. Future work aims to determine if DDT or other pesticides have contributed to a dietary shift.

**W13.5 Poole, Alan**, (CORNELL LAB OF ORNITHOLOGY, Ithaca, United States); **WILEY, JAMES** (USGS MD CO-OP FISH & WILDLIFE RES. UNIT, MARION STATION, United States)

#### IS THE CARIBBEAN OSPREY AT RISK?

Information gathered over the past 10-15 years suggests that the Caribbean Osprey (*Pandion halietus ridgwayi*) is rare and threatened; it is certainly one of the least well-known Osprey populations in the world. This subspecies has likely always been rare, but its numbers appear to be increasingly low – perhaps as few as 200-300 pairs total – with centers of breeding along the coasts of Cuba, the southern Yucatan and the Bahamas. Using data from museum specimens and unpublished reports, we document what little is known about the status and distribution of this elusive bird, including notes on its life history, and we discuss ways to improve surveys and bolster this population with artificial nesting platforms.

**W17.5 Porzig, Elizabeth**,\* (PRBO Conservation Science, Bolinas, United States); Seavy, Nathaniel; Gardali, Thomas; Geupel, Geoff (PRBO Conservation Science, Petaluma, United States); Eadie, John (UC Davis, Davis, United States)

#### A TIME SERIES MEETS A HABITAT MODEL: EVALUATING THE INFLUENCE OF HABITAT CHANGE AND POPULATION PROCESS ON SONGBIRD ABUNDANCE

Confronted with a rapidly changing world and limited resources for conservation, we are increasingly interested in predicting the impact of climate and land use change on bird populations. Habitat-suitability models (HSMs) explain species presence or abundance with physical habitat features and are increasingly used by managers and conservation planners, especially within the context of climate change. With the growing use of HSMs, there is increasing concern that certain assumptions limit their application. HSMs are typically created using variability across space rather than through time, such that any temporal dynamics in species-environment interactions or population processes, such as biologically realistic growth rates or density dependence, are not captured. We investigated the temporal aspect of species-environment relationships by comparing HSMs with autoregressive population models. We used data spanning 1983-2010 from the Palomarin Field Station of PRBO Conservation Science, a time over which the majority of coastal scrub habitat transitioned to conifer forest, with dramatic changes in bird community composition. We developed models to evaluate the relative role of vegetation change, weather variability, and population processes in affecting local density of seven bird species over 23 years. We then tested the ability of these models to predict changes in abundance over the subsequent five years. We found that HSMs explained between 59% and 82% of the deviance in species abundance. However, demographic models that included density dependence as well as habitat covariates provided a better fit to the data for three of the seven species. We found that neither an HSM nor a demographic model had consistently better predictive ability. This investigation shows that studying the complex interplay between species and their habitats must go beyond examining a single process in a single temporal or spatial dimension and move toward a more integrated understanding of the combined influences of different but related processes.

**PS1.87 Potter, Beth**, (Penn State Erie, Behrend College, Erie, United States); Carlson, Brian; Pander, Kaitlin (Penn State Erie, Behrend College, Erie, United States); Voss, Margaret (Pennsylvania State University at Erie, Behrend College, Erie, PA, United States)

#### EGGSHELL MICROSTRUCTURE AND TEMPERATURE FLUCTUATION FACILITATE MICROBIAL INVASION DURING INCUBATION

The mineralized shells of avian eggs protect developing embryos from physical damage and desiccation while permitting exchange of respiratory gases and water with the external environment. Microscopic pores that pass through eggshells facilitate embryonic metabolism; this, however, provides a route for potential bacterial contamination. Bacterial infections reduce hatch success and increase neonate mortality. We examined the role of eggshell pores in microbial contamination of quail eggs under artificial incubation conditions. The external surfaces of 240 eggs were sterilized and inoculated with *Pseudomonas fluorescens*. The eggs were artificially incubated at  $75 \pm 5\%$  relative humidity. Three incubators were held at constant temperatures ( $23.93 \pm 1.29^\circ\text{C}$ ,  $28.71 \pm 0.43^\circ\text{C}$ ,  $32.9 \pm 0.27^\circ\text{C}$ ), while three temperature treatments simulated intermittent incubation ( $23.24 \pm 2.97^\circ\text{C}$ ,  $29.25 \pm 3.63^\circ\text{C}$ ,  $33.0 \pm 2.97^\circ\text{C}$ ). The intermittent temperature treatments fluctuated through cooling cycles every 15 minutes during 12 hours of daylight. Eggs were sampled on day 4, 8, and 14 to quantify external and internal *P. fluorescens* concentrations. The microstructures of sampled eggshells were examined using scanning electron microscopy. Pore size and density were compared with the density of bacterial colonies found on the internal surface of the eggs. Increases in eggshell pore size and density, coupled with lower average egg temperatures and intermittent cooling facilitated bacterial passage through the eggshell and internal contamination of incubated eggs.

**SAT14.1 Powell, Luke**, (School of Renewable Natural Resources, Louisiana State University, Baton Rouge, United States); Stouffer, Philip (School of Renewable Natural Resources, Louisiana State University, Baton Rouge, Canada); Erik, Johnson (National Audubon Society, Baton Rouge, LA, United States)

#### RECOVERY OF AVIAN MOVEMENT ALONG THE INTERFACE OF PRIMARY AND SECONDARY AMAZON RAINFOREST

Due to large-scale regeneration following deforestation, lowland Amazonia now contains vast areas of secondary forest, yet the value of secondary forest to wildlife remains poorly understood. From 1992–2011, we captured 2773 understory birds of ten foraging guilds along the interface of primary forest fragments and 0–30 year-old secondary forest (hereafter “the interface”) at the Biological Dynamics of Forest Fragments project near Manaus, Brazil. Our objectives were: (1) to understand the land use history characteristics that drive movement along the interface, and, (2) to determine how long it takes each guild to recover to pre-isolation capture rates. Age of secondary forest within 100-m of the interface was the most important variable driving capture rates, as this variable was included in the best-fit model for every guild. The effect of land use history on capture rates was otherwise variable, with no one factor (including area effects, matrix effects and burn history) appearing in the best-fit model of more than three guilds. Based on best-fit models, mean recovery to pre-isolation for all ten guilds was 26 years ( $+16 / -13$ ), and nine of ten guilds recovered between 13 and 34 years. We project that terrestrial insectivores will take 54 years to recover if borders are not burned—67 years if borders are



burned. Six of 12 terrestrial insectivore species were never caught along the interface, even though they were all captured at least once within forest fragments. Our recovery estimates essentially quantify the dynamic permeability of secondary forest, thus contributing to understanding the value of secondary forests as corridors among primary forest fragments. If we can predict how variable landscapes affect connectivity for the most sensitive indicator species (e.g. terrestrial insectivores), we can better focus conservation strategies as second growth and small fragments become increasingly significant in tropical landscapes.

**SAT17.10 Preston, Kristine,** (Center for Conservation Biology, Riverside, United States); Hanser, Steve (US Geological Survey, Boise, CA, United States); Johnson, Robert (Center for Conservation Biology, Riverside, CA, United States); Knick, Steve (US Geological Survey, Boise, CA, United States)

#### USING ECOLOGICAL MINIMUM REQUIREMENTS TO MODEL GREATER SAGE-GROUSE HABITAT ACROSS THEIR WESTERN RANGE, U.S.A.

The greater sage-grouse (*Centrocercus urophasianus*), is an obligate resident of semi-arid sagebrush shrublands with a widespread distribution in western North America. Sage-grouse populations have been reduced by half since European settlement and the species was recently designated as a candidate for listing under the U.S. Endangered Species Act. Our objectives were to develop niche models for greater sage-grouse identifying minimum characteristics of important habitats and to delineate suitable habitat throughout their western range. Sage-grouse occur under variable environmental conditions, making it difficult to predict suitable habitat, especially for smaller, peripheral subpopulations. We constructed partitioned Mahalanobis D2 models to identify consistent environmental characteristics considered as ecological minimums and representing essential habitat requirements. Using active grouse lek locations, we developed models with different combinations of topographic, climatic, edaphic, modeled sagebrush, land cover, fire history, and anthropogenic variables. Variables were calculated at the lek and within areas of 5- and 18-km radii. We ran 1,000 iterations of each model, randomly sampling among subpopulations to avoid spatial bias, and averaged results. We evaluated models with randomly withheld lek locations and a dataset of active and historic, extirpated grouse locations. Models performed well predicting suitable habitat for core and small, peripheral subpopulations. Averaging across top performing models, we mapped suitable habitat in the western range. The model best distinguishing active from historic grouse habitat consisted of land cover and anthropogenic variables measured at the 18-km scale. Certain climate, topographic and edaphic relationships were consistent for leks. Most importantly, anthropogenic variables describing land use and infrastructure were among the strongest ecological minimums, indicating sensitivity of grouse distributions to human activities. By identifying ecological minimums, insight is gained into how greater sage-grouse may respond to future projected environmental changes.

**PS2.106 Prevost, Stephanie,** (University of Tennessee, Knoxville, United States); Fischer, Richard (U.S. Army Engineer Research and Development Center, Alexandria, VA, United States); Buehler, David; Wilkerson, John; Worley, Stacy; Smith, David; Hockman, Emily (University of Tennessee, Knoxville, TN, United States)

#### DEMONSTRATION AND IMPLEMENTATION OF AUTONOMOUS AERIAL ACOUSTIC RECORDING

#### SYSTEMS TO INVENTORY DOD INSTALLATION IMPACT AREAS FOR THREATENED, ENDANGERED, AND SPECIES AT RISK BIRD POPULATIONS

The Department of Defense (DoD) administers nearly 30 million acres of lands for the primary purposes of training troops and testing weapons platforms to ensure military readiness. These lands are unique in that very large and inaccessible parcels have been set aside as impact areas for various types of munitions and explosive ordnance. Frequent disturbance to these impact areas, usually in the form of fires, makes them highly suitable as habitat for many threatened, endangered, and sensitive (TER-S) avian species. DoD has both regulatory and stewardship responsibilities to manage and monitor for many of these species. However, this has been very difficult on most installations because of the inability to access these restricted areas on the ground. The overall objectives of this project are to demonstrate and validate the use of autonomous aerial acoustic recording systems (AAARS) for monitoring threatened, endangered, and sensitive (TER-S) bird species populations on military installations. We will illustrate the ability of the autonomous aerial acoustic recording system to collect data on avian vocalizations for TER-S birds across a broad range of accessible military lands, train project staff on use of this technology, evaluate the ability of staff to deploy the technology, and compare the accuracy, precision, and cost of monitoring data collected by AAARS to data collected by conventional means. We have collected one year of data and will discuss the benefits of this monitoring method as well as the implications associated with using this technique on inaccessible areas across North America.

**T7.5 Prior, Nora,** (University of British Columbia, Vancouver, Canada); Heimovics, Sarah; Yap, Kang Nian (Jeff); Soma, Kiran (University of British Columbia, Vancouver, BC, Canada)

#### NEUROENDOCRINOLOGY OF PAIR-MAINTENANCE BEHAVIOR IN A SOCIAL SONGBIRD, THE ZEBRA FINCH

Zebra finches (*Taeniopygia guttata*) are desert-dwelling birds that form long-term pair bonds, which they actively maintain year-round. Natural droughts and experimental water restriction affect breeding in this species. Sex steroids can regulate courtship and behaviors associated with pair-maintenance in breeding condition zebra finches. However, pair-maintenance in non-breeding condition zebra finches has not been studied. Here, we used water restriction (1mL/subject/week) to bring zebra finch pairs into non-breeding condition. Control pairs were provided with water ad libitum. We then examined the effects of water restriction on (1) pair-maintenance behaviors, (2) reproductive physiology (number of eggs laid, gonad size, oviduct length), and (3) sex steroid levels in the circulation and brain. Baseline behaviors were recorded before and after water restriction. After water restriction, we conducted a “partner preference test” and a “partner reunion test.” For all three paradigms, pair-maintenance behaviors were scored. Following the partner reunion test, trunk blood and brain tissue were collected and stored at -80°C until tissue processing and steroid measurement. Pair-maintenance behaviors (e.g. time spent in close proximity) were unaffected by water restriction in any of the three behavioral paradigms. In females, water restriction significantly reduced the number of eggs laid, largest follicle size, and oviduct length. In males, water restriction did not affect testis size; however it did decrease circulating testosterone levels. Additionally, water restriction decreased estradiol in behaviorally-relevant brain regions in both males and females. These data show that water restriction dramatically downregulates female reproductive physiology, however it decreases sex steroid levels in both males and females. That

pair-maintenance behavior is high regardless of breeding condition suggests that these behaviors may be maintained independent of, or through local production of, brain steroids. The potential role of systemic and neurally-synthesized estradiol in zebra finch pair-maintenance behaviors is currently being examined.

**PS2.203 Prosser, Kelsey**, (Black Hills State University, Sturgis, United States);

#### MOLECULAR CHARACTERIZATION OF AVIAN GUT PARASITES (EIMERIA)

*Eimeria* species (~1200 described species) are the main cause of coccidiosis, an intestinal disease that increases stress and mortality in several invertebrate phyla and across vertebrate classes. In birds, *Eimeria* species are best characterized in domesticated fowl. Anticoccidial drugs designed to treat coccidiosis account for the largest expenditure on medication in poultry farms around the world. Studies have demonstrated that multiple species of *Eimeria* can infect the digestive system of one or more bird species. Given the possibility of cross species transmission, it is surprising the paucity of data collected documenting the diversity of *Eimeria* species in wild bird populations. In this study, we use DNA barcoding procedures to characterize the *Eimeria* species infecting the gut of a number of North American songbirds. Multilocus sequence data (16S, COI, and ITS genes) indicate that a single host can be infected by several *Eimeria* species. Phylogenetic analysis of the sequence data suggests that each host examined is infected by at least one previously unidentified species of *Eimeria*. Insights into host and *Eimeria* shared evolutionary history are discussed.

**W8.4 Pruett, Christin**, (Florida Institute of Technology, Melbourne, United States); Topp, Carrie (University of Alaska Museum, Fairbanks, AK, United States); Maley, James (University of Wyoming, Laramie, WY, United States); McCracken, Kevin (University of Alaska Museum, Fairbanks, AK, United States); Rohwer, Sievert; Birks, Sharon (University of Washington, Seattle, WA, United States); Sealy, Spencer (University of Manitoba, Winnipeg, MB, Canada); Winker, Kevin (University of Alaska Museum, Fairbanks, AK, United States)

#### EVIDENCE FROM THE GENETICS OF ELEVEN LANDBIRD SPECIES FOR A FORESTED REFUGIUM IN THE HAIDA GWAII AREA

Refugia in glaciated regions likely contributed to the modern biodiversity of northern areas. Using the mitochondrial DNA cytochrome b gene, we compared eleven forest-dwelling bird species from Haida Gwaii, British Columbia with populations from Alaska, Washington, and other locations in the United States. If Haida Gwaii was a glacial refugium, modern populations should feature a high number of endemic lineages and divergence times that predate the end of the last glacial maximum (ca. 13,000-19,000 ybp). Further, these populations might exhibit higher genetic diversity than areas that were post-glacially colonized. Four of the species examined from Haida Gwaii showed old divergences and a high percentage of endemic lineages: Northern Saw-whet Owl (*Aegolius acadicus*), Hairy Woodpecker (*Picoides villosus*), Steller's Jay (*Cyanocitta stelleri*), and Pine Grosbeak (*Pinicola enucleator*); all four have endemic subspecies on these islands. Pacific Wren (*Troglodytes pacificus*) and Song Sparrow (*Melospiza melodia*) showed some genetic trends associated with refugial populations, including high genetic diversity. There was an association between apparent refugial membership and a sedentary life history strategy and a trend for endemic subspecies (4 of 6) to also show

this association. Our findings suggest that the Haida Gwaii area hosted a forested refugium during the climatic change cycles of the late Pleistocene.

**W17.10 Pruett, Shane**, (Archbold Biological Station, Venus, United States); Bowman, Reed (Archbold Biological Station, Venus, FL, United States); Fitzpatrick, John (Cornell University Lab of Ornithology, Ithaca, NY, United States); Boughton, Raoul; Dent, Michelle (Archbold Biological Station, Venus, FL, United States)

#### COMPONENTS OF PRODUCTIVITY: THE CONTRIBUTION OF TOP-DOWN VERSUS BOTTOM-UP FACTORS UNDER DIFFERING LANDSCAPE CONTEXTS.

Productivity is an important aspect of population demographic models. Nest survival is often a surrogate for productivity, but this assumes that most productivity is limited by whole clutch loss via predation. Conspecifics living under differing habitat conditions and landscape contexts may be constrained by different ecological processes. Some populations may be regulated in part by bottom-up processes (e.g. food limitation) as well as typical top-down predation pressure, calling into question the generalizability of estimates derived in one location to other populations. In our study, nest survival and productivity are constrained chiefly by predation (a top-down effect), but brood reduction could be an important aspect of productivity where populations lack sufficient food for young birds (i.e. bottom-up limitation). We present 17 years of nest survival and productivity data from three populations varying in landscape context. Nest survival is higher in two wildland populations than in a suburban one, driven by reduced nest survival during the nestling stage. All populations experience a seasonal decline in nest survival, but it is steepest in a wild, fragmented population. The suburban population produces more eggs and nestlings per pair than either wild population, but produces fewer fledglings (our measure of productivity), largely as a result of greatly increased brood reduction rates. Although productivity declines in each population from the first half to the second half of the season across all nests, productivity of successful nests doesn't decline substantially, i.e. nests produce just as many fledglings late in the season as early, given that they are successful. Our results suggest that although whole clutch loss through predation is the main limiting factor to productivity, the timing of predation pressure can differ substantially and predictably by population. Further, brood reduction is an added limitation on suburban productivity. Additionally, annual productivity is temporally correlated in the wild populations, but not with the suburban population; further evidence that productivity is out of sync in the different landscapes. Estimates of productivity must take into account both top-down and bottom-up constraints and appropriately account for temporal patterns specific to the habitat and landscape context of interest. Finally, care should be taken when attempting to generalize productivity estimates from one context to others.

**PS2.230 Pulgarin, Paulo**, (Universidad de Los Andes, Bogota, Columbia);

#### DOES BODY MASS PREDICT VOCAL FREQUENCY IN WOODPECKERS?

Many studies in vertebrates have found an inverse relationship between body mass and the main frequencies used for acoustic communication. In birds there is a tendency for this relationship in some groups and evidence has not been found for others. The evolutionary component of body size on predicting main used frequency spectrum remains to be explored in many avian groups. We tested for an inverse relationship between body mass

and two frequency traits (low and peak vocalizing frequencies) in 144 species woodpeckers representing more than 90% of all genera and all the current recognized clades within this bird family. Although we could not correct for phylogenetic effects, we provide support for a general negative relationship of body mass vs. frequency. Low frequency was better adjusted to the inverse relationship with body mass. With some exceptions, the species here examined used a wide spectrum of frequencies, and despite the diversity of type of songs/call, the basic structure seems to be relatively homogeneous across the group. We discuss the possible causes of this negative relationship in this cosmopolitan avian clade.

**PS2.127 Quiroga, Mónica**, (Universidad Nacional Autónoma de México, México, Mexico);

NECTAR PRODUCTION OF SALVIA IODANTHA VISITED BY HUMMINGBIRDS AND NECTAR ROBBERS DIGLOSSA BARITULA AND OREOTHLYPIS RUFICAPILLA IN THE MOUNTAINS OF MANANTLÁN, JALISCO.

Many flowers produce nectar, as a reward to their pollinators. Some animals use this resource even when they do not pollinate the plants and they are called nectar robbers. Nectar robbers have developed various strategies to evade these restrictions imposed by plants, causing floral damages that can decrease the amount of nectar available to pollinators decreasing visitation rate and diminishing seed production. If nectar is abundant robbers can be commensals in the system having neither positive nor negative effects in the system. We used nets to assess the relative abundance of hummingbirds and nectar robbers. To assess floral abundance and record nectar robbers visitation quadrants, were used. Nectar produced (nectar volume and concentration) was measured. A total of 33 individuals of the family Trochilidae of 7 species were recorded. *Selasphorus* was the most abundant of all hummingbirds. We found significant differences in the volume and calories produced between hours but not among treatments or in the interaction of these factors, in both cases three groups were formed. The presence of the robbers is low in the system, the number of flowers in this area at this season is high, which may determine that the resource was not limited, and this may determine the neutral status of nectar robbers in the system. Keywords: Hummingbirds, robbers, pollination, nectar. *S. iodantha*.

**PS1.127 Rader, Jonathan**, (University of Wyoming, Laramie, United States); Newsome, Seth (University of Wyoming, Laramie, WY, United States); Chesser, R. Terry (Smithsonian Institution, Division of Birds, Washington, DC, United States); Martínez del Río, Carlos (University of Wyoming, Laramie, WY, United States)

EXPLORING PHENOTYPE-ENVIRONMENT CORRELATIONS IN SOUTH AMERICAN CINCLODES OVENBIRDS

The suboscine genus *Cinclodes* provides an ideal system in which to study ecological and morphological covariation. The 15 species of *Cinclodes* inhabit coastal and riparian zones from sea level to >4000 m, and some species display seasonal elevational migration. Several species use marine resources either seasonally or throughout the year, and have to cope with the concomitant salt loads. These coastal *Cinclodes* may be the most maritime of all passerines. Preliminary morphological data suggest that *Cinclodes* species have diversified primarily in body size. The genus is subdivided into two clades with contrasting (and non-overlapping) body sizes, although an island species in the small size clade seems to have converged in body

size with species in the large-size clade. The data also suggest morphological convergence among the species *C. fuscus*, *C. albiventris* and *C. albidiventris*, three species formerly considered to be conspecific. Our study uses carbon ( $\delta^{13}\text{C}$ ) and nitrogen ( $\delta^{15}\text{N}$ ) isotopes as indicators of reliance on marine and terrestrial resources, and deuterium ( $\delta\text{D}$ ) and oxygen ( $\delta^{18}\text{O}$ ) isotopes to assess patterns of elevational residence and movement. Our approach is novel in that we 1) characterize the ecological habits of each species using stable isotope analysis, 2) describe morphological variation in the genus, and 3) track the evolution of ecology and morphology, and link them by mapping them along the branches of a well-resolved phylogenetic tree. To our knowledge, this project is the first to employ stable isotope analysis as a covariate for morphological study, and to document variation in  $\delta\text{D}$  and  $\delta^{18}\text{O}$  compositions in animal tissues along an elevational gradient.

**SAT7.2 Ralph, C John**, (US Forest Service, Arcata, CA, Canada); Wolfe, Jared (Louisiana State University, Baton Rouge, Louisiana, United States); Elizondo, Pablo (Costa Rica Bird Observatories, Santo Domingo de Heredia., Costa Rica)

TROPICAL BIRDS ARE A SENSITIVE INDICATOR OF CLIMATE CHANGE: THIRTEEN YEARS OF BIRD BANDING AND THE INFLUENCE OF THE EL NIÑO SOUTHERN OSCILLATION ON THE DEMOGRAPHY AND CONDITION OF SEVERAL MIGRANT AND RESIDENT BIRDS IN NORTHEASTERN COSTA RICA

We have found clear evidence that tropical bird demography and physiological condition may be influenced by the synergistic effects of forest structure and the El Niño Southern Oscillation (ENSO). We examined the influence of ENSO on the population growth, survival, and condition of resident species, especially the White-collared Manakin (*Manacus candei*), and of five Nearctic-Neotropic migrants during spring migration in young and mature forests. Our results from several stations indicate that both resident and migrant frugivores are significantly negatively influenced by the drying effects of ENSO, with the effect exacerbated in second-growth forests. More specifically, we found that during dry periods associated with ENSO, the manakin, an obligate frugivore, had lower survival and population growth, and migrant frugivores meanwhile acquired less weight. Conversely, all migrant insectivores either gained mass or exhibited no pattern during these dry phases of ENSO. We believe frugivorous species' sensitivity to climatic fluctuations reflect inherent trophic cascades where dry signals disrupt fruiting events and thus bird communities. Interactions between climate, forest structure and avian fitness, coupled with increased loss of mature forest and a changing climate necessitate a deeper understanding of community persistence across a heterogeneous landscape.

**T15.4 Raphael, Martin**, (USDA Forest Service, Pacific Northwest Research Station, Olympia, United States); Falxa, Gary (U.S. Fish and Wildlife Service, Arcata, United States)

CONSERVATION OF THE MARBLED MURRELET IN THE PACIFIC NORTHWEST, USA

The Marbled Murrelet (*Brachyramphus marmoratus*) is a small, diving seabird in the alcid family that forages within nearshore marine waters and nests on limbs of old coniferous trees. The species is federally listed as Threatened in the USA in the states of Washington, Oregon and California. As part of the regional effectiveness monitoring program in support of the Northwest Forest Plan, my colleagues and I have been surveying murrelets along coastal waters from year 2000 to present. These surveys indicate that murrelet numbers are declining at an annual rate of

about 2.2%. Concurrent modeling of murrelet nesting habitat indicates an overall decline in amount of suitable nesting habitat of about 0.5%/yr, due mostly to logging on non-federal lands and wildfire on federal lands. Furthermore, the spatial distribution of murrelets is strongly correlated with amount of adjacent suitable nesting habitat. Population decline could be due to losses of nesting habitat, but marine conditions could also be responsible. If marine conditions are the driver of population change, then we would expect other marine birds with similar foraging ecologies to experience similar population declines but we found no comparable declines among other alcid species. Circumstantial evidence leads us to conclude that the conservation and restoration of nesting habitat are keys to recovery of this species.

**PS1.176 Rasmussen, Ross**, (Geo-Marine, Inc., Plano, United States); Leukering, Anthony (Geo-Marine, Inc., Millville, United States); Nemeth, Richard (Center for Marine and Environmental Studies, University of the Virgin Islands, St. Thomas, US Virgin Islands, United States); Davis, Glen (Geo-Marine, Inc., Millville, United States); Buchanan, Gary (New Jersey Department of Environmental Protection, Trenton, United States)

#### DIURNAL SHORT AND LONG DISTANCE PASSERINE MIGRANTS

Although land birds are known to migrate over coastal and offshore waters off the east coast of North America, their identity is largely unknown because land bird occurrence data is not regularly reported in seabird survey reports. Species specific data is needed to assess potential wind turbine collision impacts on migrant passerines. The purpose of this poster is to (1) report on the occurrence, abundance, and location (distance from shore) of long distance (neotropical) and short distance (continental) passerine migrants during diurnal seabird survey conducted on the North Atlantic Ocean off of New Jersey during the 2008 and 2009 New Jersey Department of Environmental Protection's Ocean/Wind Power Ecological Baseline Study and (2) compare the survey results with other eastern Atlantic Ocean boat surveys.

A total of 44 migrant passerine species (23 Nearctic neotropical migrants and 21 North American continental migrants) were observed during spring and fall ocean surveys off New Jersey. Thirty-nine species of migrant passerines observed in this study have not previously reported during diurnal ocean surveys. Twenty-six migrant passerine species were detected offshore in spring and 40 species were detected during fall. The most abundant species were Barn Swallow (*Hirundo rustica*) and Purple Martin (*Progne subis*). Passerine migrants were observed up to 39 km (20.8 NM) from shore.

**W8.5 Rauri, Bowie**, (Museum of Vertebrate Zoology, Berkeley, United States);

#### GENE TREES, SPECIES TREES AND HISTORICAL BIOGEOGRAPHY OF THE AFRICAN GUINEO-CONGOLIAN RAINFOREST

Several molecular analyses suggest a Miocene-Pliocene origin for many songbird lineages distributed within the Guineo-Congolian rainforest of Africa. As a consequence some authors suggest that only limited lineage divergence took place during the climatically dynamic Pleistocene. This view is in stark contrast to the traditional perspective derived from analyses of species distribution patterns, which holds that shifting patterns of climate altered the balance between forest and savanna habitats and thereby fragmented the previously continuous

ranges of many forest-adapted species during glacial cycles when aridity in Africa intensified. The corollary of this is that during mesic conditions, such as the present, forest expanded, forming secondary contact zones between previously isolated taxa, from which several outcomes are possible. I review published biogeographic studies of African lowland birds, present new multilocus DNA data for two major clades of lowland birds, and integrate the above results with static and dynamic climatic models extending back to the past 120,000 years. Both static and dynamic models of forest distribution provide strong evidence for Pleistocene refugia being present in Africa, but molecular analyses suggest that divergence events are not constrained to the Pleistocene. There remains surprisingly little evidence of hybridization among putative refugial lineages, but given current sampling gaps, it is difficult to know whether this result has a biological basis or is a consequence of incomplete sampling.

**SAT13.10 Rector, Megan**, (Memorial University of Newfoundland, St. John's, Canada); Carolyn, Walsh; Anne, Storey (Memorial University of Newfoundland, St. John's, NF, Canada)

#### BEGGING AND BOASTING: ATLANTIC PUFFIN CHICK CALLS SIGNAL NEED AND QUALITY

The Signal of Quality (SoQ) model of honest begging predicts that higher quality offspring should call more, or boast, to signal their viability to parents, while the Signal of Need (SoN) model suggests that lower quality offspring should call more, or beg, to signal their poor body condition. We observed two types of calls in Atlantic puffin chicks (*Fratercula arctica*): a shorter peep call and a longer screech call. Chick condition was negatively correlated with the use of screech calls and positively correlated with the number of peep calls during parental visits to the nest. Following supplemental feeding, the use of screech calls declined. In contrast, chicks initially in poorer body condition showed a greater increase in peep call rate after supplemental feeding than chicks that started off in better condition. Peep calls may allow parents to assess chick quality (as in the SoQ model), while screech calls may allow chicks in poor body condition to signal their parents to increase provisioning (as in the SoN model). These results suggest that puffin chicks can use combinations of these two calls to both boast and beg.

**SAT4.3 Rega, Christine**, (University of Delaware, Elkton, United States); Shriver, Gregory (University of Delaware, NEWARK, United States); D'Amico, Vincent (United States Forest Service, NEWARK, United States); Bowman, Jacob (University of Delaware, NEWARK, United States)

#### SOIL, SNAILS, AND BREEDING BIRDS IN URBAN FOREST FRAGMENTS

The effects calcium availability on breeding birds in eastern North America are not completely understood, but they may be a factor in explaining population declines. Multiple studies have shown a strong relationship between avian reproductive success and calcium availability; however few have demonstrated habitat selection patterns related to calcium availability across a suite of species. In this study, we asked how soil calcium availability affected snail abundance, understory vegetation, and forest breeding bird territory density in urban forest fragments. In 2010 and 2011, we sampled 21 forest fragment sites in Newark, Delaware, USA to estimate soil calcium, snail abundance and weight, vegetation composition, and avian territory density. We used the soil calcium: aluminum ratio (Ca:Al) as an ecological threshold (Ca:Al  $\geq$  1) to estimate calcium availability. We compared snail abundance, vegetation

cover, and bird territory densities between calcium-poor ( $\text{Ca:Al} < 1$ ) and calcium-rich ( $\text{Ca:Al} \geq 1$ ) sites using ANOVA. In calcium rich sites, snail abundance was 2.4 time greater ( $F = 14.03$ ,  $P < 0.001$ ), and non-native plant cover was 2.6 times greater ( $F = 36.58$ ,  $P < 0.001$ ). Thirty-three bird species established territories within these forest fragments. We used the R package “unmarked” to estimate abundance of the 13 most common species in relation to soil calcium, snail weight, vegetation structure, and landscape-scale characteristics. The global model was the top model for 10 of 13 (77%) of the species. Northern Cardinal (*Cardinalis cardinalis*) abundance was negatively associated with basal area ( $\beta = -0.38$ ), forest cover ( $\beta = -0.37$ ), stand age ( $\beta = -0.34$ ), and percent of non-native shrub stems ( $\beta = -0.22$ ); and positively associated with vertical vegetation density ( $\beta = 0.03$ ), patch size ( $\beta = 0.11$ ), snail weight ( $\beta = 0.11$ ), and  $\text{Ca:Al}$  ( $\beta = 0.28$ ). Ovenbirds (*Seiurus aurocapilla*) had relatively opposite trends, in that their abundance was negatively associated with  $\text{Ca:Al}$  ( $\beta = -0.13$ ), and percent non-native shrub stems ( $\beta = -0.05$ ); and positively associated with patch size ( $\beta = 0.55$ ), basal area ( $\beta = 1.11$ ), forest cover ( $\beta = 1.27$ ), snail weight ( $\beta = 1.40$ ), vertical vegetation density ( $\beta = 1.58$ ), and stand age ( $\beta = 2.41$ ). Eastern Wood-Pewee (*Contopus virens*,  $\beta = -0.29$ ) and Red-bellied Woodpeckers (*Melanerpes carolinus*,  $\beta = 0.16$ ) were the only species which had snail weight as their top model.

**PS1.221 Reichart, Letitia**, (University of Nebraska Kearney, Kearney, United States); Stretch, Michele; Hagstrom, Amanda (University of Nebraska Kearney, Kearney, NE, United States)  
**BASELINE MEASUREMENTS OF FECAL CORTICOSTERONE IN NESTLING RED-WINGED BLACKBIRDS**

Although corticosterone (CORT) is commonly known as the avian stress hormone, most often it plays an important role maintaining homeostasis in birds. In fact, CORT is only considered an indicator of stress when levels are elevated in response to a perceived stressor. To evaluate potential responses to stress, studies measuring baseline levels of CORT are necessary. Measurements of fecal CORT have provided a non-invasive method to determine baseline levels of CORT in birds. To date few studies have measured baseline levels of fecal CORT in nestlings during development; however, these measurements may provide a method to evaluate nutritional stress or competition among offspring within the nest. During nestling development, chicks experience a variety of social and environmental cues that may influence baseline levels of CORT. For this study, we identified an extraction procedure and an enzyme immunoassay useful for measuring fecal CORT in nestling red-winged blackbirds (*Agelaius phoeniceus*). In addition, we determined baseline levels of nestling fecal CORT from a wild population of red-winged blackbirds in Nebraska.

**SAT17.5 Reiley, Bryan**, (University of Illinois, Champaign, United States);  
**EFFECTS OF A LARGE CATASTROPHIC FLOOD ON UNDERSTORY HABITAT, PREY ABUNDANCE, AND PRESENCE OF SWAINSON'S WARBLERS**

Large-scale natural disturbances can influence the ecology of avian species and the habitats they occupy. This is particularly true for the Swainson's Warbler (*Limnithlypis swainsonii*) which is susceptible to flooding due to its preference for nesting in thick understory and foraging in leaf litter. In 2008, a catastrophic flood occurred on the Mississippi River and its tributaries, completely inundating a study site where we have studied Swainson's Warblers since 2004. To determine in the

impact of flooding on habitat suitability and Swainson's Warbler populations, we investigated factors influencing changes in territory occupancy within the White River National Wildlife Refuge in southeastern Arkansas. In 2008 and 2009, we surveyed 42 Swainson's Warbler territories that had been occupied between 2004 and 2007 and examined changes in occupancy relative to changes in habitat structure and prey abundance. In 2008, only 21 previously occupied territories (50%) were occupied and 19 were occupied (45%) in 2009. Territories that became unoccupied had greater increases in bare-ground cover, decreases in giant cane (*Arundinaria gigantea*) stem density, and decreases in Araneae abundance than those that remained occupied between pre-flood and flood periods. Despite recovery of habitat and prey abundance during the post-flood period, Swainson's Warbler occupancy did not recover to pre-flood levels. Conservation for this species should focus on identifying and conserving the highest elevation, least flood-prone areas within bottomland hardwood forests and managing those areas for thick understory vegetation.

**T10.3 Reitsma, Leonard**, (Plymouth State University, Plymouth, United States); Jukosky, James (Colby-Sawyer College, New London, NH, United States); Goodnow, Marissa; Kimiatek, Alexi (Plymouth State University, Plymouth, NH, United States); Hallworth, Michael (George Mason University, Fairfax, VA, United States); Wampler, Jesse (Plymouth State University, Plymouth, NH, United States)

**EXTRA-PAIR PATERNITY IN A CANADA WARBLER POPULATION IN CENTRAL NEW HAMPSHIRE**

Extra-pair paternity has been frequently documented among socially monogamous migratory songbirds, including many species of wood warblers. We analyzed blood from nestlings and adults over three years (2006-2008) to determine the frequency and patterns of extra-pair paternity in an intensively studied population of Canada Warblers in west-central New Hampshire. All males were captured and color-banded and as many females as possible were also marked. We analyzed paternity for 33 nests and 62% of these nests had nestlings from multiple male parents. The number of nests cuckolded by males ranged from 0-5 with 28% of males cuckolded 2 and 3 nests, respectively and 41% cuckolded either 1 or 2 nests. Only one male sired young in 5 nests. The percent of males that successfully sired their own young was inversely proportional to the number of nests successfully cuckolded. Older, more experienced males appeared to go farther from territories in pursuit of extra-pair copulations, and successful extra-pair paternity extended beyond immediate neighbors. These results suggest potential trade-offs between seeking extra-pair copulations and successfully siring and fledging one's own young.

**S4.2 Rempel, Rob**, (Ontario Ministry of Natural Resources, Thunder Bay, Canada); Jackson, Janet (Ontario Ministry of Natural Resources, Thunder Bay, ON, Canada)

**ACOUSTIC TECHNIQUES TO IMPROVE THE POWER OF SONGBIRD MONITORING DATA: TREATING POLICY AS HYPOTHESIS**

Treating conservation planning and resource management policies as testable hypotheses requires sampling methods that go beyond simple surveillance monitoring. Hypothesis-based monitoring methods must be rigorous, and with sufficient power to meet the challenge of testing policy effectiveness. Monitoring objectives include solid and robust estimate of habitat occupancy (or density), stability in model estimates, confidence in the data, and cost-effectiveness. We investigated

the ability of autonomous audio recorders to improve the quality of monitoring data by comparing the effect of single versus multiple site observations on estimates of habitat selection for 8 forest and wetland bird species, and then evaluating cost-effectiveness. Songmeter autonomous audio recorders were used to collect repeated samples, morning and evening, within sites over two to five days. RSPF habitat models were estimated using both simple logistic regression and joint occupancy/detection methods. Detection covariates improved model fit for all eight species, with the detection covariates ambient temperature, weeks-since-spring, and time-of-day significantly improving the precision of occupancy estimates. We found significant differences in RSPF parameter estimates using a single site observation versus multiple site observations. We evaluated optimal survey design, and found that for 7 of 8 species a survey designed to achieve a coefficient of variance (CV) for the occupancy estimate of 0.25 could be achieved using four 10-min repeat recordings within a site, surveying 100 independent wetland sites, for a total sample size of 400 recordings. Use of autonomous recorders offered significant cost-effectiveness benefits, and the technology allowed us to implement effective sample design strategies for hypothesis testing that could not otherwise be afforded. As a case study, we illustrate use of acoustic data to test the monitoring/policy null hypothesis that forest harvest in the vicinity of a wetland (local and landscape scales) does not affect occupancy of the wetland. Two species, Common Yellowthroat and Red-winged Blackbird, selected wetlands with less adjacent forest cover at the local scale (15 ha). The effect of forest harvest at the landscape scale (306 ha) improved model fit for only one species, Alder Flycatcher, where the odds of occupancy was 1.38 times higher for every unit increase in recently disturbed forest.

**S2.3 Renfrew, Rosalind**, (Vermont Center for Ecostudies, Norwich, United States); Kim, Dan (Platte River Whooping Crane Trust, Wood River, NE, United States); Perlut, Noah (University of New England, Biddeford, ME, United States); Fox, James (British Antarctic Survey, Cambridge, United Kingdom); Marra, Peter (Smithsonian Migratory Bird Center, Washington, DC, United States)

#### MIGRATION OF BOBOLINKS FROM ACROSS THE BREEDING RANGE

Bobolink (*Dolichonyx oryzivorus*) is one of the longest-distance passerine migrants in the western hemisphere, but the migration strategy and connectivity of this declining species are not known. In 2009-2010 we deployed geolocators at three distinct breeding sites spanning the breeding range (Vermont, Nebraska, Oregon), to determine migration timing, routes, and stopovers. We recovered 15 geolocators that contained data. Oregon birds migrated east in the fall before proceeding south, presumably due to geographical barriers or evolutionary inertia. We documented the first case of a passerine with long, multiple stopovers; fall stopovers by all birds in northern Venezuela lasted up to six weeks (mean = 35 days), and in Bolivia up to three weeks (mean = 17.2 days). The Caribbean was a brief but important stopover in spring and fall. Most birds wintered in northeastern Argentina, but four birds wintered in northwestern Argentina, Paraguay or Bolivia. Based on data from five birds, spring departure from the wintering grounds occurred 3-8 April, one month later than previously believed. We found no evidence of regional connectivity along a longitudinal gradient. Two years of data from the same individual show consistent stopover and winter locations, but variable timing. We recommend additional work in the northern breeding range to assess latitudinal connectivity, with 1 year of data on individuals to determine plasticity in stopovers and phenology. Rainfall,

food availability, and weather patterns are likely influencing migration phenology, and potentially, locations of Bobolink outside of the breeding season.

**S8.4 Renton, Katherine**, (Universidad Nacional Autonoma de Mexico, San Patricio-Melaque, Jalisco, Mexico);

#### CHALLENGES FOR CONSERVING THREATENED ENDEMIC SPECIES: THE CASE OF PARROTS IN MEXICO

The majority of avian species considered threatened or at risk of extinction in North America are endemic to Mexico. Of the tropical bird species resident in Mexico that are considered of high trilateral concern, just under half have specific nesting requirements for tree cavities. Furthermore, those bird families that are predominantly cavity-nesters have a high proportion of threatened species. In particular, Psittacidae represents the avian family with the greatest number and proportion of species at risk. In Mexico, 36% of parrot species are endemic to the country and 76% are considered at risk. I conducted a revision of studies on parrots in Mexico from 135 publications in theses and scientific papers over the period 1910-2010. There was a lack of studies on natural history and ecology of parrots in Mexico. Most studies were species lists, distribution accounts or taxonomic in nature, with natural history studies being conducted mainly in the last two decades, and ecological studies increasing only over the last decade. Furthermore, these natural history and ecological studies have been conducted on only a third of Mexican parrot species, mainly the attractive species of macaws and large parrots. All Mexican parrot species have suffered a reduction in original distribution and habitat loss. Nesting studies of parrots demonstrate they have low nest success and reproductive output, but there is a lack of information on the limiting factors for parrot reproduction. Little data exists on population size and tendencies for any of the Mexican parrot species, or on diseases and genetic diversity of wild populations, and the ecological requirements of many parrot species are poorly understood. Finally, two thirds of Mexican parrot species have not been studied, and their ecology and natural history is practically unknown. This dearth of knowledge on many threatened endemic species extends to other tropical bird families, and creates limitations in defining priorities and developing appropriate conservation strategies.

**F10.5 Reudink, Matthew**, (Thompson Rivers University, Kamloops, Canada); Kyle, Christopher (Trent University, Peterborough, Canada); Reudink, Robyn (Thompson Rivers University, Kamloops, BC, Canada); Kyser, Kurt (Queen's University, Kingston, ON, Canada); Somers, Christopher (University of Regina, Regina, SK, Canada); Nocera, Joseph (Ontario Ministry of Natural Resources, Peterborough, ON, Canada)

#### MULTIPLE STABLE-ISOTOPES (DD, D13C, D15N) INDICATE LONG-DISTANCE DISPERSAL FACILITATES GENE FLOW AND GENETIC PANMIXIA IN A CONTINENTALLY-DISTRIBUTED WATERBIRD

Many highly mobile species, such as pelagic seabirds, are capable of long-distance movement and dispersal, yet exhibit high levels of population genetic structuring, often due to high philopatry. In this study, we examined patterns of genetic and isotopic differentiation across the range of a highly mobile, colonial waterbird, the American white pelican (*Pelecanus erythrorhynchos*). To assess patterns of genetic structuring, we sampled individuals from 19 colonies across their North American range. The use of 10 variable microsatellite markers and a single mitochondrial marker revealed high levels of allelic richness with no difference between core and peripheral

populations and no population differentiation. Contrary to presumed population divisions, we found no evidence of genetic structuring across the Continental Divide or between migratory and non-migratory colonies. We then analyzed variation in three stable isotopes ( $\delta D$ ,  $\delta^{13}C$ ,  $\delta^{15}N$ ) to profile the feathers of 200 individuals from the same colonies. Our results indicate extremely high variation in isotopic signatures within colonies, suggesting low levels of philopatry and a high incidence of long-distance dispersal. Although all isotopes exhibited some minor spatial structuring, graph-based segregation indices (Mean Composite Information scores) were best for  $\delta D$  (MCI = 38.22) followed by  $\delta^{13}C$  (MCI = 38.64) and  $\delta^{15}N$  (MCI = 39.28) Frequent long-distance dispersal, resulting in high levels of gene flow, may be a mechanism by which American White Pelicans deal with ephemeral resources and unpredictable habitat conditions.

**W5.6 Rich, Terrell**, (U.S. Fish and Wildlife Service, Boise, United States); Will, Tom (U.S. Fish and Wildlife Service, Bloomington, United States)

#### USING SPECIES VULNERABILITY ASSESSMENT TO REDUCE UNCERTAINTY IN SETTING BIRD CONSERVATION PRIORITIES IN NORTH AMERICA

There are a variety of ways to predict the effects of perturbations such as climate change on species, habitats and ecosystems. The objective of species vulnerability assessment (SVA) is to determine if there are species or species groups that are more vulnerable than we might otherwise have thought. The strength of SVA is that it seeks to evaluate the capacity of species to adapt to any major stressor. SVA separates the uncertainty about a species' adaptive capacity from the uncertainty in climate-habitat predictive models. We examined 10 species traits, e.g., mean clutch size and migration distance. Each of these traits can be scored and total scores then used to array species or groups of species along a vulnerability axis. There are complete data for 668 North American bird species. Principle components analysis shows that the 10 species traits are largely independent. Vulnerability scores are consistent with those from the 2010 State of the Birds report, Partners in Flight species assessment, and with IUCN risk categories although correlations are relatively low.. Among major bird groups, waterbirds and shorebirds are the most vulnerable, landbirds less so, and waterfowl least. Among larger families (8 or more species), the Alcidae are most vulnerable. However, the Trochilidae are second, with a mean score equal to that of shorebirds. The latter is the sort of unexpected result we need to examine more carefully. Given the uncertainty in our ability to predict the effect of climate change on migrating birds, an open format SVA provides the opportunity to decouple life history trait information from hypotheses about how climate change may interact with those traits. An open format SVA also permits incorporation of integrated data-driven assessments (e.g., quasi-extinction probabilities based on Breeding Bird Survey data), multiple author expert opinion, and connectivity information.

**PS2.116 Richman, Samantha E.**, (University of Rhode Island, Kingston, United States); McWilliams, Scott R. (University of Rhode Island, Kingston, RI, United States); Leafloor, James O. (Environment Canada, Winnipeg, MB, Canada); Karasov, William H. (University of Wisconsin-Madison, Madison, WI, United States)

#### GROWING FAST AND DYING YOUNG: HOW FORAGE QUALITY EFFECTS GROWTH AND SURVIVAL OF CANADA AND SNOW GOOSE GOSLINGS

Keystone herbivores such as geese in Arctic ecosystems are highly sensitive to reduced quantity and quality of available forage like that caused by intensive goose grazing at important brood rearing areas. To determine the effects of diet quality on growth and survival of sympatric goose populations, we raised 100 Canada and 100 Snow goose goslings on grass-based diets with high or low protein and fiber content. During early growth phase (0–21 days), goslings were fed one of six diets that included a factorial combination of three levels of protein (10, 18 and 26%) and two levels of neutral detergent fiber (30 and 45%), but were similar in overall energy content (~18 kJ g<sup>-1</sup>). During late growth phase (22–100 days), we reduced protein levels for some groups (from 26% to 14 or 18%), and maintained the low protein group on the same diet; fiber content remained unchanged for all groups. Survival of Snow goslings was significantly affected by both dietary protein and fiber content with high mortality during early growth phase. Goslings fed the low protein diets had ~65% lighter body mass and reduced growth of skull, culmen, tarsus, and 9th primary compared to goslings raised on the higher protein diets. The effects of dietary fiber were more extreme for Snow goslings compared to Canada gosling in part because Canada goslings increased food intake (corrected for body size) by ~100% while Snow goslings increased food intake by only 15% when fed the high-fiber diets compared to the low-fiber diets. Apparent Metabolizable Energy was similar between species, but lower for diets with high fiber content. In addition, Canada goslings had larger gizzard mass and small intestine length than Snow goslings in response to increased fiber content of the diet. These results indicate that Snow gosling had higher protein requirements than Canadas, and that there were interspecific differences in compensatory growth that were explained by their digestive physiology. Specifically, when goslings were fed the higher-fiber forage, Snow goslings were less able than Canada goslings to increase their food intake and gut size and this limited their ability to compensate for reduced forage quality. Although phenotypic flexibility in gosling growth and their digestive system allows geese to respond successfully to habitat change, there appears to be a lower limit to the quality of forage eaten (<10% protein and high fiber) on survival and growth that is to a degree species-specific.

**S7.6 Ricklefs, Robert**, (University of Missouri St. Louis, St. Louis, United States);

#### WHAT FUNDAMENTAL THINGS CAN A TREE OF ALL BIRDS (NOT) TELL US?

The reconstruction of phylogenetic relationships has revolutionized the ways in which we analyze the distribution and diversity of life. Phylogenetic hypotheses also constrain our thinking in several ways. Most importantly, phylogenies based on contemporary species miss the history of extinct life. The coalescence of all living descendants back to a single ancestral lineage gives the impression of a continual expansion of diversity and provides little, and often biased information about the distribution and character of past biotas. The fossil record fills in some gaps, but the limited information and uncertain taxonomic attributions of avian remains obscure insight into the evolution and ecology of past avifaunas. One goal of historical analysis is to align the phylogenetic history of birds with our understanding of evolutionary diversification and ecological assortment of species. In this endeavor, we shall benefit from considering the potential signatures of a range of historical scenarios and paying attention to groups with richer historical records.

**W1.6 Ringelman, Kevin**, (University of California - Davis, Davis, United States); Eadie, John (University of California -

Davis, Davis, CA, United States); Ackerman, Joshua (United States Geological Survey, Davis, CA, United States)

#### DEAREST NEIGHBORS: CONSPECIFIC CUEING AND ADAPTIVE NEST CLUSTERING IN WATERFOWL

Dabbling ducks are non-territorial at nesting sites, and while researchers have noted that nests appear to be clustered in space and time, local nest clustering has never been subjected to a rigorous analysis. Furthermore, the behavioral mechanisms by which clustering is created, and the potential adaptive significance of group nesting in waterfowl are relatively unknown. We used three years of data on nesting waterfowl (2,038 nests) from Grizzly Island, CA to examine nest clustering at small spatial and temporal scales. In all three years, simultaneously active nests were indeed significantly clustered at local spatial scales (50-400 m). Furthermore, nests with closer nearest neighbors were more likely to hatch successfully; a result that challenges the commonly held belief that nest predation in waterfowl is positively density-dependent (i.e. clusters of nests attract predators). To better understand how clusters of nests are created, we examined the relative influence of vegetation and social cues (conspecific attraction) on habitat selection decisions. Our results suggest that when vegetation cues were unreliable, waterfowl relied on presence of conspecifics to choose nest sites. This is the first study to suggest that social cues may, in some cases, be more important than environmental variables in waterfowl nest-site selection. In a broader context, this study establishes explicit links between animal behavior (habitat selection decisions), ecological patterns (local nest dispersion), and evolutionary processes (differential survival for clustered nests) in our study system.

**F15.3 Riordan, Maggie**, (University of Montana, Fort Collins, United States);

#### EXAMINING WHAT LIFE STAGE MALE BIAS ARISES IN MOUNTAIN PLOVERS (*CHARADRIUS MONTANUS*)

Population decline has been prevalent in several avifauna. The Mountain Plover (*Charadrius montanus*) is a grassland shorebird experiencing population declines. Mountain Plovers have a unique mating system. Males and females each provide care for separate nests and uniparental care is continued through chick rearing. A male-biased sex ratio (2.3 males per female) has been detected in breeding adults in eastern Colorado. Heavily skewed sex ratios can have implications for population growth or persistence. A surplus of one sex can affect the reproductive output of the population as a whole. Conversely, skewed sex ratios may be adaptive for some mating systems. Skewed sex ratios may arise at a number of different stages. My research focused on the egg and chick stages. Focusing on these stages provide insight into when sex specific mortality is occurring. My research explored possible variation in sex-specific survival on three different levels; individual, brood, and environmental. I evaluated how eggs size, chick size, hatching order, sex of tending adult, temperature eggs exposed to during incubation, habitat type, and time of breeding season influence both male and female survival at hatching and to fledging. I measured the sex ratio in eggs and chicks using DNA samples. To measure chick survival differences between the sexes, I used radio telemetry to track chicks daily. I sampled 150 eggs and chicks, and placed approximately 100 transmitters on chicks each year of 3 year study. Understanding when a skewed sex ratio arises informs population dynamic processes and where to focus conservation actions.

**PS1.25 Ríos-Muñoz, César A.**, (Museo de Zoología, Departamento de Biología Evolutiva, Universidad Nacional Autónoma de México, Mexico City, Mexico); Navarro-

Sigüenza, Adolfo G. (Museo de Zoología, Departamento de Biología Evolutiva, Universidad Nacional Autónoma de México, Mexico City, Mexico)

#### AN ANALYSIS OF BIOGEOGRAPHIC AFFINITIES IN THE AVIFAUNA OF THE MEXICAN TRANSITION ZONE

The biogeographical patterns of species richness and endemism are important in the understanding of the evolutionary history of the biotas, and in the design of conservation strategies. The Mexican Transition Zone represents a challenge in the understanding of the processes that have modeled the biotas in the region. We analyzed the association gradients of three species groups according to their biogeographical affinities (Nearctic, Neotropical, and endemic to Mesoamerica) based on the percentage of the entire distribution area of the species. Species richness maps were obtained from individual maps generated through species distribution modeling (SDM) for each species for each biogeographical category. Based on these maps, we developed an index which helped us to measure the relative importance of each element in a geographic perspective. Our results show important breaks in the presence of each component through geographical and climatic barriers. This allows us to visualize the importance of topographical and climatic diversity of Mexico and their influence in biogeographical patterns.

**PS1.29 Ritchison, Gary**, (Eastern Kentucky University, Richmond, United States); Kieffer, Barbara (Eastern Kentucky University, Richmond, United States)

#### EFFECT OF NESTLING SEX RATIO ON THE PROVISIONING BEHAVIOR OF EASTERN BLUEBIRDS

To maximize reproductive success, parents may differentially invest in sons and daughters, i.e., sex-biased parental investment. Preferential provisioning behavior has been reported in one population of Eastern Bluebirds (*Sialia sialis*) and attributed to local resource competition. We studied the provisioning behavior of Eastern Bluebirds in Madison County, Kentucky. We experimentally manipulated brood sex ratios in 24 bluebird nests, creating female-biased, male-biased, and control nests. Following manipulation, nests were video-taped to record adult provisioning behavior. Brood sex ratio had no effect on the provisioning behavior of either male ( $P = 0.97$ ) or female ( $P = 0.27$ ) Eastern Bluebirds. Similarly, we found no effect of brood sex ratio on the provisioning rates of either male ( $P = 0.72$ ) or female ( $P = 0.30$ ) bluebirds for control broods that naturally differed in number of male and female nestlings ( $N = 9$ ; 5 male-biased and 4 female-biased). In contrast, Gowaty and Droge (1991. Proc. 20th Int. Ornithol. Congr., pp. 932-945) found that male Eastern Bluebirds fed nestling males less than nestling females, possibly because sons were more likely to compete with them for resources in the future. However, local resource competition seems unlikely because Eastern Bluebirds exhibit low rates of philopatry. Given these conflicting results, additional study is needed to determine if factors such as latitude, food availability, or availability of other resources might influence the provisioning behavior of male Eastern Bluebirds.

**PS2.201 Ritterson, Jeffrey**, (1. University of Massachusetts Amherst, MA, United States); King, David (Northern Research Station USFS, Amherst, MA, United States) **HABITAT-SPECIFIC SURVIVAL OF GOLDEN-WINGED WARBLERS (*VERMIVORA CHRYSOPTERA*) DURING THE STATIONARY NON-BREEDING SEASON**

The annual cycle of Neotropical-Nearctic migrant species is dominated by the non-breeding season, when events may in fact



limit populations. Although many migrants are experiencing population declines, studies on the basic ecology of most species during this period are non-existent. This information is needed to guide management decisions if we expect to fully protect species of conservation priority.

One such migrant species is the Golden-winged Warbler (*Vermivora chrysoptera*), which has recently been proposed for protection under the U.S. Endangered Species Act. This species has been found to occur at low densities, defend large territories, and be rather cryptic on the stationary non-breeding grounds, making conventional methods for mapping territories and estimating survival rates impractical. Efforts to estimate survival rates with radio-telemetry are problematic because previous research shows survival is affected by radio-transmitters.

We present a spatially explicit mark-resight protocol we developed that can be used to generate habitat-specific survival estimates for wide-ranging, cryptic species like Golden-winged Warblers, and illustrate its application based on data from [currently 42] individuals marked at our study area in an agricultural landscape in western Costa Rica. This methodology represents an important contribution to our ability to identify habitat characteristics and other features important for maintaining the viability of high priority Neotropical-Nearctic migrants during the stationary non-breeding season.

**PS1.185 Rivera-Ortíz, Francisco Alberto**, (Centro de Investigación en Ecosistemas, Universidad Nacional Autónoma de México, Morelia, Mexico, Mexico); Solorzano, Sofia; Arizmendi, Maria del Coro (Facultad de Estudios Superiores Iztacala, Universidad Nacional Autónoma de México, Estado de México, Mexico); Oyama, Ken (Centro de Investigación en Ecosistemas, Universidad Nacional Autónoma de México, Morelia, Mexico, Canada)

#### DIVERSITY GENETIC OF MILITARY MACAW (*ARA MILITARIS*) IN MÉXICO.

The Military Macaw according to CITES (1998), is considered a vulnerable species, mainly due to two factors: 1) to capture for the legal and illegal trade, and 2) strong pressures on their habitat. The hypothesis of the negative impact of fragmentation on genetic diversity is the basis of conservation genetics. The objective was to analyze the diversity and genetic structure of populations of Military Macaw (*Ara militaris*) in Mexico. This study was performed in nine sampling sites along the distribution of the Military Macaw in México. The collection of feathers are made each of the sampling sites, we extracted DNA sequences were obtained by microsatellite technique PCR. For structure and genetic diversity estimated the number of alleles and the number of effective alleles for each population. Genetic diversity was obtained, observed heterozygosity, expected heterozygosity, polymorphism and the inbreeding coefficient, and measured the levels of gene flow between populations. The results suggest two genetic groups; the value of DK indicates that the number of genetic groups is two ( $DK = 2$ ). Macaw populations have a fairly low genetic diversity. The population of Jalisco presented the lowest levels of diversity. The FIS showed that the population with higher excess of heterozygotes was Nayarit and the population more heterozygous deficiency was Jalisco. Genetic diversity compared to other parrots is relatively low and the population with the lowest levels was Jalisco.

**PS1.3 Rivers, James**, (Oregon State University, Corvallis, United States); Newberry, Gretchen (Oregon State University, Corvallis, United States); Ardia, Daniel (Franklin & Marshall College, Lancaster, Canada)

#### DIVERGENT RESPONSES TO AN EXTREME STRESSOR IN TWO SYMPATRIC *TACHYGINETA* SWALLOWS.

Animals often respond to environmental stressors with a combination of physiological and behavioral responses, collectively known as a coping style, which serve to maximize fitness during stressful periods. To date, the majority of studies on animal coping styles have examined individual-level variation within a single species, and we currently lack information regarding whether, and if so how, closely-related species differ in their coping styles. During the 2010-11 breeding seasons we captured two sympatric *Tachycineta* swallow species (Violet-green Swallow [*T. thalassina*] and Tree Swallow [*T. bicolor*]) and measured their behavioral and physiological responses to a standardized handling protocol. Female Violet-green Swallows exhibited a significantly higher breathing rate (a proxy for metabolic rate), suggesting that this species allocates greater energy to their coping style than Tree Swallows. In contrast, a second proxy for energy expenditure, cloacal temperature, was similar between the two species. Finally, female Violet-green Swallows also spent more time immobile when placed in a mesh bag relative to female Tree Swallows, although this result was marginally significant. Our results indicate that these two closely related species have diverged in the way in which they cope with an extreme stressor, although the fitness consequences of this divergence remains unknown.

**W10.5 Robertson, Ellen**, (University of Maine, Veazie, United States); Olsen, Brian (University of Maine, Orono, Canada)

#### DENSITY, BREEDING STAGE, AND SEX AFFECT RAIL BROADCAST SURVEY RESULTS

Several species of marsh birds are thought to be declining and a National Marsh Bird Monitoring Program is being initiated to determine and monitor population trends using call-broadcast surveys. Our objectives were to improve survey methodology for marsh-bird surveys by studying the effects of site-estimated rail density, breeding stage, call type, and sex differences on marsh-bird response probability. During 2010 & 2011 we conducted 335 surveys on 113 rail nests in ten wetlands. We used generalized linear models to determine important variables for predicting response probability of Virginia rails and soras to broadcast surveys 10 m from known nests. The odds of both rail species responding to broadcast increased as rail density increased. Nest age and recent nest failure due to predation significantly decreased the odds of sora response. For Virginia rails, the post-predation stage decreased the odds of response to broadcast calls (relative to response during incubation) and rail response was marginally less, although not significantly so, during the post-hatch stage (i.e. successful nests). Rails responded similarly to broadcast during egg laying, incubation, and hatching. Virginia rails and soras both used “peep” call in late nesting/post-hatching stages, and this call could be used during surveys later in the breeding season as an index of nest success (and include young into estimates). The “kadic-kadic” (Virginia rail) and the “per-weep” (sora) calls are used primarily during the pre-nesting phase (and not prior to replacement clutches) and may be indicators of unpaired birds. These vocalization differences could be used to strengthen population estimates by differentiating between presence and active breeding throughout the season. Spectrogram analysis of recorded vocalizations showed that male Virginia rails responded to broadcast calls with louder (possibly related to approach distance), longer, and faster calls (hence higher detectability) than females. We recommend that large-scale marsh-bird population trend estimates take density and sex

detectability issues into account and recognize that wetlands with low response rates may underestimate population estimates more than those with high response rates due to lower bird densities and differences in sex ratios and breeding stage.

**PS1.73 Robertson, Holly**, (University of Wisconsin - Madison, Madison, United States); Sorenson, Lisa (SCSCB, Arlington, United States); Eubanks, Ted (Fermata, Inc., Austin, United States); Sutton, Ann; Wheeler, Jennifer (SCSCB, Arlington, United States)

#### THE SCSCB CARIBBEAN BIRDING TRAIL: PROMOTING CONSERVATION AND SUSTAINABLE LIVELIHOODS THROUGH BIRD AND NATURE TOURISM

The Society for the Conservation and Study of Caribbean Birds (SCSCB) is developing a new regional project called the Caribbean Birding Trail (CBT). The CBT will connect residents and travelers to the avifauna of the Caribbean. Stretching over 2,000 km from the Bahamas to Trinidad and Tobago, the CBT includes a unique array of countries, cultures, foods, arts, landscapes, habitats and endemic species, especially birds. The islands support important avifauna, providing essential winter and stopover habitats for many neotropical migratory birds. Unfortunately, most islands are increasingly threatened by inappropriate development, deforestation, unsustainable hunting, pollution, invasive species, and climate change. High levels of rural unemployment and poverty and low levels of awareness of the importance of the natural environment in general or birds in particular are contributing factors. The overall goal of the CBT is to heighten awareness of the birds of the Caribbean, increase appreciation for the places where they live, and build support for their conservation. The program uses experiential tourism as a sustainable approach to community revitalization and conservation of important sites for birds and biodiversity. To implement the CBT we will work at multiple levels: at the community level by building capacity for sustainable livelihoods via bird and nature tourism through training workshops; at the national level by creating interpretive plans to direct localized work; and at the international level with marketing via the CBT website and other media. The CBT project includes 1) completing an inventory of bird species of conservation concern and associated sites and partners, 2) carrying out a participatory assessment of resources and needs at pilot sites in several countries (Dominican Republic, Jamaica) and developing an interpretive strategy for each site, and 3) enhancing trail development in select sites through infrastructure (e.g., interpretive signs), development of birding tours and promotional materials, and/or guide training. Emphasis is placed on developing sustainable livelihoods and economic benefits for local people, so that the public profile and political gravitas of protected areas are enhanced. Ministries of Tourism and the Environment and diverse stakeholders throughout the region endorse this approach.

**PS2.246 Robinson, Douglas**, (Mount Saint Mary College, Newburgh, United States); Liporace, James (Mount Saint Mary College, Newburgh, United States)

#### ANTIBIOTIC RESISTANCE IN BACTERIA FROM SUBURBAN AND RURAL NESTLING AMERICAN CROWS IN IOWA AND NEW YORK

The ubiquitous use of antibiotics in human and veterinary health care has resulted in increased prevalence of antibiotic-resistant bacteria in the environment. Evidence indicates species living in close proximity to sites of high antibiotic use (e.g., livestock operations) are very likely to carry antibiotic-resistant bacteria, but the range of species known to acquire such bacteria is

limited. We investigated whether nestling American Crows (*Corvus brachyrhynchos*) raised in suburban and rural settings carried bacteria that were resistant to commonly-used antibiotics. In May 2008 and 2011, we collected cloacal samples from nestling American Crows in Storm Lake, Iowa, and Newburgh, New York, respectively, and tested individual bacterial colonies for resistance to 15 different antibiotics (8 tested in Iowa; 12 in New York; 5 in common between sites) using the Kirby-Bauer method. In the Iowa population (n=58), 67% of the nestlings had bacteria resistant to at least one of the 8 antibiotics tested; in the New York population, all nestlings (n=22) carried bacteria resistant to at least one of the 12 antibiotics tested. All the nestlings tested in Iowa and 91% of those tested in New York contained bacteria resistant to at least one of the 5 antibiotics tested at both sites. High proportions of suburban, but not rural, nestlings carried bacteria resistant to bacitracin, erythromycin, oxacillin, polymyxin B, sulfadiazine, sulfathiazole, and vancomycin. Future work will investigate the environmental sources of antibiotic resistance, attempt to identify the bacterial species in the cloacal samples, and determine their pathogenicity to humans.

**PS1.54 Robinson, Scott**, (University of Florida, Gainesville, United States); Gomez, Juan Pablo; Ungvari-Martin, Judit; Burleigh, Gordon; Kimball, Rebecca; Braun, Edward (University of Florida, Gainesville, FL, United States)

#### SIZE-ABUNDANCE RELATIONSHIPS IN BIRD COMMUNITIES

The abundance of organisms has been hypothesized to be regulated by the energetic requirements of each species and thus negatively related to their body mass. Damuth originally demonstrated that the relationship between population density and body mass in mammals had a negative slope of -0.75 and proposed that this relationship should be universal. However, there have been several bird studies that have shown that this relationship might be shallower than predicted by energetic constraints alone. One study from an Amazonian bird community hypothesized that this relationship might be mediated by despotic behavior in which larger species are controlling more than their share of resources, which might even result in a positive relationship between body size and abundance. In this study, we provide further tests of the hypothesis that abundance of species might be mediated mainly by despotic behaviors rather than energetic regulation and that the magnitude of this relationship is related to the productivity of a specific site. We collected abundance of bird species from almost 50 sites worldwide and determined the slope of the relationship for each community. We show that the relationship is negative but much shallower than what Damuth originally predicted suggesting that in fact there is an energetic regulation of the abundance of species, but also that there are additional factors that might influence the slope of this relationship and that despotic effects may be greatest in more productive habitats.

**F5.4 Robles, Hugo**, (University of British Columbia, Vancouver, Canada); Norris, Andrea; Martin, Kathy (University of British Columbia, Vancouver, Canada)

#### QUALITIES OF A KEYSTONE CAVITY FACILITATOR FOR SECONDARY CAVITY-NESTING SONGBIRDS: EXCAVATOR ABUNDANCE, CAVITY QUALITY AND HABITAT SELECTION

Although cavity excavators are the primary producers of nest sites for secondary cavity-nesting birds (SCNs) in North America, the underlying mechanisms of the specific influential associations between cavity facilitators and SCNs are poorly

known. To address this issue, we assess cavity use, habitat selection and reproductive success of SCNs for a cavity nester community in interior British Columbia (1997-2010). In the passerine assemblage associated with forest edges, European Starlings, Mountain Bluebirds and Tree Swallows used high numbers of Northern Flicker cavities (72%, 58% and 30% of nests in Flicker cavities, respectively), but Swallows also used many Red-naped Sapsucker cavities (39%). Hairy Woodpeckers were considerably less abundant than Flickers or Sapsuckers (0.06 vs. 0.10 birds/ha) and, consequently, provided fewer cavities to SCNs (<12%). Starling and Bluebird reproductive output did not differ among cavities formed by different facilitator species, but they preferred large Flicker cavities to smaller Sapsucker cavities, whereas Swallow reproductive success was higher in cavities formed by Sapsuckers than Flickers (1.89 vs. 0.71 fledglings/nest). Thus, near forest edges, Flickers were the key cavity facilitators for larger SCN passerines (Starlings and Bluebirds), whereas Sapsuckers provided key cavities for smaller Swallows. In the forest interior, Mountain Chickadees used similar numbers of cavities of Downy Woodpeckers, Red-breasted Nuthatches and Sapsuckers (28%, 25% and 33%, respectively). However, Chickadee reproductive success was higher in small cavities of Nuthatches and Downy Woodpeckers than in the larger Sapsucker cavities (4.4 vs. 3.0 fledglings/nest). These results suggest that habitat selection (edge vs. interior), excavator abundance and cavity quality determine the specific associations between SCNs and cavity facilitators in nest web communities.

**T15.10 Roby, Daniel**, (Oregon State University, Corvallis, United States); Adkins, Jessica; Lyons, Don; Courtot, Karen (Department of Fisheries and Wildlife, Corvallis, OR, United States); Collis, Ken (Real Time Research, Inc., Bend, OR, United States)

#### DOUBLE-CRESTED CORMORANTS IN THE PACIFIC NORTHWEST: STATUS, CONSERVATION, AND THE PRESSURE TO CONTROL

Conflicts between Double-crested Cormorants (*Phalacrocorax auritus*) and fisheries in the Pacific Northwest have intensified in the last decade, especially with regard to cormorant predation on salmonids (*Oncorhynchus* spp.) listed under the U.S. Endangered Species Act (ESA). The largest breeding colony for the species in western North America has formed since 1989 on East Sand Island at the mouth of the Columbia River, where 13,000 pairs nested in 2011, about 40% of the entire western population. Cormorants from this one colony consumed ca. 23 million juvenile salmonids from throughout the Columbia River basin in 2011 (roughly 15-20% of all juvenile salmonids surviving to the river mouth). Wild and hatchery-reared smolts were taken in proportion to their availability. The entire western population of Double-crested Cormorants numbers ca. 31,500 breeding pairs, and has been increasing an average of 3%/year over the last two decades. This increase is mostly due to the increase in size of the East Sand Island colony. In contrast, the eastern/central North America population has erupted in recent decades, and is now more than an order of magnitude larger than the western population. Data on population genetic structure for Double-crested Cormorants in North America indicates that subspecific designation for the western North America population is not warranted, but the western population is demographically distinct from the eastern/central population, and thus a separate management unit. Natural resource agencies are currently considering options for reducing the impact of predation by cormorants from the East Sand Island colony on recovery of ESA-listed salmonids, including extending the

Public Resource Depredation Order that is currently restricted to the eastern/central population.

**PS1.243 Roche, Erin**, (University of Tulsa, Tulsa, United States); Brown, Mary (Tern and Plover Conservation Partnership, Lincoln, United States); Lear, Kristen (Fulbright Program, Naracoorte, Australia); Brown, Charles (University of Tulsa, Tulsa, Canada)

#### INCREASED EXPOSURE TO MIST NETS LEADS TO NET AVOIDANCE IN CLIFF SWALLOWS

Ecologists often use mark-recapture methods to estimate demographic variables such as abundance, growth rate, or survival for samples of wild animal populations<sup>1</sup>. Among the statistical assumptions underlying mark-recapture are that all animals have an equal probability of detection, and failure to meet this assumption—as when certain members of the population are either easier or more difficult to capture than other animals—can lead to biased and inaccurate demographic estimates<sup>2-5</sup>. While various statistical methods exist to identify recapture heterogeneity, little is known about what causes detection differences in natural populations. Here we identify sources of capture heterogeneity in a population of colonially nesting cliff swallows (*Petrochelidon pyrrhonota*) caught using mist-netting as a part of a 20-year mark-recapture study in southwestern Nebraska, USA. Cliff swallows were less likely to be caught in stationary mist nets at their colony sites as they got older (i.e., across years) and as the frequency of netting there in a season increased; however, experienced birds' avoidance of the net could be countered by sudden disturbances that startled them into the net. Our results support the widely held assumption that birds learn to avoid stationary mist nets over time but also show that modifications of traditional field methods can reduce this source of recapture heterogeneity. This study illustrates that failure to account for age-dependence in recapture probability could lead to erroneous conclusions about age-specific demography (e.g., false positive detections of survival senescence).

**SAT6.5 Roche, Erin A.**, (Minnesota Cooperative Fish and Wildlife Unit, St. Paul, United States); Terry, Shaffer (Northern Prairie Wildlife Research Center, Jamestown, United States); Stucker, Jennifer; Sherfy, Mark; Anteau, Michael (Northern Prairie Wildlife Research Center, Jamestown, ND, United States); Mark, Wiltermuth (Northern Prairie Wildlife Research Center, Jamestown, United States)

#### SURVIVAL OF PIPING PLOVER AND LEAST TERN CHICKS IN MIXED-SPECIES NESTING AGGREGATIONS ON THE MISSOURI RIVER

Mixed-species colonies may evolve by conferring fitness benefits to at least one of the constituent species. In the US Great Plains, Piping Plovers (*Charadrius melodus*) and Interior Least Terns (*Sterna antillarum*) share Missouri river sandbars for nesting and chick rearing. We investigated whether chick survival of one species varied in response to the proportional presence of the other. During 2007-2009 we banded and resighted 689 tern and 1067 plover chicks on 61 sandbars located along two river reaches. Using a Cormack-Jolly-Seber model in program MARK ( $\hat{c} = 1.168$ ), we estimated daily apparent survival ( $\phi$ ) of both species relative to the proportion of total chicks represented by the other species for each sandbar and while controlling for river reach, year, sandbar size and chick age. Piping Plover chick survival increased with the proportion of tern chicks ( $\beta_{\text{proportion.LETE}} = 0.10$ , 85% CI: 0.02 to 0.13). In contrast, Least Tern chick survival decreased with increasing proportions of plover chicks ( $\beta_{\text{proportion.PIPL}}$

= -0.28, 85% CI: -1.06 to -0.54), but this effect diminished as sandbar size decreased ( $\beta$ proportion.PIPL\*Barsize -0.28, 85% CI: -0.40 to -0.17). Least Terns may suffer negative impacts of nesting along side large numbers of Piping Plovers because plovers arrive first and secure the most favorable nesting substrate. Although plovers select sandbars first, they have high fidelity to sites at which they have had reproductive success in a previous year, which may be enhanced by the predator-detering mobbing behavior of the nesting terns.

**S6.7 Rockwell, Sarah,\*** (Smithsonian Conservation Biology Institute, Greenbelt, United States); Bocetti, Carol (California University of Pennsylvania, California, PA, United States); Marra, Peter (Smithsonian Conservation Biology Institute, Washington, DC, United States)

#### WINTER DROUGHT PRECEDES LATER SPRING ARRIVAL DATES, REDUCED REPRODUCTIVE SUCCESS, AND LOWER SURVIVORSHIP IN THE ENDANGERED KIRTLAND'S WARBLER

Understanding how animals will adapt to global climate change requires understanding how climate variables influence their biology year-round. Migratory birds may be especially vulnerable to climate change due to the wide range of geographic areas that they occupy throughout the annual cycle. Here we examine the potential effects of non-breeding season climate change on the Kirtland's warbler (*Setophaga kirtlandii*), an endangered songbird that breeds in northern lower Michigan and winters in The Bahamas. Winter rainfall affects the abundance of important fruit resources and late winter body condition in this species. Our objectives were to determine whether late winter rainfall also carries over to affect demographic events in subsequent seasons. We sampled individuals across multiple years to show that male Kirtland's warblers arrive on breeding grounds later following drier winters in The Bahamas. Second-year males delayed spring arrival after winters with lower rainfall more than adults, while males of all age classes fledged fewer offspring following drier winters. In a mark-recapture analysis, we modeled the effects of multiple winter and summer climate variables on male Kirtland's warbler survival in relation to a constant-survival model. March rainfall in The Bahamas was the most well-supported survival model, and had a positive influence on annual survival in the subsequent year. Significant drying trends in the Caribbean are predicted by several models of climate change. If increased winter drought occurs as predicted, it could have important ecological consequences, including constrained spring arrival dates, limited reproductive success, and reduced annual survival of the endangered Kirtland's warbler, and potentially other Neotropical migrants wintering in the Caribbean.

**T2.2 Rodewald, Amanda,** (The Ohio State University, Columbus, United States); Rudolf, Rohr; Miguel, Fortuna; Jordi, Bascompte (Estación Biológica de Doñana  $\zeta$  CSIC, Sevilla, Spain)

#### DEMOGRAPHIC CONSEQUENCES OF ALTERED BIRD-PLANT NETWORKS IN URBANIZING LANDSCAPES.

Structure of ecological networks can mediate ecosystem attributes, but research has yet to establish an empirical link between interspecific networks and demography. In this study we asked, does the structure of ecological networks explain the demographic consequences of anthropogenic disturbance? Specifically, we hypothesized that invasive shrubs associated with urban landscapes would alter networks between nesting birds and plants in ways that impacted avian nest survival. From 2001-2011, we studied 141 networks between plants and nesting

birds (4906 nests) in 19 forest remnants distributed across an urbanization gradient in Ohio USA, as well as from an in situ invasive removal experiment. Compared to rural networks, urban networks were more nested, less compartmentalized and were dominated by certain strong interactions. Evenness of interactions within the network was positively related to nest survival and performed better than environmental metrics. We are the first to demonstrate that changes in interspecific networks have demographic consequences. Interestingly, the effect of network structure at one trophic level (birds and plants) was transferred to higher trophic levels (predators and prey). Our work also demonstrates that knowledge of landscape and habitat heterogeneity was not sufficient to explain demographic patterns, and weight quantitative network measures were necessary. Thus, demographic consequences of anthropogenic change were not direct, but were filtered through the ecological network. In this way, our study provides compelling evidence that knowledge of species interactions and a network approach are requisite to understand demographic responses to environmental change.

**PS1.241 Rodríguez Hernández, Karla Maryan,** (UNAM, México State, Mexico); Arizmendi, María del Coro (UNAM, Tlalnepantla, México, Mexico)

#### RICHNESS AND ABUNDANCE OF THE BIRDS OF SAN JUAN COYULA, OAXACA, MÉXICO

The knowledge of local and regional diversity is essential for the implementation of man-agement and conservation plans for regions and species. Bird can be considered as good indicators of conservation status and can be used to promote conservation actions. In this work we de-scribe the avifauna of San Juan Coyula Oaxaca (17° 52' 45.80" N y 96° 52' 31.99"O), located in the southwestern of the Reserva de la Biósfera de Tehuacán-Cuicatlán. This region is a high di-versity area where a lot of endemic taxa has been described. The purpose of this work was to de-scribe bird composition and abundance using fixed radius point counts. Censuses were done be-tween April 2010 and January 2011. 130 bird species were registered belonging to 10 orders, 30 families and 86 genus. The more represented orders are: Passeriformes (75.38%), Apodiformes (8.46%) and Accipitriformes (5.38%). 40.76% of the registered birds were residents, 40.76% winter visitors, 6.92% casuals, 6.15% accidentals and 5.38% summer residents. Ten species were included as endangered in Mexico and the world. Densities were calculated for 53 species where more than 10 registers were done. Density was calculated using Distance 6.0. Bird composition origins can be described as related with avifaunas from the Balsas Basin, the Pacific slope, Atlantic slope, mountain ranges and arid lands.

**PS2.204 Rodriguez, Flor,** (Instituto de Ecología A.C., Xalapa, Mexico); Ornelas, Francisco (Instituto de Ecología A.C., Xalapa, Mexico)

#### GENETIC AND ECOLOGICAL DIVERGENCE OF MESOAMERICAN AZURE-CROWNED HUMMINGBIRDS (AMAZILIA CYANOCEPHALA)

Populations of Azure-crowned hummingbird (*Amazilia cyanocephala*) from the Mesoamerican highlands represent the least understood members of the white-bellied *Amazilia* species complex. A previous mtDNA (Atpase6-COII, control region) phylogeographic study indicates that at least two distinct evolutionary lineages of *A. cyanocephala* exist in northern Mesoamerica corresponding to populations separated by the Isthmus of Tehuantepec. However, no previous phylogeographic study has included populations from southern Chiapas and highlands in Guatemala. Here, we used sequence mtDNA data

(ND2, ND5, Atpase6-COII and control region) and ecological niche models (ENMs) to reconstruct the evolutionary history and influence of climate on the genetic divergence of Mesoamerican population of *A. cyanocephala* hummingbirds. Results of Bayesian coalescence analyses confirmed that Mesoamerican populations of *A. cyanocephala* form a monophyletic group. Two highly supported reciprocally monophyletic clades were retrieved: one comprising populations from southern Tamaulipas to Chiapas and the second clade comprised by populations from Tacaná and Guatemala. The split at the Isthmus of Tehuantepec is also recovered in this analysis with lower resolution. The ENM retrieved two lineages: one within the west and other within the east (Chiapas and Guatemala). Genetic analyses and divergence time estimates suggested recent genetic divergence. Our results also suggest that historical-geological, ecological, genetic and stochastic events for this Mesoamerican hummingbird have acted alone or in concert to promote divergence.

**PS2.158 Rodriguez-Colon, Ivelisse**, (Universidad del Turabo, Guayama, United States);

INFERENCE OF HABITAT CONNECTIVITY VIA HABITAT USE BY RESIDENT AND MIGRATORY BIRDS BETWEEN MANGROVE AND SECONDARY FOREST IN JOBOS BAY NATIONAL ESTUARINE RESEARCH RESERVE, (JBNERR), PUERTO RICO.

Fixed-radius point counts (25-m, 6 min) of birds were used to determine whether individuals of multiple species of migrants and resident warblers use mangrove forest and secondary dry forest in Jobos Bay, Puerto Rico, during September 2010 to September 2011. A two-way ANOVA was conducted to assess migrants' effect over residents during the non-breeding season in both habitats. Fixed-radius point counts revealed several species in both habitat types. In addition, I assessed connectivity between habitats using direct observations from blinds and mist netting in the interface between mangrove forest and secondary dry forest, during the dry migratory season. Mist netting revealed diurnal migrations in Prairie Warblers (*Setophaga discolor*, PRAW), Northern Waterthrushes (*Parkesia noveboracensis*, NOWA), Yellow Warblers (*Setophaga petechia*, YEWA), Northern Parulas (*Setophaga americana*), Western Palm Warblers (*Setophaga palmarum*), male and female American Redstarts (*Setophaga ruticilla*), and that movement was more intense shortly before sunset. Migrants represented 62% of 312 captures between (February-April, 2011). Arthropods biomass determination was assessed in dry secondary forest and mangrove forest in the dry season. Arthropod samples were collected using active searching on the ground and branch clipping in the canopy foliage, and sorted to order in both habitats revealing Coleoptera, Hymenoptera, Collembolla and Araneae as the most common orders. The results of this research underscore the importance of secondary dry forest to this avian guild, despite the preference by most species for mangroves as nighttime roosts.

**PS1.204 Rodriguez-Contreras, Vicente**, (CONABIO, Mexico City, Mexico); Berlanga-Garcia, Humberto (CONABIO, Mexico City, Canada); Pardieck, Keith (USGS Patuxent Wildlife Research Center, Laurel, MD, United States)

EXPANSION OF THE BREEDING BIRD SURVEY PROGRAM TO MEXICO

Breeding Bird Survey is one of the oldest and well supported bird count programs in North America. For more than 30 years, thousands of birders most of them volunteers, had run point count routes across Canada and the continental United States in

order to gather useful bird information on a systematic basis. Analysis of this huge amount of data had result on bird population status, relative abundance and trends for more than 420 bird species. Such information is crucial for decision making process among conservation, prioritization and sustainable use as well.

Even though few bird monitoring projects exist in Mexico, the lack on mechanisms and interest from investigators and technicians on data sharing has contributed to maintain a big gap on avian knowledge. This gap is affecting directly the decision making process on bird conservation and sustainable use since few hard data is available on population status, trends etc. Filling the information gap will led to a more complete North American avifauna status, and thus, improved conservation priorities.

The Mexican Coordination of the North American Bird Conservation Initiative in CONABIO, with support from USGS, CONANP and several Mexican and US associations, started in 2008 the process of expansion of the Breeding Bird Survey to all northernmost states of Mexico. Despite technical and social difficulties, big achieves have been made, and specific improvement needs and opportunities have been identified towards the institutionalization of this program.

**PS1.216 Rodriguez-Flores, Claudia**, (UNAM, Tlalnepantla de Baz, Mexico); Ornelas, Juan Francisco (Instituto de Ecología, A.C., Xalapa, Mexico); María de Coro, Arizmendi (UNAM, Tlalnepantla de Baz, New Zealand)

PHYLOGENETIC STRUCTURE OF HUMMINGBIRD COMMUNITIES IN MEXICO

One of the fundamental questions on the field of evolutionary ecology is to establish the mechanisms responsible of the species composition on actual communities. Here, we established the phylogenetic structure of 173 hummingbird communities in Mexico inhabiting along different environmental gradients and across biogeographic barriers, trying to clarify the role of competition, biogeography and environmental filters like organizer processes on these communities. To identify the role of the scale in the analysis, we constructed two phylogenies using sequences of four genes: One nuclear (AK1) and three mitochondrial (ND2, ND5 and 12SrRNA). One phylogeny included only the Mexican hummingbird species (47 of 53 species), and the other included 108 hummingbird species that represented the principal clades of Trochilidae family. With our work it was possible to begin to address the effect of large scale and local process about and the role of different the mechanisms that organized hummingbird communities in this part of the continent.

**PS2.65 Rohrbaugh, Ron**, (Cornell Lab of Ornithology, Ithaca, United States); Roth, Amber (Michigan Technological University, Houghton, MI, United States); Aldinger, Kyle (West Virginia University, Morgantown, WV, United States); Bakermans, Marja (Indiana University of Pennsylvania, Indiana, United States); Barker Swarouth, Sara (Cornell Lab of Ornithology, Ithaca, NY, United States); Bohall Wood, Petra (U.S. Geological Survey, Morgantown, WV, United States); Buehler, David (The University of Tennessee, Knoxville, TN, United States); Confer, John (Ithaca College, Ithaca, NY, United States); Crawford, Dolly (Cornell Lab of Ornithology, Ithaca, United States); Friis, Christian (Canadian Wildlife Service, Toronto, ON, Canada); Fowlds, Monica (University of Wisconsin, Madison, United States); Larkin, Jeffrey (Indiana University of Pennsylvania, Indiana, PA, United States);

Loefering, John (University of Minnesota- Crookston, Crookston, MN, United States); Lowe, James (United States); Piorkowski, Martin (Cornell Lab of Ornithology, United States); Rosenberg, Kenneth (Cornell Lab of Ornithology, Ithaca, NY, United States); Smalling, Curtis (Audubon Society of North Carolina, Chapel Hill, NC, United States); Terhune, Theron (Tall Timbers, Tallahassee, FL, United States); Vallender, Rachel (Environment Canada, Gatineau, PQ, Canada); Will, Tom (U.S. Fish and Wildlife Service, Division of Migratory Birds, Bloomington, MN, United States)

#### A RANGEWIDE APPROACH TO STABILIZING AND REVERSING GOLDEN-WINGED WARBLER POPULATION DECLINES

Golden-winged Warbler (*Vermivora chrysoptera*) populations, especially in the Appalachian Mountains, have declined significantly during the past 45 years. Furthermore, Appalachian Mountain populations have become largely disjunct from Midwestern (Great Lakes) populations, which are now declining as well. Much of the decline in both regions can be explained by habitat loss; however, hybridization with Blue-winged Warbler (*Vermivora cyanoptera*) has exacerbated the downward trend and added complexity to the development of effective conservation strategies. In addition, the contribution of non-breeding season impacts remains largely unknown. The Golden-winged Warbler Working Group has completed a comprehensive analysis of a coordinated, multi-year, multi-scale dataset derived from seven widely distributed sites. The analysis was aimed at developing research-driven, breeding season conservation strategies to restore the current estimated population of approximately 418,000 breeding individuals to approximately 630,000 (similar to population in 1980s). We have identified key conservation focal areas, and through landscape-scale modeling and analyses of site-level habitat data, we developed habitat management guidelines for populations throughout the range, and document the potential benefit to other habitat-associated bird species. To minimize Blue-winged Warbler contact, we recommend working at sites above 600 m in the southern Appalachians and above 400 m in the northern Appalachians. Throughout the breeding range, landscape context should include 50-75% deciduous forest and less than 20% coniferous. Habitat patches should include 30-70% shrubs and trees, which are unevenly clumped and interspersed with grass and forb openings. We recommend retaining a minimum of 10-15 canopy trees per ha, resulting in canopy cover of 10-30%. Detailed conservation strategies and habitat management guidelines are available in the Golden-winged Warbler Status Assessment and Conservation Action Plan ([www.gwwa.org](http://www.gwwa.org)).

**S8.2 Rojas, Octavio**, (Instituto de Ecologia, A. C., Xalapa, Mexico);

#### WHAT'S IN A SPECIES? THE IMPORTANCE OF SPECIES LIMITS IN AVIAN CONSERVATION

The taxonomic criteria used as bases for endangered species lists can affect conservation policy decisions. We emphasize that the use of different taxonomic units affects the baselines of such lists. Recent taxonomic reviews for the Mexican avifauna provided the tools for assessing this effect on a highly diverse avifauna which is currently in need of serious conservation actions. Most ornithologists have used a taxonomy based on the biological species concept (BSC) to make decisions on species limits and therefore to set them into endangered species lists. However, the application of the phylogenetic species concept (PSC) as an alternative for delimiting species, results in a different panorama of what should be protected. Our analysis shows that the current official Mexican endangered species list,

BSC based, encompasses 371 birds, ranked as 277 species and 94 subspecies. The same list of protected forms changes under the phylogenetic species concept because 47 of them are not recognized as valid species; while another 28 forms merit higher levels of protection. Additionally, under this concept another 11 forms should be candidates for inclusion based on their restricted distribution. We call attention to the fact that the use of one or another species concept affects endangered species lists.

**SAT4.2 Rondon-Rivera, Julian**, (Rutgers, the State University of New Jersey, Newark, United States); Holzapfel, Claus (Rutgers, the State University of New Jersey, Newark, NJ, United States); Newhouse, Michael (NJ Meadowlands Commission, Lyndhurst, United States)

#### URBAN GREEN SPACES: TRAPS OR HAVENS FOR MIGRATORY BIRDS?

We aim at understanding the role that small, scattered patches of vegetation within urban spaces have in sustaining bird migration. In the Northeast, the main migratory flyway overlaps the most urbanized region of North America which forms a potential physical barrier for migrants. It has been shown that many migrants use stopover sites within cities to replenish spent energy. However, insufficient research has been conducted on the possible role of isolated small pockets of vegetation as stopover habitats within urban areas. The study is focused on a 520 square meter wooded plot in downtown Newark, NJ (Rutgers Campus) to determine if the necessary conditions are provided for birds to replenish depleted fat stores during length of stopover. In particular we ask whether and how long birds stay and whether they gain or lose body mass during their retention in the urban habitat. During two autumns and one spring, 1315 passerines were captured in mist-nets and banded to obtain measurements of body mass and overall body conditions. The number of individual captures indicates that there is a high density of migratory birds in the studied site. Additionally, the presumed stopover length observed in recaptured individuals indicates that the urban habitat patch indeed acts as stopover habitat. Analysis of mass gained throughout duration of stopover provides two contrasting conclusions. Some neotropical migratory species are able to replenish spent energy at small, urban wooded habitats and on the contrary such habitats might be an energy sink for certain species of neotropical birds.

**PS1.229 Rose, Eli**, (North Carolina Cooperative Fish & Wildlife Research Unit, Department of Biology, NCSU, Raleigh, United States); Borneman, Tracy (North Carolina Cooperative Fish & Wildlife Research Unit, Department of Biology, NCSU, Raleigh, NC, United States); Simons, Theodore (USGS - North Carolina Cooperative Fish and Wildlife Research Unit, Department of Biology, NCSU, Raleigh, NC, United States)

#### USING ARTIFICIAL-EGG HEART RATE MONITORS TO ASSESS THE PHYSIOLOGICAL RESPONSE OF AMERICAN OYSTERCATCHERS (*HAEMATOPUS PALLIATUS*) TO ANTHROPOGENIC ACTIVITY.

Artificial-egg heart rate monitors have recently been used to address questions about avian physiology, metabolic requirements, and responses to anthropogenic activity or other potential sources of disturbance. Our design allowed continuous monitoring of nesting American Oystercatcher heart rates for extended periods of time. Heart rate recordings were collected from wild birds under a wide variety of environmental

conditions throughout their 27 day incubation period. We discuss the strengths and weaknesses of using this method over existing alternatives and present results from monitoring 42 oystercatcher nests on Cape Lookout National Seashore, North Carolina during the 2010 and 2011 breeding seasons. Oystercatchers readily accepted false-eggs into their nests with most birds returning to their nests within 30 minutes of monitor placement. American Oystercatcher heart rates ranged from 108 to 348 beats per minute with an average of 187 beats per minute (n=1461). Despite continuous monitoring, heart rates were only discernible approximately 21 percent of the time that a bird was on the nest. The quality of the recordings varied with the condition and position of the microphone. Artificial-egg monitors are a less invasive alternative to implants but they do not always provide continuous high-quality heart rate information.

**S12.1 Rosenberg, Kenneth**, (Lab of Ornithology, Cornell University, Ithaca, United States); Ruth, Janet (U.S. Geological Survey, Albuquerque, NM, United States); Beardmore, Carol (U.S. Fish and Wildlife Service-Sonoran Joint Venture, Phoenix, AZ, United States); Easton, Wendy (Canadian Wildlife Service-Environment Canada, Delta, BC, Canada); Will, Tom (U.S. Fish and Wildlife Service, Bloomington, MN, United States); Pashley, David (American Bird Conservancy, The Plains, VA, United States)

#### FILLING KNOWLEDGE GAPS TO ENHANCE FULL LIFE-CYCLE BIRD CONSERVATION: PARTNERS IN FLIGHT'S TRI-NATIONAL VISION

Neotropical migratory birds continue to decline, despite decades of research and conservation planning; clearly a more integrative, full-life-cycle approach is necessary, that links primary research to on-the-ground conservation. Partners in Flight recently released *Saving our Shared Birds: Partners in Flight Tri-National Vision for Landbird Conservation*, which provides the first comprehensive conservation assessment of landbirds in Canada, Mexico, and the continental United States. Effective bird conservation must be based on the latest science; yet relatively few studies have enabled the targeting of effective conservation actions to benefit migrants (and associated residents) on the wintering grounds. In particular, conservation of migratory birds requires coordinated actions throughout their life cycle, including research on seasonal connectivity between breeding and non-breeding locations, and on important factors limiting survival and productivity throughout the annual cycle. We also need to expand our knowledge base on population status, distribution, habitat needs, and threats faced by migrants on their wintering grounds, as well as response to management actions and environmental change. The following talks in this symposium highlight advances in field and analytical methodologies, synthesize recent results on migratory connectivity, demographic modeling, and conservation genetics, and provide perspectives from conservation practitioners attempting to apply these research results to on-the-ground projects at regional and hemispheric scales. All speakers have been asked to describe how research results in their fields can be applied to bird conservation planning and actions, and identify the next breakthroughs and future research priorities that will enable effective full-life-cycle conservation. Our intent is to begin a dialogue among researchers, students, resource managers, and policy-makers so that collectively we can take on the challenge of addressing critical research questions and linking research results to conservation decision-making.

**PS1.260 Rotenberg, James**, (Department of Environmental Studies, University of North Carolina Wilmington, Wilmington, United States); Garcia, William (Belize Foundation for Research and Environmental Education, Punta Gorda, Toledo District, Belize, Belize); Marlin, Jacob (Belize Foundation for Research and Environmental Education, Punta Gorda, Toledo District, Belize, Canada)

#### A LONG-TERM BANDING STUDY IN THE MAYA MOUNTAINS OF BELIZE: FOUR-YEARS AND COUNTING.

In 2008, we initiated a four-site Monitoreo de Sobrevivencia Invernal (MoSI) banding program in the Bladen Nature Reserve (BNR) and the Belize Foundation for Research and Environmental Education (BFREE) field station in Belize. The BNR represents the core conservation area for the Maya Mountains, and supports some of the highest levels of biodiversity in north Central America. All four sites fall within the riparian corridor of the Bladen River with the BNR sites representing natural habitat, and the BFREE sites representing disturbed or altered habitats. Through January 2012 we captured 3200 total birds; 50.2% were migrants and 49.8% were residents. Of these, 76% were newly captured and 24% were recaptures. Mean capture rates overall were 29 birds/100 net-hours and 19 species/100 net-hours. The disturbed sites had higher rates of capture compared to the undisturbed sites for both total birds and species (Disturbed: total-23/100 net-hours and species-34/100 net-hours; Undisturbed: total-16/100 net-hours and species-26/100 net-hours). Because our location is a stopover site, we detected a distinct fall and spring pulse of migrants, as well as a separate overwintering population with recaptures indicating site fidelity. Our most common migrant and resident species are the Wood Thrush (*Hylocichla mustelina*) and Kentucky Warbler (*Oporornis formosus*), and Ochre-bellied Flycatcher (*Mionectes oleagineus*) respectively. Currently, our data show population trends; however, our goal is to collect the first long-term (at least 10 year) dataset in Belize so that we will be able to calculate survivorship and determine the role of local and landscape variables on regional bird conservation.

**PS2.25 Rothstein, Stephen**, (University of California, Santa Barbara, United States); O'Loughlen, Adrian; Zaratzian, Devin (University of California, Santa Barbara, CA, United States)

#### SINGING TOUGH AND SEXY: COWBIRD SONG REPERTOIRE USE

Several lines of evidence indicate that large song repertoires provide fitness advantages in the 75% of songbird species that have more than a single song type. There is also evidence for advantages related to repertoires consisting of locally shared song types. Playback studies involving brown-headed cowbirds show that females are more likely to respond sexually with copulation solicitation displays when they hear locally shared song types, as opposed to acoustically normal but unshared types. Females also respond more strongly when they hear multiple song types as opposed to playbacks consisting of a single song type. The adaptive value of large repertoires consisting of locally shared types is further indicated by the fact that male cowbirds replace the small repertoires of 2-4 mostly unshared song types that they possess as yearlings with larger repertoires of 4-7 mostly locally shared types in their second and later breeding seasons. So it is predicted that cowbirds benefit by displaying their repertoires as quickly as possible. Field studies show that male cowbirds switch song types at a higher rate than predicted by random probability in response to playback of female calls. Moreover, male song switching rates

are higher at the start of a song bout than later in a bout so that the entire repertoire is typically presented in the first 10-12 songs a male sings in response to playback of female calls. In addition, focused captivity studies involving several thousand songs show that males tend to favor song types in their repertoires that are shared by all or most other males in their group, whereas males tend to less often do song types in their repertoires that few or no other birds share. These trends applied both to songs males directed to other males as well as songs directed to females. Overall, results agree with those predicted if cowbirds attempt to maximize the benefits of their song repertoires and use singing to intimidate other males and to display their desirability as mates to females.

**T9.1 Rourke, James**, (Hemmera, Vancouver, Canada); Palmer, Charlie; Paterson, Brian (Hemmera, Vancouver, BC, Canada)

#### FACTORS INFLUENCING SANDHILL CRANE SITE SELECTION AND HABITAT USE DURING FALL-STAGING PRIOR TO SOUTHWARD MIGRATION, LOWER MAINLAND, BC

Factors influencing Sandhill Crane (*Grus canadensis*) site selection and habitat use during fall-staging prior to southward migration were studied in Delta, British Columbia (BC) in 2009. Crane abundance and distribution were documented to build an index of use by field, location, and cover type. This data was used to develop a forage preference index which considered both the time cranes spent on a cover type and the availability of the cover type in the study area. To evaluate differences in use of cover types, focused behavioral observations of cranes were conducted. Geospatial features (i.e., distance to closest street or highway, night roost, and size of field (ha)) were modeled using logistic regression to inform physical features influencing habitat use.

Sandhill cranes were documented staging within the study area from September 1 to November 27, 2009. The maximum number of cranes documented was 56. Cranes were documented using 14 of the 39 cover types. Cover crops ranged from cash crops (e.g., beans, blueberries) to winter cover crops (WCC) (primarily barley) planted for wintering waterfowl. Cranes spent the most time foraging on mature WCC. However, the preference index showed cranes preferentially selected freshly seeded WCC (10.3) and young WCC (9.7) over mature WCC (2.9) when available. Harvested corn (5.2) was also a preferred cover type. When available, cranes spent significantly more time foraging on seeded WCC than the other preferred crops ( $F(3, 49)=3.1, P=0.04$ ). Cranes spent 51-61% of their time foraging when on preferred cover types. Behaviours on non-preferred covers showed a larger proportion of resting and comfort behaviours. A field's distance to the closest surface street ( $t=3.7, P<0.001$ ) and its distance from night roost ( $t=4.2, P<0.001$ ), were significant predictors of sandhill crane use. These results provide a means of assessing the impacts of increasing development and shifting agricultural land use on cranes using the study area and provide data to maintain required staging/stopover habitat for cranes.

Preliminary analysis of data collected in 2010 and 2011 show similar results and will also be presented.

**W17.6 Routhier, Daniel**, (University of Saskatchewan, Saskatoon, Canada); Clark, Robert (University of Saskatchewan, Saskatoon, SK, Canada); Dufour, Kevin (Environment Canada, Saskatoon, SK, Canada)

#### WETLAND OCCUPANCY AND PRODUCTIVITY PATTERNS OF GREBES IN PRAIRIE CANADA: EFFECTS

#### OF INTERSPECIFIC COMPETITION, WETLAND STRUCTURE AND LANDSCAPE COMPOSITION

Wetlands of the Prairie Pothole Region (PPR) provide a significant proportion of the breeding habitat for >30 species of waterbirds. Approximately 70% of PPR wetlands have been lost since European settlement and remaining wetlands are subjected to frequent degradation, primarily due to agricultural activities. Horned grebes (*Podiceps auritus*) are experiencing long-term population declines and are listed as a species of Special Concern in Canada. There is virtually no information on the status of pied-billed grebes (*Podilymbus podiceps*) but the population may be declining and thus is also of considerable conservation concern. Understanding processes that affect grebe distribution patterns and productivity could provide insights into actions needed to achieve conservation goals. Marshbird research has focused primarily on breeding habitat use or selection but has seldom examined how productivity is related to wetland characteristics. Therefore, occupancy of wetlands by breeding and brood-rearing horned and pied-billed grebes was evaluated on 6-7 study sites in south-central Saskatchewan, 2010 and 2011, and related to wetland and upland habitat features. In general, wetland occupancy by grebes was influenced by interspecific competition as well as local and landscape-level wetland features. Horned and pied-billed grebes rarely co-occurred on smaller ( $\leq 4$  ha) semi-permanent and permanent wetlands. At the wetland level, horned grebe occupancy and productivity were highly correlated with the amount of emergent vegetation, whereas wetland area alone was a better predictor of adult pied-billed grebe occupancy and productivity. At a landscape level, the number of semi-permanent and permanent wetlands was an important predictor for breeding and brood-rearing occupancy probability of pied-billed grebes in 2010 and 2011 and for horned grebes in 2010. However, breeding horned grebe occupancy probability and productivity were higher in landscapes with fewer semi-permanent and permanent wetlands. Horned grebes may be opportunistic, exploiting more of the available wetland habitats in low wetland density landscapes during years of above-average water conditions. Conservation initiatives should consider the roles of wetland-specific and landscape-level features while protecting semi-permanent and permanent wetlands in landscapes characterized by both high and low wetland densities.

**PS1.99 Rowse, Linnea**, (The Ohio State University, Columbus, United States); Rodewald, Amanda (The Ohio State University, Columbus, United States)

#### EXPOSURE OF SONGBIRDS TO HEAVY METAL CONTAMINANTS ACROSS AN URBAN TO RURAL LANDSCAPE

Despite several high profile successes in reducing toxins in the environment, exposure to environmental contaminants remains a threat to birds, especially in human-dominated landscapes. Our research investigates how land use mediates exposure to heavy metals and identifies health and reproductive consequences of exposure at individual and population levels. We study two representative songbirds, Northern Cardinal (*Cardinalis cardinalis*,  $n = 49$ ), a resident species positively associated with urbanization, and Acadian Flycatcher (*Empidonax virescens*,  $n = 17$ ), a Neotropical migrant negatively associated with urban environments. We monitored nests from April through August 2011 in riparian forest fragments in Columbus, Ohio. Blood samples ( $<1\%$  body mass,  $\sim 50-70\mu\text{l}$ ) were collected from territorial birds and analyzed for concentrations of arsenic, cadmium, lead, mercury, selenium, and thallium. Selenium and mercury were the most commonly detected contaminants and



were found in greater concentrations in Acadian Flycatchers (selenium mean  $\pm$  S.E. (n): 3242.69  $\pm$  286.32 ppb (16); mercury: 179.76  $\pm$  21.09 ppb (17)) than in Northern Cardinals (selenium mean  $\pm$  S.E. (n): 443.73  $\pm$  34.13 ppb (48); mercury: 3.61  $\pm$  1.43 ppb (48)). We used a mixed model analysis to examine the relationship between blood contaminant level and urbanization or watershed placement, using site as a random effect variable. Contrary to our expectations, blood contaminant level was not significantly related to amount of urbanization surrounding forests but rather, was better explained by site location within the watershed. Specifically, selenium concentrations in Acadian Flycatchers were significantly lower at sites north, compared to within or south, of the city (F1,8=6.78, P=0.0314), which presumably reflects increasing contamination in the southward flowing waterways. Exposure to mercury showed a similar trend, though not statistically significant, for Acadian Flycatchers (F1,9=2.42, P=0.1540). Our findings suggest that conservation planning efforts should consider watershed placement as a potentially important landscape factor mediating wildlife exposure to toxins.

**S1.4 Roy, Christian,** (Laval University and Ducks Unlimited Canada, Quebec City, Canada); McIntire, Eliot (Canadian Forest Service / Université Laval, Victoria, BC, Canada); Cumming, Steven (Université Laval, Québec, PQ, Canada); Darveau, Marcel (Ducks Unlimited Canada, Québec, Canada); Barker, Nicole (Université Laval / Ducks Unlimited Canada, Québec, PQ, Canada)

#### USING THE WATERFOWL BREEDING POPULATION AND HABITAT SURVEY TO IDENTIFY SPATIAL POPULATION DYNAMICS IN BOREAL DUCKS

The importance of the boreal forest in the dynamics of waterfowl populations has long been underappreciated. However, the western boreal forest has recently been as the second most important waterfowl breeding area in North America, after the prairie pothole region. Understanding how boreal populations are regulated and identifying the mechanisms that drive population dynamics are important steps for effective population management and conservation. We used data from the United State Fish and Wildlife Service (USFWS) annual Waterfowl Breeding Population and Habitat Survey (WBPHS) to assess the population dynamics of 7 boreal-breeding duck species in survey strata of the boreal forest and the boreal transition zone of Canada (N=21 strata). We modelled population dynamics of each species independently, evaluating Gompertz and Ricker population models within a Bayesian state-space framework. We included random terms for intercepts and density dependence in strata, with seasonal (spring, summer, fall, winter) mean precipitation and temperature as annual covariates. We tested the hypothesis that density dependence and the effects of weather covariates on population growth varied among strata. In general, models with density-dependent terms on the log population size performed better than those with a Ricker formulation. Both the strength of density dependence and the estimated carrying capacity showed a geographical trend for all species but these trends were not significant due to sample and population size. Early nesters like the mallard showed a response to summer precipitation while late nesters like scaup and scoters showed response to autumn precipitations. For some stratum the response to precipitations was quadratic which could be linked to nestling survival. However, the effects of precipitation were not consistent across all strata and no simple spatial patterns were evident across species. In spite of few generalizations across these large spatial scales, the fact that the Gompertz model performed better for

most species suggests that waterfowl boreal population response to perturbations could be slower than expected.

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**S5.2 Ruegg, Kristen,** (University of California, Santa Cruz, Santa Cruz, United States); Smith, Tom (Center for Tropical Research, UCLA, Los Angeles, CA, United States); Eric, Anderson (National Marine Fisheries Service, Santa Cruz, CA, United States)

#### POPULATION GENOMICS OF THE SWAINSON'S THRUSH, CATHARUS USTULATUS

One of the grand challenges in evolutionary biology is to reveal the genetic basis of traits important to speciation. As the field of population genetics moves into the field of population genomics our ability to identify genes potentially important to divergence has increased substantially. Here we use a population genomics approach to investigate genes important to incipient speciation within the Swainson's thrush, *Catharus ustulatus*. We estimate sequence variation at ~150,000 locations in the genome and determine the potential for divergent selection. By mapping a subset of our sequences back to the Zebra Finch reference genome we identify a number of candidate genes that may be important to reproductive isolation. Using the Swainson's thrush as an example, we describe ways that population genomic approaches can be more generally useful in avian speciation research and beyond.

**F4.5 Ruiz-Gutierrez, Viviana,** (Colorado State University, Fort Collins, United States);

#### SURVIVAL OF RESIDENT NEOTROPICAL BIRDS: CONSIDERATIONS FOR SAMPLING AND ANALYSIS

## BASED ON 20 YEARS OF BIRD BANDING EFFORTS IN MEXICO

Long-term bird banding programs provide knowledge on demographic rates of avian populations. To date, we lack information on demographic rates for most bird populations inhabiting species-rich tropical ecosystems relative to temperate systems. Banding in tropical regions is typically conducted with protracted or irregular sampling occasions, presenting challenges in selection of appropriate capture-mark-recapture (CMR) models. Here, we address common challenges related to collecting and analyzing data to estimate survival rates of resident tropical birds using 20 years of banding efforts in Mexico as a case study. We applied Cormack-Jolly-Seber and Barker models to estimate apparent survival and recapture probabilities for six Neotropical bird species. For monitoring programs with existing data collected at continuous, uneven, or irregular intervals, we recommend the application of the Barker model over models that can lead to violations of CMR assumptions because this model was more efficient in the use of available banding data. For future and continuing monitoring efforts, we present sampling protocol suggestions that: 1) summarize published protocols, 2) meet CMR assumptions, 3) correct for sampling bias, and 4) consider the ecology and life histories of Neotropical birds. We recommend that monitoring programs last > 10 yrs, and provide additional suggestions for primary and secondary sampling occasions, as well as the number of nets, potential net configurations, and the extent of the spatial scale. These baseline recommendations are likely to foster an increase in our knowledge of avian survival rates in tropical ecosystems, which is imperative for managing tropical bird populations under changing environmental conditions.

### **SAT13.6 Rush, Andrew**, (Museum of Vertebrate Zoology; University of California Berkeley, Berkeley, United States); McCallum, D. Archibald (Applied Bioacoustics, Eugene, CA, United States); Bowie, Rauri (Museum of Vertebrate Zoology; University of California Berkeley, Berkeley, CA, United States) THE ROLE OF INNATE SONG AS AN ISOLATING MECHANISM IN EMPIDONAX FLYCATCHERS

Divergent song types can act as isolating mechanisms by functioning as cues for assortative mating. Research in this area has focused primarily on oscine passerines, birds that learn their songs. Innate subsong is far less labile than learned song, and may be more effective in maintaining species boundaries either by functioning as a strong pre-mating barrier to hybridization, or as a strong post-mating barrier if hybrids with intermediate songs are ineffective in attracting mates. Pacific-slope Flycatcher (*Empidonax difficilis*) and Cordilleran Flycatcher (*E. occidentalis*) are subsongers that were elevated to species status, in part due to differences in song. We have shown recently that gene flow occurs between these taxa in contact zones in the interior Pacific Northwest, and appears to be biased from Pacific-slope to Cordilleran. Our current analyses confirm that the songs of allopatric populations are distinct, but contact zone populations have intermediate vocalizations. An apparently biased introgression of Pacific-slope song elements into Cordilleran populations indicates a possible preference for Pacific-slope song. We tested the effect of song divergence on gene flow using playbacks of conspecific, heterospecific, and intermediate ('hybrid') songs. Pacific-slope populations showed a greater preference for conspecific song than Cordilleran populations, and contact zone populations responded to all song types. These results suggest that behavioral asymmetries may be partially responsible for asymmetrical gene flow between these taxa. If divergent innate song types do not function as strong

isolating mechanisms, this could have important implications for delimiting subsong species.

### **T17.11 Rushing, Clark**, (Smithsonian Migratory Bird Center, Greenbelt, United States); Dudash, Michele (University of Maryland, College Park, MD, United States); Marra, Peter (Smithsonian Migratory Bird Center, Washington, DC, United States)

#### QUANTIFYING THE REPRODUCTIVE CONSEQUENCES OF LONG-DISTANCE NATAL DISPERSAL IN A MIGRATORY BIRD, THE AMERICAN REDSTART

Natal dispersal is one of the most important yet least understood processes in the ecology and evolution of all species. Although researchers typically assume that dispersal is costly to individual fitness, empirical support for this assumption has been elusive in part because mark-recapture data is often collected at scales much smaller than the scale of natal dispersal, particularly in wide-ranging species such as migratory birds. Additionally, events occurring during the non-breeding season are known to influence reproductive success in migratory birds but these carry-over effects are rarely accounted for in studies of dispersal that rely on mark-recapture. Recent advances in the use of stable isotopes have provided a new tool to study natal dispersal with potential to overcome the limitations of mark-recapture. We used stable isotopes to quantify the reproductive consequences of: 1) long-distance natal dispersal distance, 2) long-distance natal dispersal direction, and 3) winter habitat quality in a long-distance migratory bird, the American redstart.

Our results support the hypotheses that long-distance natal dispersal and low-quality non-breeding habitat negatively influence reproductive success but the data also suggest that the relationship between reproductive success, non-breeding habitat and natal dispersal is more complex than previously recognized. Yearling males that originated north of the study site and wintered in high-quality habitat were significantly more likely to acquire a mate than individuals originating south of the study site and wintering in low-quality habitat. These data provide the first evidence that natal dispersal direction influences reproductive success in migratory birds and add to the growing evidence that non-breeding season events carry-over to influence breeding season processes. However, of the yearling males that acquired a mate, local recruits were more likely to fledge young than non-local recruits, supporting the hypothesis that long-distance natal dispersal is costly to reproductive success. These results offer a new perspective on the consequences of natal dispersal in migratory birds and illustrate the potential of stable isotopes to provide insights on previously undocumented aspects of long-distance dispersal in migratory birds.

### **SAT14.10 Ruskin, Katharine**, (University of Maine, Orono, United States); Olsen, Brian (University of Maine, Orono, ME, United States)

#### TESTING FOR STABILITY IN THE SHARP-TAILED SPARROW HYBRID ZONE: 130 YEARS OF PLUMAGE COMPARISONS

Saltmarsh Sparrows (*Ammodramus caudatus*, hereafter SALS) are a species of global conservation concern. Of the many threats to SALS populations, climate change has the potential to increase hybridization rates by shifting the range edges of SALS and its sister species, the Nelson's Sparrow (*Ammodramus nelsoni*, hereafter NESP). Apparent SALS and NESP hybrids have been observed for over a century, and research conducted from 1997-2000 determined that the hybrid zone extended from midcoast Maine to northern Massachusetts

based largely on plumage characteristics. More recent genetic analysis found NESP alleles in SALS populations as far south as Long Island, suggesting that the hybrid zone may be broader than initially described or has expanded. To understand the temporal dynamics of the sharp-tailed sparrow hybrid zone over the past century, we measured the extent of hybridization during two time periods at a site in the center of the hybrid zone using a single, directly comparable metric. Nineteen research skins, collected in southern Maine during breeding seasons from 1882-1941, and 249 sparrows captured in 2011 from the same site as the historical specimens were scored for 13 plumage characteristics that differ between SALS and NESP. Both the means of the summed plumage scores and the individual categories differed significantly through time. Eleven out of 13 categories shifted toward the SALS end of the hybridization gradient through time. Results from this site indicate a change in mean phenotype within the center of the hybrid zone and dynamic but asymmetrical introgression. These patterns may result from variation around a stable level of introgression or of temporal changes in the mean phenotype.

**PS1.154 Russell, Jill**, (College of Mt. St. Joseph, Cincinnati, United States);

#### COMPARATIVE GROWTH AND DEVELOPMENT RATES OF BOREAL OWL NESTLINGS BASED ON SEX

The Boreal Owl (*Aegolius funereus*), is a widespread, albeit difficult to find, owl of the circumboreal region and because of its place near the top of the boreal food web, is an important bioindicator of forest health. Due to climatic changes in the boreal zone causing the loss of forest cover and food sources, and the potential for even greater changes in the near future, the Boreal Owl is considered a species of “conservation priority”. The growth and development of 40 young Boreal Owls was monitored outside Fairbanks, Alaska in May/June of 2011. Eleven metrics were measured and buccal swabs were taken for DNA determination of sex. Twenty-six individuals successfully fledged at 28 to 32 days of age. Development of males and females was roughly parallel until about day 17 when male mass and skull length plateaued and female values continued to increase. At fledging, female mass was approximately 25% greater than males and female skull width approximately 5% greater. Values for metrics including hand length, tarsal length, days until egg tooth loss, culmen length, feather track and primary feather development did not show differential growth based on sex through fledging.

**S8.6 Ruvalcaba-Ortega, Irene**, (Universidad Autónoma de Nuevo León, San Nicolás de los Garza, Mexico); Allen-Bobadilla, Jorge (Universidad Autónoma de Nuevo León, San Nicolás de los Garza, Mexico); Panjabi, Arvind (Rocky Mountain Bird Observatory, Fort Collins, CO, United States); González-Rojas, José I. (Universidad Autónoma de Nuevo León, San Nicolás de los Garza, Mexico)

#### USE OF AGRICULTURAL AREAS BY WINTERING GRASSLAND BIRDS IN NORTHEASTERN MEXICO

It is estimated that 70% of the temperate grasslands have been converted to agricultural use. In northeastern Mexico, tendency has been similar with a loss of 74% of the desert grasslands, mainly due to land conversion to potato fields. This has resulted in the severe declines of the associated bird species populations. Nevertheless, some agriculture areas (e.g. hayfields, pasture and small grains) may provide the resources for certain grassland specialist species to feed, refuge, or even nest during the breeding season. However, the use of such areas has often been associated with a lower nesting success and an exacerbated

reproductive effort that may ultimately result in a diminished adult survivorship. The use of cultivated areas by grassland bird populations wintering in Mexico has not been studied, and it is therefore our objective to determine their densities in the agricultural landscape located in the limits of Coahuila and Nuevo León and to compare them with two native grassland areas of the same region. Using distance sampling, we conducted 107 randomly selected line transects (1 km) in the agricultural area, 61 in El Tokio and 36 in Valle Colombia, during two wintering seasons (2010-2011). Fourteen obligate and 17 facultative grassland species were recorded in cultivated fields. We found that richness corrected by rarefaction was significantly higher on the agricultural area than native. Also, Horned Lark (*Eremophila alpestris*), Savannah Sparrow (*Passerculus sandwichensis*), Vesper Sparrow (*Poocetes gramineus*), and Say's Phoebe (*Sayornis saya*) obtained significantly higher densities in agricultural areas than in both native grasslands. Finally, we analyze species densities by type of crop activity (resting, < 2 years; abandoned, > 2 years without activity). Savannah Sparrow showed significantly higher densities in abandoned fields, and the opposite was observed for Horned Lark, Vesper Sparrow and Meadowlarks. Grassland bird specialists are using the agricultural matrix of northeastern Mexico during the wintering season; however, other factors that may be affecting their survival such as pesticide and novel parasites exposure, anthropogenic stress and immune system status should be studied.

**T5.2 Ryder, Thomas**, (Smithsonian Migratory Bird Center, Washington, United States); Marra, Peter; Fleischer, Rob (Smithsonian Conservation Biology Institute, Washington, United States)

#### THE ECOLOGICAL-EVOLUTIONARY INTERPLAY: DENSITY-DEPENDENT SEXUAL SELECTION IN A MIGRATORY SONGBIRD

Little is understood about how environmental heterogeneity influences the spatial dynamics of sexual selection. Within human-dominated systems, habitat modification creates environmental heterogeneity that could influence the adaptive value of individual phenotypes. Here, we used the gray catbird to examine if the ecological conditions experienced in the suburban matrix and embedded forest parks influence reproductive strategies and the strength of sexual selection. Our results show that these habitats varied in a key ecological factor, breeding density. Moreover, this ecological factor was closely tied to reproductive strategies such that local breeding density predicted the probability that a nest would contain extra-pair offspring. Partitioning reproductive variance showed that while within-pair success was more important in both habitats, extra-pair success increased the opportunity for sexual selection by 39% at higher breeding densities. Body size was a strong predictor of relative reproductive success and was under directional selection in both habitats. Importantly, our results show that the strength of sexual selection did not differ among habitats at the landscape scale but rather that fine-scale variation in an ecological factor, breeding density, influenced sexual selection on male phenotypes. Here we document density-dependent sexual selection in a migratory bird and hypothesize that coarse-scale environmental heterogeneity, in this case generated by anthropogenic habitat modification, changed the fine-scale ecological conditions that drove the spatial dynamics of sexual selection.

**W17.9 Saab, Victoria**, (U.S. Forest Service, Rocky Mountain Research Station, Bozeman, United States); Mosher, Brittany (Montana State University, Bozeman, MT, United States); Latif,

Quresh (U.S. Forest Service, Rocky Mountain Research Station, Bozeman, MT, United States)

#### AVIAN COMMUNITY RESPONSES TO A MOUNTAIN PINE BEETLE OUTBREAK IN MONTANA

Recent epidemics of mountain pine beetles (*Dendroctonus ponderosae*) will fundamentally alter forests of the Rocky Mountain West, impacting management decisions related to fire, logging, and wildlife habitat. We evaluated effects of a recent mountain pine beetle epidemic on site occupancy dynamics of 50 avian species. Seventy-six point count stations were randomly located in 4, 250 ha study units within the Elkhorn Mountains of western Montana in areas dominated by ponderosa pine (*Pinus ponderosa*). Each point was visited 3 times during the breeding seasons (May-July) of 2003-06 (pre-epidemic) and again during 2009-11 (during epidemic). We used a Bayesian hierarchical model of multi-species occupancy that accounts for detection probability and allows for estimates of rare, as well as common species. Both occupancy and detection were modeled for all species with respect to the occurrence of the beetle outbreak and snag densities. Species responded variably to the epidemic. Greater changes in occupancy are expected with time since disturbance, when growth of the understory vegetation is expected. However, results supported our predictions that occupancy rates would increase after the outbreak for bark drilling woodpeckers (*Picoides* spp.), whereas occupancy rates declined for foliage gleaning chickadees (*Poecile* spp.). The community-wide nature of this analysis elucidates the variety and degree of changes exhibited, and also gives managers more information upon which to base their decisions regarding post-beetle management activities.

**SAT12.4 Safran, Rebecca**, (University of Colorado, Boulder, United States); Jenkins, Brittany; Joanna, Hubbard; Wilkins, Matthew; Flynn, Andrew; Wildrick, Rachel (University of Colorado, Boulder, United States)

#### GEOGRAPHIC VARIATION IN SEXUAL SIGNALING: CAUSAL EVIDENCE THAT DIFFERENT TRAITS UNDERLIE SEXUAL SELECTION IN CLOSELY RELATED POPULATIONS OF BARN SWALLOWS

Divergence in the signals involved in mate-selection behavior is a critical step in the evolution of reproductive isolation and can be influenced by both natural and sexual selection. Here, we used manipulative field experiments to test hypotheses about the function of two prominently divergent traits (tail streamer length and ventral feather color) among sub-species of barn swallows *Hirundo rustica*, with data presented on the North American population. Barn swallows in European populations are frequently cited as a classic example of sexual selection based on the relationships between variation in male tail streamer length and reproductive success; whereas our previous studies in North America have shown that feather coloration is causally related to reproductive performance in males. To simultaneously evaluate causal associations between both traits and reproductive performance, we analyzed paternity before and after manipulating both plumage coloration and tail streamer length in male barn swallows. Males with experimentally enhanced plumage color, shortened streamers, or a combination of these treatments received greater paternity from their social mates. Counter to findings from European populations, males in groups where tail streamers were lengthened lost paternity from their social mates. These results indicate no casual association between elongated streamers and reproductive performance in our North American population and accordingly, we confirm

geographic difference in the role of sexual selection in shaping variation in this trait.

**PS2.92 Saggese, Miguel**, (CVM - Western University of Health Sciences, Pomona, United States); Debrota, Joseph (Western University of Health Sciences, Pomona, CA, United States); Bloom, Pete; Thomas, Scott (Bloom Biological, Inc., Santa Ana, CA, United States); Papp, Joe (Bloom Biological, Inc., Santa Ana, United States); Komar, Nick (Arboviral Diseases Branch, Division of Vector-Borne Diseases, Centers for Disease Control and Prevention, Fort Collins, CO, United States); Pauvolid-Correa, Alex (Laboratório de Flavivírus, Instituto Oswaldo Cruz-Fiocruz, Ministério da Saúde, Rio De Janeiro, Brazil); Taylor, Shelley (Western University of Health Sciences, Pomona, CA, United States); Dahlhausen, Bob (Veterinary Molecular Diagnostics, Milford, OH, United States)

#### PREVALENCE OF WEST NILE VIRUS ANTIBODIES, TRICHOMONAS SPP. AND LEUCOCYTOZOON SPP. ON WILD NESTLING BIRDS OF PREY FROM SOUTHERN CALIFORNIA

West Nile Virus (WNV), *Trichomonas* spp., and *Leucocytozoon* spp. infection causes breeding failure in raptors and can negatively impact their populations. Understanding the exposure of nestlings to these pathogens could aid in identifying the role they play in the declining population of southern Californian raptors. In this study, we investigated the prevalence of these microorganisms infecting five species of raptors from Orange and San Bernardino counties, southern California (*Elanus leucurus* [n=10], *Buteo jamaicensis* [n=12], *Buteo lineatus* [n=5], *Accipiter cooperii* [n=36] and *Tyto alba* [n=15]) between May and July (summer) of 2011. Only *A. cooperii* was positive for *Trichomonas* spp. (56%): 73% prevalence for those birds nesting in urban areas; 23% for those nesting in rural areas. Overall prevalence of *Leucocytozoon* spp. was 32.9%: *A. cooperii*, 33%; *B. jamaicensis*, 25%; *E. leucurus*, 89%; and *B. lineatus*, 40%. One *A. cooperii* nestling had WNV antibodies, although non-specific anti-flavivirus antibodies were found in another 3 nestlings. Our preliminary results confirmed exposure and high prevalence of two common pathogens (*Leucocytozoon* spp. and *Trichomonas* spp.) in nestlings of southern Californian diurnal raptors. The low prevalence of WNV antibodies probably represents low WNV activity in the area. Further monitoring during the summer of 2012, molecular epidemiology studies, and characterization of the prevalence of infection by species, age, sex, geographic distribution, and breeding success are necessary to fully understand the potential role these microorganisms may have on the breeding success and population decline of southern Californian raptors.

**SAT6.3 Salafsky, Susan**, (Colorado State University, Corvallis, United States); Noon, Barry (Colorado State University, Fort Collins, United States); Reynolds, Richard (USDA Forest Service, RMRS, Fort Collins, United States)

#### THE INFLUENCE OF FOOD LIMITATION ON GOSHAWK REPRODUCTION IN NORTHERN ARIZONA

An evaluation of habitat quality provides a critical link between forest conditions and northern goshawk (*Accipiter gentilis*) reproductive rates, but the benefits of this approach are restricted by our current understanding of goshawk-habitat relationships. Previous research suggests that habitat quality for raptors is primarily determined by food availability, which is a function of both prey density and accessibility. However, inferences about habitat quality for breeding goshawks are limited by a lack of

information on the densities of multiple prey species and the abundance of prey in specific goshawk foraging habitats. To determine the characteristics of high-quality reproductive habitat for goshawks, we quantified spatial and temporal variation in goshawk reproduction, diets, and prey density among 607 breeding sites (2.2 km<sup>2</sup> circular areas centered on the nest or territory center) from 102 goshawk territories during 1999-2004. The mean number of goshawk fledglings produced per territory varied significantly among territories and years. The density of Kaibab squirrels (*Sciurus aberti kaibabensis*) and red squirrels (*Tamiasciurus hudsonicus*) within breeding sites combined with the biomass of cottontail rabbits (*Sylvilagus* spp.), northern flickers (*Colaptes auratus*), and Steller's jays (*Cyanocitta stelleri*) in the diet best explained variation in the reproductive output of goshawks. Patterns in the distribution, abundance, availability, and energetics of prey species suggests that Kaibab squirrel and to a lesser extent red squirrel and cottontail rabbit populations are among the most important determinants of annual goshawk productivity on the Kaibab Plateau in northern Arizona.

**PS2.96 Salgado-Ortiz, Javier**, (Facultad de Biología, Universidad Michoacana de San Nicolas de Hidalgo, Morelia, Mexico); Alvarez-Mena, Israel (Facultad de Biología, Morelia, Mexico); Ramirez-Alvarez, Ma. Teresa (Facultad de Biología, Ciudad Universitaria, Morelia, Mexico); Villaseñor-Gomez, J. Fernando (Facultad de Biología, Morelia, Mexico)

PREVALENCE AND ABUNDANCE OF BLOOD PARASITES AND ITS EFFECT ON BODY CONDITION OF INDIVIDUALS OF THE LOGGERHEAD SHRIKE (*LANIUS LUDOVICIANUS*) FROM CENTRAL MEXICO

The Loggerhead Shrike (*Lanius ludovicianus*), has shown sustained declines in abundance and range extent over the last few decades. Most authors agree that the main factor for diminution of this species is loss of habitat resulting from conversion to intensive agriculture. While populations in North America have been studied extensively, life history data are lacking for resident populations from Mexico where a number of distinct subspecies exist. In this study, we determined the prevalence and abundance of blood parasites and assessed its effect on the physical condition of individuals in relation to body mass and heterophil/lymphocyte (H:L) indices on individuals from a resident population of Central Mexico. Three types of parasites: Plasmodium, Leukocytozoon and Haemoproteus were found in a total of 49 blood samples, with a prevalence of 86%, 83% and 55% respectively. Plasmodium and Leukocytozoon were significantly more abundant than Haemoproteus. No difference in parasite abundance was found between sexes, however, between age classes Plasmodium was significantly more abundant in nestlings. There was a significant negative relation between the abundance of parasites and body mass of nestlings but not so in adults. No significant relationship was found between the abundance of blood parasites and H/L index. Our results indicate a high prevalence of blood parasites in our study population and that these might play an important role in survivorship rate during the nestling stage, however more detailed studies are needed to support this idea.

**PS2.13 Salinas-Melgoza, Alejandro**, (UNAM, Uruapan, Michoacan, Mexico); Wright, Timothy (New Mexico State University, Las Cruces, NM, United States)

BEHAVIORAL PLASTICITY IN A NEOTROPICAL PARROT

Behavioral plasticity is expected to be a fitness enhancing trait because it allows a rapid response to changes in the

environment. Many parrot species perform wide-ranging movements, which may lead individuals to face constant changes in resources and social companions. We evaluated plastic responses in the behavior of the yellow-naped amazon (*Amazona auropalliata*) when subjected to changes in the vocal and physical environment. Firstly, we simulated a change in the vocal environment resulting from cross-dialect dispersal by translocating parrots between two vocal dialects. One translocated juvenile altered its call type to resemble the new local dialect by week six, providing support for the vocal imitation hypothesis. However, five translocated adults did not demonstrate vocal imitation, and maintained a degree of social segregation from the new local population, providing evidence supporting the reduced dispersal hypothesis. Plasticity in both behavioral strategies, of vocal imitation and reduced dispersal, may explain the long-term maintenance of vocal dialects in the yellow-naped amazon. Secondly, we evaluated behavior of resident parrots in ranging, roosting, and habitat use at a ranching and a farming site with contrasting vegetation density. We then translocated individuals from the ranching to the farming site to evaluate plasticity of behavioral responses to potential changes in habitat during long-distance movements. Both resident and translocated individuals at the ranching site had significantly larger home ranges, and attended almost exclusively one roost site in large numbers. By comparison, individuals from the farming site ranged over smaller areas and used several roosting sites in smaller numbers. This agrees with the resource dispersion hypothesis for range size and the recruitment center hypothesis to maximize foraging efficiency when vegetation density imposes constraints in resources. Furthermore, translocated individuals modified their pattern of habitat use, ranging, and roosting behaviors to resemble that of resident individuals at the new site. These plastic responses to changes in the environment may be advantageous for species that perform wide ranging movements with a high likelihood of experiencing changes in social companions, call types, and habitat conditions

**T13.1 Sanchez, Cesar**, (Museum of Natural Science, LSU, Baton Rouge, United States);

ORIGIN AND PHYLOGEOGRAPHY OF THE ENDEMIC AVIFAUNA OF THE PACIFIC RAINFOREST OF COSTA RICA AND WESTERN PANAMA

Understanding the scenarios of historical and biogeographical origins of endemic lowland rainforest avifaunas requires the study of species-specific evolutionary patterns, geographical events, and dispersal/gene flow events. The codistributed endemic avifauna of the Pacific lowlands of southwestern Costa Rica and western Panama provides an invaluable opportunity to understand the origin and phylogeographic patterns across a complex geologic landscape. Geographical and ecological barriers define this area of endemism, which is isolated by dry forests and savannas to the north and south, and the Talamanca-Chiriquí Cordillera to the east. This phylogenetically diverse avifauna consists of 49 endemic taxa (16 species and 33 subspecies, representing 20 families). Here I use comparative phylogeographic techniques to examine the impact of ecological, geological and historical processes on the divergence of this endemic avifauna. Vouchered tissue samples were obtained from various institutions and my own field work across Costa Rica and western Panama. Preliminary analyses provide evidence on the vicariant role of the Talamanca-Chiriquí Cordillera uplift. Populations on either side of the Cordillera are genetically divergent, showing large variation since the time of isolation. Further research focuses on exploring patterns of divergence, migration and gene flow across the Talamanca-Chiriquí Cordillera, and from populations of Caribbean and

Central Panama. This ongoing work highlights the role of isolation in diversification, while it represents the first attempt to study the patterns of diversification of a lowland rainforest avifauna north of the Isthmus of Panama.

**F3.4 Sánchez-González, Luis Antonio**, (Iniciativa para la Conservación de las Aves de América del Norte (NABCI-México), Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, Mexico City, Mexico); Rodríguez-Contreras, Vicente; Berlanga, Humberto (CONABIO, Mexico City, Mexico)

#### STATE OF THE BIRDS OF MEXICO, A PRELIMINARY ASSESSMENT

Mexican bird diversity is currently ranked as 15th in the world (1068 recorded species), and the 5th in endemic species (around 100 species). These numbers represent a great responsibility for conservation, thus conservation efforts should be mainly focused on species, habitats and regions of highest priority. By using a published method developed by Partners in Flight (PIF), vulnerability was objectively assessed for all Mexican birds. Different scores of vulnerability are generated through consideration of demographic, distributional, and vulnerability factors. Results are classified and ranked for the establishment of a vulnerability score, which allows for focusing conservation and research efforts to those species with the highest scores. Scores obtained for each species were integrated in a database, which was analyzed for the establishment of the state of the birds of Mexico, which will be the seminal document for a national strategy for bird conservation. The PIF method has already been applied for a state of the birds for Canada, USA and adjacent regions in Mexico; however, only landbirds were analyzed. A similar effort for all Mexican birds has been hitherto prevented. We here analyzed a database of Mexican birds assessed with the PIF method. Results include scores for different parameters, for example, vulnerability due to effective population size (PS) showed that 18% of the Mexican avifauna has experienced a 50% decrease, these number groups 19% of the landbirds and 14% of the waterbirds. Application of this method may ensure an adequate prioritisation for conservation efforts.

**PS1.172 Sanders, Claire E.**, (University of Windsor, Windsor, Canada); Mennill, Daniel J. (University of Windsor, Windsor, ON, Canada)

#### ACOUSTIC MONITORING OF NOCTURNAL MIGRANTS OVER THE WESTERN BASIN OF LAKE ERIE

Migratory birds have the capability of making non-stop flights of thousands of kilometers. Given that many bird species migrate at night, monitoring their movements poses many challenges. In this study we used recordings of the species-specific night flight calls of migrating songbirds to study seasonal migration patterns through the western basin of Lake Erie. By recording and analyzing night flight calls and comparing them with traditional migration monitoring methods (mist-netting data and census surveys), we show that night flight call recordings are an effective tool for population monitoring on the Great Lakes. We recorded thousands of hours of nocturnal recordings at four different sites during the fall 2011 migration and our analysis reveal seasonal and geographic differences in migration patterns between mainland and island sites. We discuss this migration monitoring technology and the ways that night flight call monitoring can provide ornithologists with information on migration corridors, population trends, and the seasonality of bird behaviour.

**SAT13.3 Sandoval, Luis**, (University of Windsor, Windsor, Canada); Mennill, Daniel (University of Windsor, Windsor, ON, Canada)

#### DO ALL VOCAL SIGNALS ENCODE THE SAME AMOUNT OF INFORMATION FOR SPECIES RECOGNITION? A CASE STUDY USING WHITE-EARED GROUND-SPARROWS

Efficient communication between animals needs specificity to ensure that animals do not attend to signals that are not beneficial to their own interests. Research on species recognition in avian acoustic signals has focused almost exclusively on signals produced by breeding males (i.e. songs), in spite of the fact that many animals produce other types of signals (e.g. calls) and that in tropical animals females also produce elaborate vocalizations, often in coordinated acoustic duets. These other types of signals can also include species-specific elements and they may inform our understanding of the evolution of species-specificity in animal signals and the importance of species recognition as an evolutionary process. Therefore, it is worthwhile to conduct comparative studies that include several types of acoustic signals, rather than focusing on just one type of signal. In this study we used acoustic playback experiments to evaluate whether White-eared Ground-sparrows (*Melospiza leucotis*) use calls, male solo songs, and duets to discriminate between conspecific versus heterospecific ground-sparrow species. We also evaluate whether prior experience influences species recognition by comparing playback responses among populations of White-eared Ground-sparrow that are allopatric and sympatric with a congeneric species. Our results show that White-eared Ground-sparrows displayed a stronger response to solo and duet songs of their own species as well as duets of a congeneric species, than to other types of vocalizations and other species. These results suggest that White-eared Ground Sparrows used the information encoded in each vocalization to recognize the identity of the species that produced each vocalization. We observed similar response patterns in allopatric and sympatric populations of White-eared Ground-sparrows. Consequently the observed responses were not related to previous experience, suggesting that the species recognition is not a learned process and may have a genetic basis. Taken together, our results shed new light on how birds can use different types of vocalizations to recognize species-specific signals.

**PS1.28 Sanin, Camilo\***, (Columbia University, New York, United States); Jiménez, Iván (Missouri Botanical Garden, St. Louis, MO, United States); Fjeldså, Jon; Rahbek, Carsten (University of Copenhagen, Copenhagen Ø, Denmark); Cadena, C Daniel (Universidad de los Andes, Bogotá, Columbia)

#### HOW MUCH SPATIAL VARIANCE IN SPECIES RICHNESS OF SUBOSCINES IN SOUTH AMERICA CAN BE ACCOUNTED FOR BY DIVERSIFICATION RATES?

The diversification rate hypothesis (DRH) proposes that spatial patterns of species richness result from variation in diversification rate. We combined a time-calibrated phylogeny with distributional data of suboscine bird species across South America to estimate how much spatial variance in current richness, measured using various grain sizes, is explainable by variance in diversification rate over different time periods. The explanatory power of the DRH increased with the duration of the time period considered and with grain size. Diversification over the last 40 Ma accounted for 20% and 50% of the spatial variance in richness measured at  $1^\circ \times 1^\circ$  and  $10^\circ \times 10^\circ$  cells, respectively; over the last 15 Ma, corresponding values were 10% and 25%. Our results imply that some prevalent ideas about

historical events that may have had strong imprints on spatial patterns of species richness in the Neotropics may need reevaluation. For example, we found that diversification over the past 20 million years (i.e. a period of time over which the Andes uplifted, the Amazon River system was established, and Pleistocene glaciations and related habitat shifts occurred) can only account for a small fraction of the spatial variance in species richness. Also, we found that considerable fractions of spatial variance in species richness can be accounted for at relatively large spatial scales (i.e. grain size of 10x10 degrees), but not at scales often studied by macroecologists (i.e. 1x1-degree quadrats), who often attribute unexplained variance in species richness at this scale to evolutionary processes not explicitly considered. Taking our results as a whole, a major insight emerging from our study is that ignoring primarily historical processes in macroecological studies or ascribing them a role solely in explaining residuals left by models could lead to flawed conclusions about the relative contribution of various factors to determining geographical patterns of richness.

**SAT3.4 Sarah, Trefry,\*** (University of New Brunswick, Fredericton, Canada); **Diamond, Antony** (University of New Brunswick, Fredericton, NB, Canada)

#### WING MARKER WOES: A CASE STUDY AND META-ANALYSIS OF THE IMPACTS OF WING AND PATAGIAL TAGS

The marking of individual birds has a long history in ornithology. This cheap and simple practice has been used to shed light on migration, behaviour, and age-specific survival and recruitment. However, problems associated with markers and tags have often been overlooked. Wing tags have been used for over 40 years on frigatebirds, but their effects on this family of highly aerial seabirds have not been examined. Following higher than expected nest failure of treatment birds in the previous breeding season, we designed a study to test the impact of wing tagging and other standard capture and sampling methods on the nest success of Magnificent Frigatebirds (*Fregata magnificens*). Twelve nests were assigned to each of various band, measure, bleed, wing-tag, and control treatments in the 2010/2011 breeding season on Barbuda, West Indies. We modeled nest fates using Generalized Linear Models. Wing tags had a substantial negative effect on pre-fledging nest success, which was 42% (10/24) for control nests, 39% (14/36) for all non wing-tagged treatments, and 15% (7/48) for wing-tagged treatments. We also used meta-analysis to explore the general impact of wing and patagial tags. Our model on survival and reproductive parameters showed a significant negative effect of wing tags, while one encompassing behavioural, reproductive, and condition parameters showed no effect. We consider possible mechanisms by which wing tags might contribute to lower nest success in frigatebirds, and propose that the use of wing tags be carefully evaluated before being applied to any species.

**FR.3 Saranathan, Vinodkumar,** (EGI, Department of Zoology, University of Oxford, Oxford, United Kingdom); **Greving, Imke** (Department of Zoology, University of Oxford, Oxford, United Kingdom); **Sheldon, Ben** (EGI, Department of Zoology, University of Oxford, Oxford, United Kingdom)

#### SIGNAL CONTENT OF STRUCTURAL COLOURS: A SYNCHROTRON NANOSTRUCTURAL STUDY OF UV-REFLECTIVE BLUE TIT PLUMAGE

Isotropic or non-iridescent avian structural colours like the ultraviolet (UV) reflective crown of blue tits (*Parus caeruleus*,

*Paridae*) form a conspicuous aspect of the appearance of many birds and are frequently used in social and sexual signalling. Previous research on such non-iridescent feather barb structural colours of 230 species from 52 avian families suggests that they are produced by self-assembled, three-dimensional, quasi-ordered or amorphous biophotonic nanostructures made up of spongy matrices of  $\beta$ -keratin and air. Unlike diet-acquired pigmentary colours, the precise signal content (function) and evolution of structurally coloured plumage remains difficult to understand, perhaps because contemporary bird behaviour studies rarely consider the mechanistic basis of structural colour variation within a bird population, namely the fine-scale properties of barb nanostructures that produce visible structural colours. We address mechanistically how the tight interplay between structural colours and the underlying nanostructure affects social structure and reproductive fitness of individuals in two well-studied Oxfordshire populations of blue tits, by combining field-based behavioural and ecological data with synchrotron Small Angle X-ray Scattering (SAXS) nanostructural measurements at Argonne National Labs (Chicago, IL) and Diamond Light Source (Didcot, UK) and (micro-)spectrophotometric colour measurements of their UV crown feathers. We also present precise SAXS data on the comparative development of the spongy medullary biophotonic nanostructure in nestling and adult blue tits individuals from assays of growing feather germs. We present SAXS as an ideal tool to assay bulk structural properties of complex biomaterials, providing a precise, and high-resolution structural measurements of the scattering nanostructure on a cell-by-cell basis with essentially no sample preparation, allowing for a high throughput hitherto inconceivable. Understanding these biophotonic nanostructures will not only inform biology, but could bio-mimetically inspire novel photonic devices.

**W15.8 Sari, Eloisa, \*** (University of Missouri - St. Louis, Saint Louis, United States); **Parker, Patricia** (University of Missouri - St. Louis, Saint Louis, MO, United States)

#### MOLECULAR AND MORPHOLOGICAL VARIATION IN THE GALÁPAGOS FLYCATCHER (*MYIARCHUS MAGNIROSTRIS*)

*Myiarchus magnirostris* (Galápagos flycatcher; Passeriformes: Tyrannidae) is an endemic species that inhabits most of the Galápagos Islands, Ecuador, and is among the least studied Galápagos terrestrial birds. Here, to better understand the evolution of *M. magnirostris* we used seven microsatellites and morphological measurements to compare birds we captured on seven of the Galápagos Islands. The comparison between the molecular and the morphological variation across islands is important for our understanding of the interaction among different evolutionary processes underlying the speciation of *M. magnirostris*, like local adaptation, drift, and migration. Genetic diversity of *M. magnirostris* ( $n = 137$ ) within islands was strongly correlated with island size, supporting our hypothesis that drift is important in the distribution of the genetic diversity of *M. magnirostris*. We detected significant population genetic structure ( $F_{st} = 0.0945$ ;  $p = 0.000$ ), but the correlation between genetic and geographic distances was not significant, showing that physical distances among islands are not driving their differentiation. Our samples were grouped into four Bayesian genetic clusters representing birds from: (1) Española island, (2) San Cristóbal island, (3) Floreana and Santa Cruz islands, and (4) Santiago, Santa Fé, and Isabela islands. We used t-tests, ANOVAs, and PCAs to analyze the morphological data ( $n=213$ ), and we identified significant differences between males and females and also across islands. In general, morphological distances across islands were not correlated with pairwise

genetic distances. Morphological differences were observed in Santa Fé even in the presence of gene flow, possibly due to local adaptation. In contrast, Española and San Cristóbal were both morphologically and genetically distinct from the other islands; lower migration rates together with drift could be contributing to the differentiation of these two island populations, but local adaptation cannot be excluded as a contributing evolutionary force.

**W11.2 Saucier, Jacob**, (University of Wyoming, Laramie, United States);

#### COMBINING POPULATION AND LANDSCAPE GENETIC APPROACHES TO TEST DIVERGENCE HYPOTHESES IN THE THRYOTHORUS MODESTUS COMPLEX

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Abstract- Investigating the evolutionary processes that underlie genetic and morphological changes across the landscape is critical to understanding the mechanisms of biodiversity generation. The dynamic geophysical history of Central America makes it well-suited for pursuing such phylogeographic questions. We focused on the Plain Wren (*Thryothorus modestus*), a ubiquitous lowland tropical species found in scrub and young second growth throughout Central America. Plain Wrens, of which there are three recognized subspecies, display substantial morphological and behavioral variation across their range, which stretches from Panama to southern Mexico. The most widespread of the subspecies is the nominal *T. m. modestus*; the other taxa, *T. m. zeledoni* and *T. m. elutus*, occupy similar habitats in the southern part of the species range. Using voucher tissue samples from various institutions along with samples from our fieldwork across Costa Rica, we investigated how landscape features shape the organization of genotypic and phenotypic diversity in this species. Preliminary findings indicate substantial levels of morphological and genetic variation within *T. modestus*. Ongoing work is focused on exploring the relationship between these patterns and patterns of environmental variation across our sampling area. These findings will lead to insights into how the current and historical geography of a region can influence the evolution and maintenance of diversity in a sedentary tropical bird species.

**S1.1 Sauer, John**, (USGS Patuxent Wildlife Research Center, Laurel, United States); Link, William; Pardieck, Keith (USGS Patuxent Wildlife Research Center, Laurel, MD, United States); Ziolkowski, David (USGS Patuxent Wildlife Research Center, Laurel, MD, United States); Fallon, Jane (USGS Patuxent Wildlife Research Center, Laurel, MD, United States)

#### ACCOMMODATING GEOGRAPHIC SCALE IN ANALYSIS OF SPECIES GROUPS FROM THE NORTH AMERICAN BREEDING BIRD SURVEY

The North American Breeding Bird Survey (BBS) is the only source of population change information for most species of birds that breed in North America. Goals for use of BBS information have evolved significantly from initial interests in description of trends in bird populations. As the only data set with sufficient information to develop dynamic models of

influence of climate, land use, and other global changes on bird populations, increasing emphasis is placed on using the data to discriminate between hypotheses of factors influencing bird populations. Analyses focus on integration of BBS data with a variety of other data to enhance inference and include environmental features that influence population change. Model-based, hierarchical analyses are needed to accommodate issues of scale and to control for factors that influence counting of birds. Summarizing patterns of population change for species groups is a computationally intensive and time-consuming task, but permits evaluation of bird population dynamics at multiple scales. We use cluster analysis of regional species occurrence data within Bird Conservation Regions to define regions of consistent species groups and use these regions as the basis of hierarchical structuring of species groups analysis. We apply this analysis to document regional variation on composite population change for grassland birds, forest birds, and other species groupings. Obligate grassland birds form 4 clusters with regional variation in patterns of composite population change.

**PS2.22 Saunders, Sarah**, (University of Minnesota, Saint Paul, United States); Roche, Erin (University of Tulsa, Tulsa, OK, United States); Cuthbert, Francesca (University of Minnesota, Saint Paul, MN, United States)

#### INNATE ANTI-PREDATOR BEHAVIOR IN CAPTIVE-REARED GREAT LAKES PIPING PLOVERS

Captive rearing endangered species for re-introduction is considered useful for supplementing critically small populations because it can potentially increase the rate of recruitment through bypassing the early, high-risk stages in an individual's life history. One strategy to increase the small Great Lakes Piping Plover population is captive rearing young from abandoned eggs. However, released individuals have lower survival and fitness rates than wild-reared chicks. We evaluated why captive-reared chicks have lower survival rates by testing the hypothesis that released individuals have a diminished response to predators. Vocalizations of predators and non-predators were combined with parental alarm calls, as well as silhouettes of predators, to test for vigilant responses in captive-reared chicks (n=16) prior to release. We controlled for individual variation with random effects and tested for increases in percent time spent on vigilant behaviors associated with treatment using linear mixed models and Tukey's test. Chicks were most likely to exhibit the greatest increase in vigilance when the treatment was combined with the parental alarm, regardless of whether it was paired with threatening or non-threatening stimuli (all  $p < 0.01$ ). There was a 21% ( $\pm 6.5\%$ ) increase in vigilance, on average, during non-predator treatments compared to silence, while there was an average increase of 78% ( $\pm 6.1\%$ ) in vigilance during predator treatments compared to silence. This indicates that chicks innately recognize non-predator vocalizations as non-threatening. Vigilance increased by an average of 57% ( $\pm 3.6\%$ ) during predator treatments compared to non-predator treatments, but individuals did not differentiate between specific predators or non-predators. Our results provide strong evidence that captive-reared chicks possess an innate response to avian predators. This suggests that other captivity-induced behavioral or morphological differences are more likely responsible for decreased post-release survival in Piping Plovers.

**PS2.62 Savoca, Matthew**, (University of California, Davis, Davis, Canada);

#### EVIDENCE FOR A MARINE TRI-TROPHIC INTERACTION: EXAMINING 50+ YEARS OF DIET DATA IN A SOUTHERN OCEAN SEABIRD ASSEMBLAGE.



Dimethyl sulfide (DMS) is a plant-derived, volatile chemical abundant in the world's oceans that has importance in global climate regulation and interspecific biological interactions. Using sensory and diet data collected on 18 species of Antarctic and sub-Antarctic procellariiform seabirds over the course of 50 years, I conducted a meta-analysis to test for the potential of a tri-trophic interaction with DMS as the mediating infochemical. It has been widely postulated that some procellariiform species use DMS released by depredated phytoplankton as a cue to find hotspots of their crustacean prey; however, this theory has never been tested in a rigorous manner via diet data analysis. I hypothesized that if DMS is an infochemical utilized by some procellariiform species in a foraging context, then the diets of DMS-tracking species would contain significantly higher proportions of crustacea (euphausiids, copepods, decapods, etc.) than those of non DMS-tracking species. Indeed, I found that the diets of DMS-tracking species contain significantly higher proportions of crustacea. Additionally, I also found that smaller, more maneuverable species had more crustacea in their diets than did larger, less agile species. The maneuverability of smaller DMS-tracking species enables them to follow discrete odor patches to their source and to exploit foraging sites before being outcompeted by larger, more aggressive species. I will also discuss potential benefits of DMS production to phytoplankton: aside from reducing predation through a tri-trophic interaction, it may encourage reverse nutrient cycling – the fertilization of the surface layer of the ocean by seabird excrement from dense feeding flocks.

**PS2.119 Sawara, Yuji**, (Hirosaki University, Hirosaki, Japan); Takaya, Satoru (Iwate University, Hirosaki, Japan)

#### SIZE-SELECTIVE FEEDING OF THE GREAT CRESTED GREBE IN JAPAN

The Great Crested Grebe, *Podiceps cristatus*, had formerly been an uncommon winter bird in Japan, but its breeding was first reported in 1972 in northern Honshu, the main island in Japan, and is now increasing both in wintering and breeding populations. This contrasts with another species of grebe, the Little Grebe, *Tachybaptus ruficollis*, which is recently declining in number. The declining of the Little Grebe is partly attributed to a decrease in number of small indigenous freshwater fishes in predation by an exotic fish, the Largemouth Bass, *Micropterus salmoides*. We studied the feeding ecology of the Great Crested Grebes breeding in an irrigation pond during the chick-raising period. The grebes nearly exclusively exploited Stone Morokos *Pseudorasbora parva* and Crucian carp *Carassius* spp. The consumable prey size was restricted for the youngest chicks, and the body depth of the fish was a restricting factor for consumption. Fusiform Stone Morokos make an important part of the diet for the youngest chicks, whereas Crucian carp become a more important food item at a later stage. Thus, our findings indicate that at an early stage of a brood, an important prey may be small fish with a low body depth, whereas larger fish with greater weight may become an important prey at a later stage. These results showed a strong dependence on small fish at an early stage after hatching, suggesting that the future of the Great Crested Grebe in Japan is not so hopeful.

**PS2.172 Scarpignato, Amy**, (Smithsonian Migratory Bird Center, Washington, DC, United States); Marra, Peter (Smithsonian Migratory Bird Center, Washington, DC, United States); Haig, Susan (USGS Forest and Rangeland Ecosystem Science Center, Corvallis, United States); Cohen, Emily (Smithsonian Migratory Bird Center, Washington, DC, United States); Lutmerding, Jo Anna; Bystrak, Danny; Peterjohn, Bruce

(Bird Banding Laboratory Patuxent Wildlife Research Center, Laurel, United States)

#### MINING A HIDDEN TREASURE: USING ENCOUNTER DATA FROM THE USGS BIRD BANDING LABORATORY TO DESCRIBE MIGRATORY CONNECTIVITY OF THE BIRDS OF NORTH AMERICA

Migratory birds travel annually between breeding and non-breeding localities. The degree to which breeding and non-breeding populations are linked is defined as migratory connectivity. Because events within periods of the annual cycle are often inextricably linked, understanding migratory connectivity has important implications for the population dynamics and conservation of species. Unfortunately, our understanding of migratory connectivity for most species is rudimentary. The USGS Bird Banding Laboratory (BBL) database represents an untapped resource of data for estimating migratory connectivity for many species of birds. More than 63,000,000 birds have been banded and 4,500,000 have been encountered and reported to the BBL. The data within the BBL have occasionally been used for independent research projects but there has never been a comprehensive analysis of the encounter database to study the movement of birds from their banding locations. To quantify migratory connectivity, we are analyzing the BBL encounter data of all species banded from 1914 to present to produce an atlas of the migratory connectivity for the birds of North America. Here, we present several examples from the atlas that illustrate the problems and complexities of this effort but also highlight the enormous value of the BBL encounter data. These maps, especially when combined with other sources of information on large-scale spatial movements, will provide the best assessments of migratory connectivity available for any species.

**F12.2 Schmidt, Annie**, (University of California, Davis, Davis, United States); Botsford, Louis W.; Eadie, John M. (University of California, Davis, Davis, CA, United States); Bradley, Russell W.; Jahncke, Jaime (PRBO Conservation Science, Petaluma, CA, United States)

#### BREAKING UP LONG-TERM RELATIONSHIPS: HOW THE NORTH PACIFIC GYRE OSCILLATION MAY BE OVERTAKING EL NIÑO AS THE DOMINANT DRIVER OF SEABIRD PRODUCTIVITY IN CENTRAL CALIFORNIA

In the central California Current, annual productivity is primarily determined by the wind-driven upwelling of nutrients. In this bottom-up system, we expect parallel trends in productivity across trophic levels. For this study, we utilized 41 years of data from the Farallon Islands to examine recent contrasting trends in productivity between two seabird species at different trophic levels: the piscivorous Brandt's Cormorant (*Phalacrocorax penicillatus*), and Cassin's Auklet (*Ptychoramphus aleuticus*), a zooplanktivore. We often assume that a species' relationship to the environment is stable through time. Here, we test the hypothesis that contrasting productivity trends for these two species are linked to changes in how each species responds to the environment. We used a sliding correlation analysis with a 10-year window to examine how ocean conditions (measured locally and basin-wide) influence productivity of each seabird species and how these relationships change over time. We found that both species initially responded strongly to El Niño variability. In the last 15 years, Cassin's Auklet response to El Niño weakened while at the same time, the correlation to the North Pacific Gyre Oscillation (NPGO) increased. This occurred at about the same time that productivity of the two species began to diverge. Understanding what causes the physical drivers of productivity to change will be critical for

population modeling and predicting the consequences of climate change.

**F2.5 Schmutz, Joel**, (USGS Alaska Science Center, Anchorage, United States); Ramey, Andrew (USGS Alaska Science Center, Anchorage, AK, United States); Ely, Craig; McCloskey, Sarah (USGS Alaska Science Center, Anchorage, United States); Hall, Jeffrey (USGS National Wildlife Health Center, Madison, WI, United States); Lemons, Patrick (US Fish and Wildlife Service, Anchorage, AK, United States); Reed, John (USGS Alaska Science Center, Anchorage, AK, United States)

#### DISEASE AS A DEMOGRAPHIC CONSTRAINT ON A BERING SEA ENDEMIC: THE EMPEROR GOOSE

The abundance of Emperor Geese (*Chen canagica*) has remained depressed below population management goals for decades. The roles of harvest, a winter environment devoid of agricultural foods, and a summer environment competing with other geese have been debated as influential factors, but none has provided a sufficient explanation for this demographic pattern. A new factor has emerged – exposure to disease and a possibly related physiological toll. Virtually the entire species population is exposed to Avian Influenza Virus (AIV), as > 90% of Emperor Geese sampled in 2009-2010 harbored antibodies to AIV. Sympatrically nesting cackling geese (*Branta hutchinsii*), brant geese (*B. bernicla*), and white-fronted geese (*Anser albifrons*) had much lower frequencies of antibodies to AIV. Similarly, in 2011 summering Emperor Geese had more than twice the infection rate of blood parasites (*Leucocytozoon* sp.) than the other 3 goose species (22% vs. 0, 8, and 10%, respectively). This infection rate in Emperor Geese appears much higher than that observed at this same study site in 1996 (60% of nests) than sympatric geese, a behavior believed to arise from a compromised physiological state. These collective data suggest that disease and physiological status are constraining the species population. Their unique non-breeding distribution, in the Bering Sea and east Asian habitats, may play a significant role in their vulnerability to health risks.

**F7.5 Schoech, Stephan**, (University of Memphis, Memphis, Tennessee, United States); Bebus, Sara; Small, Tom (University of Memphis, Memphis, TN, United States)

#### CORTICOSTERONE AND BEHAVIORAL PHENOTYPE IN FLORIDA SCRUB-JAYS: LINKS AMONG STRESS, PERSONALITY, AND LIFE SPAN

Recently, numerous studies have revealed links between endocrine and behavioral phenotypes. In our long-term study of free-living Florida scrub-jays (*Aphelocoma coerulescens*), we have examined the relationship between corticosterone (CORT) and ‘personality’. Our finding that baseline CORT levels of nestlings were positively correlated with fearfulness eight months later (see Schoech et al. 2009, *GCE* 163:201-207), inspired follow-up studies. These studies have yielded intriguing findings, such as tame individuals in our population have significantly lower baseline CORT levels than less tame individuals (approach distance of researchers). Further, adults with higher stress-induced CORT levels (integrated CORT) were far less likely to approach and learn to use a feeder than were individuals with lesser CORT responses. Similarly, in neophobia tests in which jays must approach a novel object or cross a ring to access peanuts (a favorite food item), more stress responsive individuals (i.e., higher integrated CORT levels) were less likely to complete both tasks. The physiological phenotype seems to be fixed within individuals as we have found positive relationships between baseline and integrated CORT levels and the magnitude of the CORT response to a

stressor is repeatable throughout an individual’s life. Finally, the degree of stress responsiveness is predictive of life span as high stress jays tend to not live as long as less responsive individuals. Ongoing and future research will manipulate nestling CORT levels to determine whether developmental CORT ‘programs’ future behavioral and physiological phenotypes.

**W12.10 Schulwitz, Sarah**, (University of North Texas, Denton, United States); Bedrosian, Bryan (Craighead Beringia South, Kelly, WY, United States); Johnson, Jeff (Department of Biological Sciences, Institute of Applied Sciences, University of North Texas, Denton, TX, United States)

#### ISOLATED POPULATION OF GREATER SAGE-GROUSE IN NORTHWEST WYOMING REVEALED BY MICROSATELLITE DATA

Greater Sage-Grouse (*Centrocercus urophasianus*) have received widespread attention among conservation and wildlife management communities due to declining population size and increasing isolation throughout much of their range. The historic distribution of this species was throughout western North America, but human mediated activities such as agriculture, overgrazing by elk and bison, oil/natural gas drilling, and invasive plants have severely altered the sagebrush-steppe landscape, consequently reducing suitable habitat for Sage-Grouse. The species now occupies approximately one-half of its historic distribution and populations have become highly fragmented. Recent genetic-based studies have identified multiple isolated populations with reduced genetic diversity. These studies, however, excluded a population within Teton National Park, located north of Jackson, Wyoming, which is surrounded by potential natural dispersal barriers as well as recent anthropogenic habitat fragmentation. Using 16 microsatellite loci, we analyzed 300 Greater Sage-Grouse samples collected from five subpopulations in Wyoming and Montana: north of Jackson (Teton), northeast of Jackson (Gros Ventre), west-central WY (Pinedale), east WY (Powder River Basin), and southeast MT (Big Horn Basin). We found that significant population differentiation existed among Greater Sage-Grouse populations with data suggesting that the Jackson population is isolated relative to the other sampled populations, particularly Pinedale, its closest neighboring large population. Further study will discern the timing of divergence of the Jackson population relative to other surrounding Greater Sage-Grouse populations within Wyoming. These results will be necessary for making informed decisions for future management of the Jackson Greater Sage-Grouse population.

**SAT13.4 Schwarz, Birgit**, (Simon Fraser University, Burnaby, Canada); Jong, Ian; Lank, David (Simon Fraser University, Burnaby, BC, Canada)

#### DOES SONG FUNCTION IN TERRITORIAL DEFENSE IN THE WESTERN SANDPIPER? AN EXPERIMENTAL APPROACH.

Many shorebird species emit complex vocalizations during the breeding season which have been termed ‘songs’. Unlike songbird songs, these shorebird songs have been little studied. Even their communicative functions remain largely unresolved – their role in territorial defense in particular has been a matter of dispute in some species, including the Western Sandpiper (*Calidris mauri*). A study by Lanctot et al. (2000; *Waterbirds* 23 (2):155-164) suggested that song functions primarily in mate attraction in this species. In our study we combine behavioural observations with an experimental approach to revisit the role of song in territorial defense in Western Sandpipers. In this species, successful breeders do not re-nest within the same breeding

season and extrapair paternity rates are low. If song functions solely or primarily in mate attraction, males should therefore have little cause to sing while attending an intact nest or brood. If song plays a role in territory defense, however, males should continue to show song activity during incubation and brood-rearing periods. In addition, males would be expected to sing in response to song playbacks and remain responsive throughout the breeding season. We observed and recorded males during different stages of the reproductive cycle (pre-laying, incubation and brood-care) and conducted playback experiments prior to laying and during incubation. Three different songs were played back during each trial and songbird songs served as controls. Responses were recorded with a parabolic microphone and a video camera. Males sang during all three reproductive stages. In addition, females sang during incubation and brood-care periods. Playbacks of Western Sandpiper song elicited a song response in all but one male, whereas controls did not. Males tended to respond quickly, with an average latency of 6.3s (pre-laying) and 4.4s (incubating) and overlapped playback songs in 66.7% of trials. During the pre-laying period, song responses generally were accompanied by direct approaches and/or agonistic signals (such as upright postures and wing-up displays), however, these were less frequent during incubation. These observations suggest that song in Western Sandpipers plays a role in territory defense.

**T17.5 Scobie, Corey**, (University of Alberta, Edmonton, Canada); Bayne, Erin; Wellicome, Troy (University of Alberta, Edmonton, AB, Canada)

#### INFLUENCE OF SOUND ON BURROWING OWL NOCTURNAL SPACE-USE

A large portion of the Canadian grasslands have been developed for petroleum extraction, raising concerns about impacts to species at risk, such as the Burrowing Owl. Petroleum development changes landscape patterns with the construction of infrastructure and introduces sensory disturbances such as sound. Sound has the potential to have a large impact on wildlife in grasslands because there are fewer vegetative and topographic barriers to sound propagation and its influence can extend significantly beyond the source, potentially impacting a large area and wildlife contained therein. Birds such as the Burrowing Owl are especially susceptible to effects from sound as they rely heavily on auditory detection of prey and may travel far from the nest when hunting at night. Avoidance of areas with high sound pressure levels may increase overall home-range size and thus influence prey delivery and associated fledging rate. We tracked 31 adult male burrowing owls with miniature GPS dataloggers, in Alberta and Saskatchewan. All home ranges included at least one sound producing structure (compressor station, oil battery or oil well), a variety of land cover types and varying amounts of petroleum development and maintenance. Sound was measured from sound-producing structures within owl home ranges and anthropogenic features (roads, gas and oil wells, buildings, etc.) and land cover types were classified and recorded around all nests. A resource selection function was used to evaluate owl selection of land cover, roads, petroleum infrastructure and sound pressure levels at one third octave bands. We show whether adult male burrowing owls are influenced by petroleum infrastructure and sound while travelling at night.

**PS2.30 Scott, Alec**, (Carleton College, Kensington, United States); Butchart, Stuart H M (BirdLife International, Cambridge, United Kingdom); Croll, Donald A (University of California Santa Cruz, Santa Cruz, CA, United States); Hernández, Daniel L (Carleton College, Northfield, MN, United

States); Holmes, Nick (Island Conservation, Santa Cruz, CA, United States); McCreless, Erin; Newton, Kelly; Spatz, Dena; Tershy, Bernie R (University of California Santa Cruz, Santa Cruz, CA, United States)

#### BREEDING DISTRIBUTION AND BIOGEOGRAPHY OF ENDANGERED AND EXTINCT LANDBIRDS IN THE SOUTHWEST PACIFIC

A significant proportion of landbird species worldwide are in decline, have been extirpated from large parts of their historical breeding range, or have gone extinct completely. The Southwest Pacific is a globally important center of biodiversity and endemism for landbirds, and is thus of high conservation concern. Accurate and detailed knowledge of threatened landbird distribution is critical for directing effective conservation at a scale commensurate with action. Using existing literature and expert interviews, we developed a database of current and historical breeding distribution of insular landbirds in the Southwest Pacific that have been classified by the IUCN as Endangered (EN), Critically Endangered (CR), Extinct (EX), and Extinct in the Wild (EW). For the 88 CR and EN landbird species occurring in this region, we identified 419 distinct breeding islands, and for the 68 EX and EW species, we identified 118 historic breeding islands. The vast majority of CR and EN landbird populations were on islands under the jurisdiction of New Zealand (32 percent), French Polynesia (20 percent), the United States (12 percent), and the Mariana Islands (9 percent). We examine the effect of island area, elevation, isolation, and ecosystem type on landbird endangerment and extinction. Based on our analysis of landbird distribution, we propose areas of special concern for landbird conservation in the Southwest Pacific.

**T9.2 Sean, McCann**, (Simon Fraser University, Burnaby, Canada); Jones, Tanya (Simon Fraser University, Burnaby, BC, Canada); Moeri, Onour (Simon Fraser University, Vancouver, BC, Canada); O'Donnell, Sean (Drexel University, Philadelphia, United States); Gries, Gerhard (Simon Fraser University, Burnaby, BC, Canada)

#### DO RED-THROATED CARACARAS HAVE A CHEMICAL WASP REPELLENT?

Red-throated Caracaras (*Ibycter americanus*) are unusual and charismatic Neotropical raptors with highly developed social behaviour and cooperative breeding. They also have an unusual diet, largely feeding on the brood of social wasps. It has been hypothesised that these birds possess a powerful chemical repellent that protects them while attacking wasp nests.

We investigated this hypothesis over four seasons of study at the Nouragues station in Central French Guiana. Using nest cameras, we obtained the first quantitative data of nest provisioning, which indicate a high reliance on wasp prey. Chemical analyses of samples taken from captured birds revealed several potential repellent compounds; however, bioassay of these against sympatric social wasps failed to demonstrate marked repellence. Using a modified camera trapping technique, we video recorded the behaviour of caracaras while attacking social wasp nests and discovered that several strategies employed by these birds obviate the necessity for a chemical repellent.

**T8.4 Seavy, Nathaniel**, (PRBO Conservation Science, Petaluma, United States); McCune, Kelli (Sustainable Conservation, San Francisco, United States); Merrill, Amy (Stillwater Science, Berkeley, United States); Keever, Megan (Stillwater Science, Berkeley, CA, United States); Guisse, Jessa

(Xerces Society for Invertebrate Conservation, Portland, OR, United States)

#### INCORPORATING BIRDS INTO A MARKET FOR ECOSYSTEM SERVICES: A CASE STUDY FROM CENTRAL CALIFORNIA

While there is growing evidence that birds and other wildlife provide ecosystem services, there have still been relatively few efforts to develop a market that can incentivize actions to support and improve these services. In California, we are working to develop a tool that will quantify the ecosystem services provided by riparian areas and enhanced by riparian restoration. This tool has modules that incorporate management effects on stream water temperature, native pollinator habitat, and riparian bird habitat into an overall ecosystem services score. Each module is built on the best available science. For birds, the module draws upon more than a decade's worth of research that has focused on developing multi-scale habitat models and validating these models by measuring the response of birds to riparian restoration. Using this information, we have developed simple metrics that can be used to evaluate a site (typically 10 to 100 ha) with respect to the opportunity (landscape context), value, and site capacity for providing habitat for riparian birds. With data from a simple landscape analysis and a single field visit, users of the tool can generate a score for the current condition of the site and then compare this to the potential condition of the site after investment in restoration or enhancement. This effort demonstrates the potential for incorporating management effects on bird habitat into ecosystem services quantification tools. Specifically, the large amount of high quality information already available on the bird species habitat associations make them good candidates for these types of efforts.

**T1.2 Seeholzer, Glenn**, (Museum of Natural Science and Department of Biological Sciences, Baton Rouge, United States); **Brumfield, Robb** (Museum of Natural Science and Department of Biological Sciences, Baton Rouge, LA, United States)

#### EXTREME GEOGRAPHIC VARIATION IN BODY SIZE AS A MECHANISM OF LOCAL ADAPTATION: BERGMANN'S RULE IN THE HIGH ANDES

Environmental gradients are powerful natural laboratories to study the effects of climatic and ecological variation on genetic and phenotypic variation. One of the most prominent examples of local adaptation in birds is Bergmann's Rule, which states that across thermal gradients, endotherm body size will be positively correlated with temperature. To date, however, no avian study has evaluated the phylogeographic history of species exhibiting the pattern. The Line-cheeked Spinetail (*Cranioleuca antisiensis*, Furnariidae) shows pronounced geographic variation in body size over a latitudinal span of ~1,000 km. Its elevational distribution (950m - 4300 m) spans an extreme ecological and thermal gradient, along which its body mass increases clinally more than twofold (12.5 - 30.0g). To examine this extreme variation in greater detail, we collected 160 individuals from eighteen localities spanning the geographic range and ecological breadth of *C. antisiensis*. We examined correlations between multivariate metrics of body size and a suite of high-resolution biotic and abiotic variables. The environmental variables that were most highly correlated with size were those related to minimum temperatures, consistent with the predictions of Bergmann's Rule. To examine the evolutionary history of *C. antisiensis*, we sequenced a mitochondrial locus for all available samples and employed phylogenetic and spatially explicit demographic analyses. We found little concordance between

genetic distance and geographic, morphological and environmental distance. The patterns of morphological and phylogeographic variation in *C. antisiensis* indicate that the geographic variation in body size is likely driven by population-level adaptation to local thermal conditions rather than phylogeographic history.

**PS1.198 Sekercioglu, Çagan**, (University of Utah, Salt Lake City, United States); **Primack, Richard** (Boston University, Boston, United States); **Wormworth, Janice** (Canada)

#### THE EFFECTS OF CLIMATE CHANGE ON TROPICAL BIRDS

Birds are among the most widely studied organisms on earth and represent an important indicator group for learning about the effects of climate change. We assess the potential impacts of climate change on tropical birds and discuss factors that affect species' ability to adapt and survive the impending alterations in habitat availability. Tropical mountain birds, species without access to higher elevations, coastal forest birds, and restricted-range species are especially vulnerable. Some birds may be especially susceptible to increased rainfall seasonality and to extreme weather events. Birds that experience limited temperature variation and have low basal metabolic rates will be the most prone to the physiological effects of warming temperatures and heat waves. Mostly unknown species' interactions, indirect effects, and synergies of climate change with other threats, such as habitat loss, emerging diseases, invasive species, and hunting will exacerbate the effects of climate change on tropical birds. In some models habitat loss can increase bird extinctions caused by climate change by 50%. 3.5°C surface warming by the year 2100 may result in 600-900 extinctions of land bird species, 89% of which occur in the tropics. Depending on the amount of future habitat loss, each degree of surface warming could lead to approximately 100-500 additional bird extinctions. Protected areas will be more important than ever, but they need to be designed with climate change in mind. Although 92% of currently protected areas are likely to become climatically unsuitable in a century, for example only 7 or 8 priority species' preferred climatic envelopes are projected to be entirely lost from the African Important Bird Area network. Networks of protected areas need to incorporate extensive topographical diversity, cover wide elevational ranges, have high connectivity, and integrate human-dominated landscapes into conservation schemes. Most tropical bird species vulnerable to climate change are not currently considered threatened with extinction, often due to lack of knowledge; systematically and regularly gathering information on the ecology, and current and future distributions of these species is an urgent priority. Locally based, long-term tropical bird monitoring and conservation programs based on adaptive management are essential to help protect birds against climate change.

**SAT15.1 Seneviratne, Sampath**, (Bird Studies Canada, Vancouver, Canada); **Hefer, Charles**; **Baute, Greg** (University of British Columbia, Vancouver, BC, Canada); **Davidson, Peter** (Bird Studies Canada, Delta, BC, Canada); **Martin, Kathy**; **Irwin, Darren** (University of British Columbia, Vancouver, BC, Canada)

#### PHENOTYPIC AND GENETIC VARIATION ACROSS HYBRID ZONES BETWEEN THREE ALLOSPECIES OF SAPSUCKERS

Hybrid zones provide a unique opportunity to study the interaction between gene flow and reproductive isolation in speciation. Three species of woodpeckers (Sapsucker;

Sphyracicus) hybridize where they come into contact, presenting a rare multi-species hybrid zone. Here we provide a detailed characterization of this system in British Columbia using phenotypic and genetic characters. We studied morphometric and plumage traits as well as genetic markers (SNPs) generated from next-generation sequencing along transect lines that span across these regions of sympatry. In addition to providing a quantitative description of the hybrid zone, we address two questions: whether phenotypic variation is a good predictor of genetic variation, and whether the differences between these forms are maintained by selection. The concordance of genetic and phenotypic characters across hybrid zones indicates that the three forms are distinct entities in both genes and phenotypes and that each character is a good predictor of the other. Selection-maintained hybrid zones should display a pattern in which phenotypic and genetic clines are concordant and narrower than predicted based on models of neutral diffusion. The spatial characteristics of the two hybrid zones are different; the ruber–varius hybrid zone appears to be a tension zone, in which selection against hybrids is balanced by gene flow into the zone, located at the western foothills of the Rocky Mountains without any evidence for habitat segregation. The ruber–nuchalis hybrid zone is a tension zone locked in an ecotone at the western edge of the Chilcotin Plateau along the Coast Mountains.

**F12.10 Senner, Nathan,** (Cornell Laboratory of Ornithology, Ithaca, United States);

**LUCK OF THE DRAW; TWO HUDSONIAN GODWIT POPULATIONS DIFFERENTIALLY RESPOND TO CLIMATE CHANGE**

Global climate change is rapidly altering the phenology of ecosystems around the world, especially at sub-arctic and Arctic latitudes. Previous work in Europe has identified significant mismatches between the timing of the return of migratory birds to their breeding grounds in spring and the peak in abundance of the food resources necessary for those species to successfully breed. Studies from North America, however, have found more ambiguous results. Here I present the results of a study undertaken between 2008-2011 on the phenology of breeding Hudsonian Godwits, *Limosa haemastica*, and local food resources at Churchill, Manitoba and Beluga River, Alaska. I followed 20-30 godwit nests from initiation to the fledging of young and maintained 2 daily transects and 6 weekly transects to monitor insect abundance annually at both sites. I found that godwits breeding at Churchill were experiencing a significant mismatch of 1-3 weeks that appears to be having a detrimental effect on fledgling survivorship. Conversely, the Beluga River population is experiencing no timing mismatch and has enjoyed relatively high fledgling survivorship. Combined with recent findings about differences in migratory timing between these two populations, these results suggest dramatic differences in the responses of these populations to recent climatic change. With future climate scenarios for the two regions projecting a continuation of current trends, the trajectory of these two populations may continue to diverge.

**PS1.143 Setash, Casey,** (Virginia Tech, Blacksburg, United States); Lin, Fang-Yee; Stauffer, Dean (Virginia Tech, Blacksburg, United States)

**WING MORPHOLOGY AND FORAGING STRATIFICATION IN FOREST-DWELLING BIRDS**

Wing morphology is well-recognized as the evolutionary product of the life history of certain organisms due to migration behavior and habitat use. In this study, we investigated the association of wing morphology and vertical stratification of 26

bird species trapped in Hui-Ban, Taiwan, which consists mostly of secondary lowland forest mixed with some agricultural land. Aspect ratio and wing loading, two most commonly used parameters of wing morphology, were estimated for each individual. We hypothesized that birds with lower aspect ratios and higher wing loadings were typically ground-foragers that did not usually fly long distances and needed more maneuverability in the cluttered environment. Average wing-loadings were 0.1925 units higher for ground-dwelling birds than for canopy-dwellers ( $p=0.026$ ). Average aspect-ratio was 0.3843 units higher in canopy-dwelling birds than in those that foraged in the brush ( $p=0.046$ ). With one or two exceptions, our findings were in alignment with our hypothesis; the species that spent most of their time on the ground or in the shrubbery tended to have higher wing loadings and lower aspect ratios than those that foraged in the canopy.

**PS2.12 Shaffer, Jill,** (US Geological Survey, Jamestown, ND, United States); Johnson, Douglas (US Geological Survey, St. Paul, MN, United States)

**AVOIDANCE OF WIND GENERATORS BY BREEDING GRASSLAND BIRDS**

The development of wind as a renewable source of energy is growing exponentially. The U.S. Department of Energy predicts that wind energy could provide 20% of the United States' electrical supply by 2030. Currently, wind is second only to natural gas as the largest source of new power generation in the United States. Natural-resource professionals are concerned about the effects of wind developments on wildlife, specifically the impacts from mortality and avoidance. Northern Prairie Wildlife Research Center is conducting a long-term (>10 yr), Before-After, Control-Impact study that evaluates the avoidance, or displacement, effects of wind developments on grassland birds in native grasslands. By recording the locations of breeding pairs relative to turbine strings, we are able to compare the observed distribution of minimum distances to expected distances under the assumption of no-displacement effect. We will discuss field and statistical methods and present results for several grassland species, including Grasshopper Sparrow (*Ammodramus saviarum*), Chestnut-collared Longspur (*Calcarius ornatus*), Western Meadowlark (*Sturnella neglecta*), and Bobolink (*Dolichonyx oryzivorus*).

**W10.2 Shaffer, Terry,** (U.S. Geological Survey, Jamestown, United States); Russell, Robin (U.S. Geological Survey, Madison, WI, United States); Buhl, Thomas (USGS, Jamestown, ND, United States); Granfors, Diane (U.S. Fish and Wildlife Service, Anchorage, AK, United States); Niemuth, Neal (U.S. Fish and Wildlife Service, Bismarck, ND, United States)

**ARE ROADSIDE SURVEYS OF SECRETIVE MARSH BIRDS IN THE PRAIRIE POTHOLE REGION BIASED?**

Population size and trends of most North American marsh bird species are poorly known, and continental marsh bird surveys are being proposed to provide better insight into marsh bird populations. The Prairie Pothole Region (PPR) is a critical and expansive breeding area for several focal marsh bird species. Roadside point-count surveys are being considered as a technique that would allow widespread areas within the PPR to be surveyed during the short crepuscular period during which these species can be detected. Counts from roadsides may differ from counts in non-roadside habitats either because densities differ between roadside and non-roadside habitats or because individual marsh birds in roadside habitats may be more (or less) detectable from the road than from an off-road location. We designed an experiment to investigate these questions. We

followed a standardized protocol and conducted call-playback surveys on pairs of wetlands in 2008 (n=125) and 2009 (n=121) in Minnesota, North Dakota, and South Dakota. We fit occupancy models to estimate detection and occupancy probability in relation to whether the survey occurred in roadside versus non-roadside habitat, and whether detection probability was enhanced or depressed when surveying roadside habitat from the road itself. We present results for five species and discuss implications for development of a large-scale marsh bird survey for the PPR.

**SAT11.8 Shearer, Jessica**, (American Museum of Natural History, New York, United States); McKay, Bailey (American Museum of Natural History, New York, NY, United States); Cracraft, Joel (American Museum of Natural History, New York, NY, United States)

#### THE SUPERB BIRD-OF-PARADISE: A PHYLOGEOGRAPHIC STUDY OF A NEW GUINEAN PASSERINE

The Superb Bird-of-paradise (*Lophorina superba*) species-complex exhibits a high level of morphological diversity and a distribution spanning montane ecosystems across the entire island of New Guinea. As very little is known about speciation and biogeography of vertebrates inhabiting the montane forests of this island, the study of this group has the potential to address this gap in our knowledge. The subspecies limits and designations, evolutionary relationships, and phylogeographic patterns of five of the six currently recognized subspecies of *L. superba* were tested using mitochondrial DNA sequences from fifty-two fresh tissue and museum specimens. GIS tools including climatic and topographic data were also used to establish environmental envelopes for each supposed subspecies in order to evaluate range limits and possible vicariant barriers. Three major clades were revealed by molecular phylogenetic analysis, corresponding biogeographically to three major centers of endemism in New Guinea: the Arfak Peninsula in the west, the central ranges, and the Papuan Peninsula in the east with the eastern clade being genetically highly divergent from the other two. Genetic structuring within the central clade suggests the existence of two taxa, which do not completely correspond to the currently recognized subspecies designations. The existence of two diagnosably distinct types at the extremities of the ranges of these two subspecies, and a less obvious morphotype in the center of the range may point to the existence of a hybrid zone.

**T14.1 Sheehan, James**, (WV Cooperative Fish and Wildlife Research Unit, Morgantown, United States); George, Gregory; Becker, Douglas; Mizel, Jeremy (WV Cooperative Fish and Wildlife Research Unit, Morgantown, WV, United States); Bohall Wood, Petra (U.S. Geological Survey, Morgantown, WV, United States); Edenborn, Harry (National Energy Technology Laboratory, Pittsburgh, PA, United States)

#### BREEDING SONGBIRD RESPONSE TO CONVENTIONAL AND UNCONVENTIONAL OIL AND NATURAL GAS DEVELOPMENT IN WEST VIRGINIA

The extensive tracts of mature hardwood forest in West Virginia support a high diversity and abundance of breeding songbirds, including species of high conservation priority in the Appalachian Mountains region. Oil and natural gas (O&G) development is increasing, including unconventional drilling for Marcellus shale gas. To understand effects of O&G activity on breeding songbirds, we conducted four seasons (2008-11) of point counts at 142 survey stations in a 6,521 ha study area of primarily mature forest in northwestern West Virginia. High

priority forest-interior species (cerulean warbler, Kentucky warbler, Louisiana waterthrush, wood thrush, and worm-eating warbler) are abundant. The primarily stream-associated worm-eating warbler declined in the compartment where the most stream length was O&G impacted. It increased in the least impacted compartment as did forest-interior and forest interior/edge species. Two edge species (chipping sparrow and indigo bunting) increased at point counts in forest newly impacted by O&G road/pipeline infrastructure. The most disturbed compartment contained smaller populations of forest interior species (cerulean warbler, ovenbird, and worm-eating warbler), and larger populations of edge species (chipping sparrow, common yellowthroat, and indigo bunting). The compartment with the most O&G impact contained forest interior species in abundances similar to the least impacted. The avian composition of the area with the most O&G impact, however, is likely to become more comparable to more disturbed areas, mostly due to increases in edge species. While the area of O&G impacts is small, their extent is not, creating abundant edge habitat within formerly contiguous forest.

**T12.9 Sheppard, Jennifer**, (University of Saskatchewan, Saskatoon, Canada); Clark, Robert (Environment Canada, University of Saskatchewan, Saskatoon, SK, Canada); Devries, James (Ducks Unlimited Canada, Institute for Wetland and Waterfowl Research, Stonewall, MB, Canada); Brasher, Michael (Gulf Coast Joint Venture, National Wetlands Research Center, Lafayette, United States)

#### TIMING OF BREEDING AND REPRODUCTIVE EFFORT IN WILD MALLARDS (*ANAS PLATYRHYNCHOS*) IS RELATED TO BOTH FEMALE AND MALE QUALITY

Most studies of waterfowl reproductive ecology focus on female attributes and virtually ignore the role of males in reproductive investment decisions. It is hypothesized that high quality males can sequester higher quality breeding habitat or induce females to increase reproductive investment; to our knowledge, no field studies have tested these ideas. Here, we evaluated the relationship between male quality and female reproductive effort for 254 pairs of wild mallards (*Anas platyrhynchos*) at six study sites over 3 years in Canada's Prairie Parkland ecoregion. We predicted that females mated to higher quality males would: (i) initiate nests earlier in the breeding season, (ii) renest more frequently, and; (iii) lay larger clutches. Individual quality was indexed by multiple measurements of plumage quality in males, and body size and condition in both sexes. We evaluated a priori regression models to relate reproductive performance measurements to indices of individual quality, and compared models using information theory. High-quality females were older, had good body condition, and were mated with males that also had good body condition. Assortative mating by body size was evident among yearling females and their mates, whereas this relationship was not detected among older females. Females mated to high-quality males tended to nest earlier, but laid smaller clutches. Older females paired with high-quality males initiated more nest attempts but did so less often, whereas younger females paired with higher-quality males nested less often but more quickly between nesting attempts. Our results are consistent with the hypothesis that male quality affects female reproductive investment decisions, but the nature and strength of these relationships vary with female age. Further work is needed to evaluate if females mated to higher quality males also gain access to superior breeding habitat and have higher reproductive success.

**PS1.270 Sherburne, Jessica**, (Boise State University, Boise, United States); Kinney, Chad (Colorado State University - Pueblo, Pueblo, United States); Furlong, Edward (U.S. Geological Society, Denver, United States); Kolpin, Dana (U.S. Geological Society, Iowa City, IA, United States); Dufty, Alfred (Boise State University, Boise, ID, United States)

#### YOU ARE WHAT YOU EAT: POLYBROMINATED DIPHENYL ETHER (PBDE) LEVELS IN THE EGGS OF TWO SPECIES OF WILD BIRDS EXPOSED TO PBDE-LADEN BIOSOLIDS

A major goal in toxicology is determining the effects of potentially harmful and persistent environmental pollutants, such as polybrominated diphenyl ethers (PBDEs), on biota and the environment. One potential mechanism for introduction of PBDEs in the environment is the disposal of sewage sludge or biosolids through land application. To assess contaminant levels, we studied American kestrel (*Falco sparverius*) and European starling (*Sturnus vulgaris*) eggs. All clutches were laid in artificial nest boxes placed on telephone poles near Boise, ID. The experimental eggs were from nest boxes adjacent to land where biosolids have been applied as fertilizer for five years. Control eggs were collected from similar boxes located at least 5 km from the experimental site, in areas where biosolids were not applied. We examined differences in egg size and eggshell thickness between species and sites. If PBDE accumulation affects egg size or eggshell thickness, we expect the effect to be more evident in kestrel eggs than in starling eggs. Spatial and interspecific differences in PBDE levels will be determined in egg yolk from both species. We hypothesize that PBDE levels will be highest in the kestrel and starling eggs collected where biosolids were applied. Additionally, we expect higher PBDE levels in the kestrel (secondary consumers) than in the starling (primary consumers) eggs because of bioaccumulation of pollutants at higher trophic levels. Through this research we hope to better understand how exposure to PBDEs through land-applied biosolids affects the eggs of birds at different trophic levels.

**W14.7 Sherry, Thomas**, (Tulane University, New Orleans, United States); Johnson, Matthew (Humboldt State University, Arcata, CA, United States)

#### HIGH DIETARY OVERLAP AND OPPORTUNISM CONSUMING ARTHROPODS INCLUDING COFFEE BERRY BORER BY FIVE WOOD WARBLER SPECIES WINTERING IN JAMAICAN SHADE COFFEE FARMS

Diets are invaluable to interpret foraging strategies, predator-prey relationships, competitive interactions, and ecosystem services, among other things, but rarely investigated. Using tartar emetic samples we compared and contrasted diets of five primarily insectivorous, long-distance migrant warblers (Parulidae) wintering in moderate elevation shaded coffee farms in Jamaica to assess the potential for inter-specific and inter-sexual competition as well as consumption of the coffee berry borer (*Hypothenemus hampei*: Coleoptera, Curculionidae). Our results, based on 109 gut samples comprising 7,732 identifiable prey items (70.1 items per sample, on average) and on 360 branch clip samples of available prey comprising 2,452 arthropods, indicate almost uniformly high diet overlaps among all five warbler species studied (American Redstart, Black-and-White Warbler, Black-throated Blue Warbler, Northern Parula, and Prairie Warbler; range in overlaps 0.77-0.97), and between sexes (0.90-0.995) where sample sizes were sufficient, indicating that all the birds were concentrating on few, abundant, small, and often patchily distributed prey types generally similar to those available, including a psyllid

homopteran, bark lice, and the coffee berry borer. Using Discriminant Function Analysis, American redstarts were the most distinctive dietarily of the five species: The discriminant function was able to predict 81% of redstart diet samples correctly to species, and only 46-72% for the other species). Moreover, the sexes foraged on diagnosably different prey types in Black-throated Blue Warblers, and in American Redstarts to a lesser extent. Taken together, our results indicate (1) diet opportunism on "non-buffered" prey, consistent with a migratory life-history; (2) the potential for strong, diffuse inter- and intra-specific competition involving all five species; and (3) consumption of the coffee berry borer (the most economically important coffee pest globally) by all five warblers, but significantly more frequently by Black-throated Blue Warblers.

**SAT4.1 Shipley, Amy**, (Portland State University, Albion, United States); Murphy, Michael (Portland State University, Portland, OR, United States); Elzinga, Adam (Unaffiliated, Albion, MI, United States)

#### RESIDENTIAL EDGES AS ECOLOGICAL TRAPS: POSTFLEDGING SURVIVAL OF SPOTTED TOWHEES IN A FORESTED URBAN PARK

Substantial mortality can occur within the postfledging period of birds, but few postfledging survival studies have been conducted within a habitat suitability context. We conducted a two-year radio telemetry study of Spotted Towhee (*Pipilo maculatus*) reproductive success in a 24 ha forested park in a residential area of Portland, Oregon. In corroboration of previous work on towhees, we found that (1) towhees nested closer to the park edge than expected by chance, and that (2) pairs that nested near the edge produced the largest and most offspring. However, fates were reversed during the postfledging period. Nearly 70% of fledglings (36 of 52) survived the 27-day tracking period, and although fledglings were more likely to be found near edges than the park interior, fledglings near edges had a far higher probability of dying. All deaths were from predation, and at least 11 predation events were attributable to domestic cats (*Felis domesticus*) and Western Screech-owls (*Megascops kennicottii*). A stochastic model that incorporated the probability of nest success and fledgling survival showed that the number of offspring produced per nest that survived the postfledging period was greatest in the park interior. The heavy use and apparent preference of edge habitat for nesting by towhees, coupled with high fledgling mortality near edges, created a severe ecological trap that was not apparent until the final stage of parental care. Hence, failure to document offspring survival in the late stages of reproduction may lead to an incorrect assessment of habitat suitability and improper management decisions.

**PS1.168 Shipley, Jeremy Ryan\*** (Oklahoma Biological Survey, Norman, United States); Kelly, Jeffrey (Oklahoma Biological Survey, Norman, OK, United States)

#### MONITORING CONTINENTAL-SCALE BIRD PHENOLOGY USING NEXRAD

Phenology is the timing of various periodic events that compose an organism's annual cycle such as bud break, egg lay-date, reproduction, fledging, migration, and senescence. Although it has been known for over 60 years that weather radar can detect organisms in the atmosphere, use of radar products for biologically oriented questions is not well-established due at least in part to technical challenges in data processing and interpretation. The NEXRAD network of Doppler weather radar stations (WSR-88Ds) provide near continuous spatial and temporal coverage of the United States for meteorological monitoring from 158 WSR-88D stations at 5 – 10 minute

intervals with a potential data archive extending to 1991. We selected a series of Purple Martin roosts located similar distances from WSR-88Ds stations that span the species' breeding range in North America. We created phenology curves based on cumulative radar reflectivity values measured above these martin roosts spanning multiple years. This approach allowed us to investigate changes in roost formation and dissipation over our analysis period based on effects of latitude, urbanization, drought, and coastal versus inland populations. The ability to easily query biological aspects of radar data spanning these spatial scales is an emerging capability and our research demonstrates potential use of these tools.

**PS1.39 Shlepr, Katherine, \*U** (College of the Atlantic, Bar Harbor, United States);

**IMPACT OF BALD EAGLE (HALIAEETUS LEUCOCEPHALUS) PREDATION ON HERRING GULL (LARUS ARGENTATUS) SURVIVORSHIP IN MAINE, USA**  
Local Herring Gull populations in Maine declined over 60% between 1996 and 2008, with several in-shore nesting colonies being completely abandoned. In the same time period, Bald Eagles, known predators of gulls, more than doubled to 450 breeding pairs concentrated along the coast and islands. The impact of Bald Eagle predation on Herring Gull colonies was recorded during two summers on Great Duck Island, Maine (lat. 44 8'N, long. 68 10'W). Shifts in the density of Herring Gulls nesting close to a Bald Eagle nest were monitored by mapping gull nest distribution, color-marking adult gulls, and analyzing nesting data collected over the past 13 years; gull chick survivorship close to and away from the eagle nest were compared; and gull behavior before, during, and after eagle sightings was recorded. In 2011, there were eagle fly-bys or attacks on 46 days of the 58-day season, with as many as 15 incidents in a single day. Immature eagles were the most common intruders, but adults often accompanied juveniles or foraged on their own. Crows and ravens were seen scavenging in the gull colony during eagle passes, and gull eggs were found at the base of a raven nest on the island. Gull and cormorant populations on nearby islands were also surveyed in order to assess how numbers have shifted elsewhere. Eagle predation raises questions about the management of gulls and eagles alike.

**PS2.93 Shriner, Susan A.,** (National Wildlife Research Center, Fort Collins, United States); Root, J. Jeffrey (National Wildlife Research Center, Fort Collins, CO, United States); Huyvaert, Kathryn P. (Colorado State University, Fort Collins, CO, United States); Mooers, Nicole L.; Hopken, Matthew W.; Piaggio, Antoinette J. (National Wildlife Research Center, Fort Collins, CO, United States); Vice, Daniel S. (Wildlife Services, Barrigada, Guam, United States); Flores, Jeffrey B. (Wildlife Services, Barrigada, Guam, Canada); Franklin, Alan B. (National Wildlife Research Center, Fort Collins, CO, United States)

**AVIAN BLOOD PARASITES AND AVIAN CONSERVATION IN THE MARIANAS**

The Mariana Islands are a Micronesian archipelago considered a biodiversity hotspot for birds. A number of endemic bird species on the island of Saipan have been listed as endangered by the U.S. Fish and Wildlife Service and recent bird surveys have indicated a number of species may be experiencing population declines. Plasmodium relictum, the causative agent of avian malaria, is an avian blood parasite with the potential to cause serious morbidity in some bird species. P. relictum has played a significant role in population declines and extinctions in the Hawaiian avifauna. Nonetheless, avian blood parasites

(haemosporidians) have received scant attention as a possible mechanism underlying bird declines in the Marianas outside the island of Guam. Consequently, we collected blood samples from birds on Guam and Saipan and screened them for blood parasites by polymerase chain reaction (PCR). PCR products were sequenced and classified to genus, and where possible, to species. We found no evidence for infections on Guam. However, on Saipan, we found 1% of birds were infected with a Haemoproteus sp. and 55% of birds were infected with Plasmodium spp. The majority of Plasmodium sequences that we identified were 98% genetically similar to the avian malaria parasite found in Hawaii. Because current conservation efforts rely on island translocations and because avian blood parasites have the potential to negatively impact bird fitness, rigorously characterizing the current distribution of blood parasites in the Marianas and clarifying the timing of their introduction to this region are high priorities for conservation.

**PS1.240 Shriver, W Gregory,** (University of Delaware, Newark, United States); Ladin, Zach; Roland, Roth (University of Delaware, Newark, DE, United States)

**ANNUAL VARIATION IN WOOD THRUSH POPULATION SIZE AND SURVIVAL FROM 1974 - 2011**

Collectively, we've been studying wood thrush demographics in a 16 ha forest fragment in northern Delaware since 1974. During these 37 breeding seasons (May – August) we banded 801 adults that bred within this forest patch (415 females, 386 males). We used the R package 'mra' to determine the long-term changes in demography by estimating female and male population size and survival rates. Population size declined from 29 females and 30 males in 1974 to 8 females and 7 males in 2011. The average intrinsic rate of increase (lambda) during this time period was 1.04 (SD = 0.44) for females and 0.99 (SD = 0.30) for males. Females had a lambda less than 1 for 19 of the 37 years (51%) and males had a lambda less than 1 for 18 of the years (49%). Both female and male survival rates varied over time. Female survival ranged from 0.16 in 1986 to 0.82 in 2008 (mean = 0.50, SD = 0.16) and male survival ranged from 0.26 in 1985 to 0.84 in 2002 (mean = 0.56, SD = 0.14). Given these population parameters (59 adults, lambda = 0.99 +- 0.30) we estimated an 86% probability of extinction over 1000 simulations. Since 1974 Rosa multiflora has invaded the site which reduces nest site availability. Restoring urban forest fragments to benefit breeding birds is warranted given there are over 10,000 small urban forest fragments ( $\leq 20$  ha) totaling nearly 500,000 ha of forested habitat in the New England and Mid-Atlantic regions.

**PS2.207 Shult, Hannah T.,** (University of Kansas, Lawrence, United States); Andersen, Michael J. (University of Kansas, Lawrence, KS, United States); Cibois, Alice (Natural History Museum of Geneva, Geneva, Switzerland); Filardi, Christopher E. (American Museum of Natural History, New York, NY, United States); Thibault, Jean-Claude (Muséum National d'Histoire Naturelle, Paris, PA, France); Moyle, Robert G. (University of Kansas, Lawrence, KS, United States)

**PHYLOGEOGRAPHY IN THE TROPICAL PACIFIC: SYSTEMATICS, BIOGEOGRAPHY, AND SPECIES LIMITS IN THE COLLARED KINGFISHER (<I>TODIRAMPUS CHLORIS</I>) COMPLEX**

A conspicuous element of island bird faunas, especially in the tropical Pacific, is the abundance of widespread 'polytypic' species. One such example is the Collared Kingfisher *Todiramphus chloris*, which comprises ~50 subspecies spanning the Indo-Pacific, including populations as far west as the Red



Sea. We present a molecular phylogeny of this polytypic species complex based on a multilocus dataset including complete DNA sequences of two mitochondrial coding genes and four nuclear noncoding introns totaling >3,500 bp. Phylogenetic analysis produced a well-resolved phylogeny of ~140 *Todiramphus* samples from across Australasia and the Pacific, including broad outgroup sampling. The results revealed several important aspects of the evolutionary history of *Todiramphus chloris*, including non-monophyly of the species. Not surprisingly, the evolutionary history of *T. chloris* is complex and comprises multiple, well-differentiated lineages with several species-level taxa nested within the broader group. Only a few archipelagos host geographically cohesive radiations (e.g., Fiji). Conversely, a biogeographic break was noted between the Solomon Islands' Guadalcanal and Makira, across which two main lineages are split into an east Pacific and Australasian clade. This implies a single colonization event of the eastern Pacific with subsequent diversification across the many remote archipelagos of Polynesia. Taken as a whole, our results suggest that the colonization of *Todiramphus* across a large swath of the Pacific happened relatively quickly with subsequent diversification occurring in smaller regions. The biogeographic history of Polynesia appears less complex, having arisen from just a single colonization event. Conversely, the Australasian clade is comprised of numerous independent lineages with more complex present-day distributions.

**SAT11.4 Sigurdsson, Snorri**, (Department of Ornithology, AMNH, New York, United States); Cracraft, Joel (Department of Ornithology, AMNH, New York, United States)

#### A NEW PHYLOGENY OF THE NIGHTJARS (CAPRIMULGIDAE) CASTS LIGHT ON NEW PHYLOGENETIC SPECIES AND A COMPLEX HISTORY OF DIVERSIFICATION IN THE NEW WORLD.

We present a new molecular phylogeny of the three main radiations of Nightjars (Caprimulgidae) restricted to the New World. By sampling densely at the species and subspecies level, we investigated the high intraspecific diversity of many traditionally defined species and thus identified a number of new phylogenetic species. We propose that traditionally defined species including *Caprimulgus longirostris*, *C. rufus*, *C. vociferus*, *Chordeiles acutipennis* and *Nyctidromus albicollis* be split into two or more phylogenetic species based on variation in mitochondrial and nuclear markers as well as the presence of unique morphological traits. We also propose substantial modifications of the generic nomenclature within the family.

A near complete phylogeny at the phylo-species level also provides an opportunity to investigate its history of diversification. We present a dated chronogram that demonstrates a highly complex history of diversification in the late Cenozoic. While tropical South America served as a source for numerous radiation events within the family, different genera diversified within and between multiple areas in South, Central and North America as well as the Caribbean and were influenced by established vicariance events, long-distance dispersal and dispersion into a variety of habitats.

**S12.3 Sillett, Scott**, (Smithsonian Institution, Washington, United States); Hostetler, Jeffrey; Marra, Peter (Smithsonian Institution, Washington, United States)

#### RECENT ADVANCES IN UNDERSTANDING THE LIMITATION AND REGULATION OF MIGRATORY PASSERINE POPULATIONS THROUGHOUT THE ANNUAL CYCLE

The abundances of migratory songbirds are determined by the seasonal interactions of events that can occur over thousands of kilometers and on different continents. Therefore, understanding the relative impacts of limiting and regulatory processes in the stationary and migratory periods, as well as how such impacts carry-over between seasons, is essential. We use demographic data from our long-term, full life-cycle studies of American Redstarts (*Setophaga ruticilla*) and Black-throated Blue Warblers (*S. caerulescens*) to show that these populations are limited (e.g. by weather and food) during all phases of their annual cycle and are regulated by both density-dependent fecundity and survival. We use stage-structured, population projection models to illustrate how the relative influence of these limiting and regulatory processes covary and are shaped by the strength of connectivity between breeding and winter grounds. Our results emphasize the need for a full life-cycle approach to understand the factors that underlie population dynamics and to conserve migratory bird species.

**T4.4 Silverio, Cassandra**, (York University, Toronto, Canada); Stutchbury, Bridget (York University, Toronto, ON, Canada)

#### THE EFFECTS OF AVIAN MALARIA ON FITNESS, EXTRA PAIR PATERNITY AND MIGRATION: A MEDICATION EXPERIMENT

Parasite resistance is an important mechanism for sexual selection. Parasitic infections are expected to negatively impact fitness as well as honest indicators of quality and thus influence social and extra-pair mate choice. This study quantified *Haemoproteus* parasite infections in purple martins (*Progne subis*) and tested the predictions that birds exhibiting higher infection loads have reduced annual survival probability, lower reproductive success in females and lower genetic mating success in males. Additionally, increased infection loads were predicted to influence fall migration parameters including departure date, distance and pace. A medication experiment was conducted in 2011 to determine the effects of a reduced infection load on reproductive success and migration. This study was conducted at two purple martin colonies in Northwestern Pennsylvania, U.S.A. over a four year period (2006-2009). Infection loads of *Haemoproteus* were determined using quantitative real-time PCR. Specific migratory parameters were collected from the use of geolocators. Infection load was experimentally reduced using subcutaneous injections of the anti-malarial drug primaquine. Our results indicate that *Haemoproteus* infections do not significantly affect female reproductive success or male genetic mating success. However survival data suggests that second year birds may be under selection pressure from increased infection loads. This comprehensive study examined the relationship between parasite resistance and sexual selection using quantitative infection data, direct and indirect fitness effects and experimental manipulations.

**PS2.103 Simons, Theodore**, (USGS NC Cooperative Research Unit/North Carolina State University, Raleigh, United States); Pollock, Kenneth (Biology, Biomath, Statistics, NC State University, Raleigh, United States); Riddle, Jason (University of Wisconsin, Stevens Point, Stevens Point, United States)

#### OBSERVER EXPECTATION - AN OVERLOOKED SOURCE OF BIAS IN REPEATED COUNT SURVEYS

Most ornithologists are familiar with the powerful memories and sense of expectation that arise when searching for a rare bird or revisiting the location of a previous sighting. Whether replicating a Breeding Bird Survey route run over many years, or searching for a glimpse of a rare vagrant or an Ivory-billed

Woodpecker, prior information can bias our observations and violate the independence assumptions underlying most survey methods. We have found clear evidence of behavioral effects in methods based on time-of-detection and repeated count survey protocols. Accounting for “trap happy” observers is possible with established models like those in program MARK. In contrast, accounting for imagined or misidentified birds associated with observer expectation is more problematic, especially when occupancy metrics are applied to presence-absence data. Even small increases in misidentification rates can induce large biases in occupancy estimates. Recent experimental findings using a song simulation system in a field setting have demonstrated that prior information can introduce significant bias into estimates of species diversity and abundance. Observer training, modeling behavioral effects, and modifications of survey design can reduce bias associated with observer expectations.

**PS2.47 Skipper, Ben**, (Texas Tech University, Lubbock, United States); Boal, Clint (USGS Texas Cooperative Fish and Wildlife Research Unit, Lubbock, TX, United States)

#### EFFECTS OF WEATHER ON NESTING SUCCESS OF URBAN AND EXURBAN MISSISSIPPI KITES

Theory and empirical evidence suggest that raptors breeding in urban environments gain a reproductive advantage over their exurban conspecifics. This urban advantage is predicated in part upon disparities in local climatic conditions. Periods of pronounced environmental stress, such as drought, afford an opportunity to examine the degree of such advantages and/or to what extent the advantages are nullified. Using the nest survival module in program MARK, we evaluated 8 a priori models of nesting success of exurban and urban Mississippi kites breeding in the Southern Great Plains of Texas with environmental covariates. Our best fitting model indicated that nest success varied with daily maximum temperature, maximum solar radiation, and average daily relative humidity. Contrary to the predictions under the urban advantage, we observed that Mississippi kite nesting success was lower in the urban area during both a typical year (2010) and during a year of severe environmental stress (2011). Our inclusion of weather covariates in assessment of kite nesting success, and the lack of an observed urban advantage, suggests that any advantage urban breeding kites may gain over their exurban conspecifics is likely not related to amelioration of local weather conditions alone.

**PS2.43 Skone, Brandi**, (Montana State University, Bozeman, United States); Rotella, Jay (Montana State University, Bozeman, United States); Walker, Johann (Ducks Unlimited, Bismarck, United States)

#### WINTER WHEAT: A POTENTIAL NESTING HABITAT FOR UPLAND NESTING DUCKS

The Prairie Pothole Region (PPR) of North America is a highly valuable landscape for breeding waterfowl that has been predominantly converted to some form of agriculture in the last century. This is cause for concern since the extent of cropland has been strongly associated with declining numbers and nest success of ducks. While past research has confirmed that nest success is very low in spring-seeded crops, few studies have assessed the potential of winter wheat, a fall-seeded crop, as a nesting habitat. We monitored duck nests (*Anas* spp.) in spring wheat (2010, n=75 nests), winter wheat (2010-2011, n=752) and perennial cover (2010-2011, n=2,046) in the PPR of North and South Dakota. A suite of models will be used to evaluate hypotheses regarding different environmental (wetland density, vegetation density, etc.) and temporal covariates (initiation date, nest age, etc.) and how they are associated with nest survival

among the three habitats. We predict that nest survival will be similar in winter wheat when compared with perennial cover after accounting for the different covariates. We also predict that nest survival will be much greater in winter wheat than in spring wheat after accounting for different covariates. Results from this study will provide valuable insight for managers on the viability of winter wheat as a suitable alternative nesting habitat for ducks.

**PS1.233 Skrade, Paul**,\* (Iowa State University, Ames, United States); Dinsmore, Stephen (Iowa State University, Ames, IA, United States)

#### VARIATION IN CIRCULATING PROLACTIN IN INCUBATING MOUNTAIN PLOVERS

The hormone prolactin (PRL) has been linked to a number of physiological and behavioral events in birds. In particular, PRL is related to parental behavior such as incubation, brood-rearing, and even helping behavior. In species where the female is the sole incubator, females have higher PRL levels than males and the opposite is also true in sex-role reversed species, where males are the sole incubators, incubating males having significantly higher concentrations of PRL than females. The Mountain Plover is a shorebird with an uncommon “rapid multi-clutch” parental care system where males and females tend to separate nests. We collected blood from incubating male and female Mountain Plovers and quantified circulating plasma PRL related to the sex of the incubating bird. We also examined how it varied throughout incubation and the nesting season. PRL levels were similar for incubating male and female Mountain Plovers. The mean circulating plasma PRL concentration for incubating female plovers was 36.70 ng/ml (n = 33, SE = 2.90 ng/ml) and ranged from 7.33 to 78.04 ng/ml. The mean for males was 36.49 ng/ml (n = 36, SE = 4.43 ng/ml) and there was greater variation in the samples with the lowest measured at 5.18 ng/ml and highest at 140.86 ng/ml. There was not a strong linear relationship between nest age and the concentration of circulating PRL for either incubating female plovers or male plovers and nest age did not explain a significant proportion of the variance in PRL concentration for either sex ( $R^2 = 0.0015$  and  $0.0312$  respectively). The linear relationship between the Julian day of nesting season and concentration of circulating PRL was also not strong for either sex and did not explain a significant proportion of the variance for either females ( $R^2 = 0.0472$ ) or males ( $R^2 = 0.0011$ ). This study provides further information about the relationship between parental care responsibilities and circulating PRL and the breeding biology of a shorebird of conservation concern.

**PS1.232 Skrade, Paul**,\* (Iowa State University, Ames, United States); Dinsmore, Stephen (Iowa State University, Ames, IA, United States)

#### AGE-SPECIFIC BREEDING PROBABILITIES OF MOUNTAIN PLOVERS IN MONTANA

The age of first reproduction is important in both life-history theory and conservation biology. It can have a large impact on individual fitness, which in turn influences population dynamics. Evolutionary theory predicts that organisms should reproduce as early as they are capable of doing so, although there are potential tradeoffs if breeding is costly. The Mountain Plover is a shorebird of conservation concern that is physically capable of breeding at age one year, but not all individuals do so. This species also has an uncommon parental care system known as a “rapid multi-clutch” where males and females tend to separate nests. We individually color-banded 850 flightless plover chicks during the breeding seasons of 1995 to 2009 in Phillips County, Montana. Of these, 112 were found in the study area as adults

with 38 individuals breeding at age one (33%). Seventeen females out of 40 resighted (43%) were found either tending to a nest or brood at age one but only 13 males of 34 resighted (38%) were on a nest or with a brood. We developed a set of multi-state mark-resighting models in Program MARK to estimate the probability of breeding at age one and how this is influenced by an individual's sex. We discuss the probability of breeding at age one versus the probability of first breeding at age two in light of the sex of the bird, and then comment on how this might affect population growth in this species. Ultimately, our study provides needed information about the reproductive rates of a species that has been in decline for more than four decades.

**PS2.227 Slade, Joel**, (Saint Mary's University, Halifax, Canada); Doucet, Stéphanie (University of Windsor, Windsor, ON, Canada); Frasier, Timothy; Barber, Colleen (Saint Mary's University, Halifax, NS, Canada)

#### PLUMAGE CHARACTERISTICS AND THEIR ROLE IN SOCIAL AND GENETIC MATE CHOICE IN EUROPEAN STARLINGS (*STURNUS VULGARIS*)

In most passerines, females pursue a mixed reproductive strategy by copulating outside of the pair bond. Females may benefit from extra-pair copulations if they obtain good genes for their offspring by choosing mates with high-quality secondary sexual characteristics, such as plumage. Another potential benefit would be genetic compatibility, such that females would mate with extra-pair males that are more genetically dissimilar to her than her social mate. Birds see in the ultraviolet (UV) spectrum (300-400nm) along with the human-visual spectrum, and studies indicate that UV has a role in avian mate choice. Female European Starlings (*Sturnus vulgaris*) tend to prefer males that have UV-purple iridescent throat feathers over UV-green iridescent ones. We hypothesize that variation in the UV characteristics of male European Starling throat feathers will be correlated with his reproductive success and parental effort. I predict that males with the brightest UV throat feathers will have the greatest reproductive success and provision their offspring more often than will males with duller UV throat feathers. I also hypothesize that the percentage of extra-pair and quasi-brood parasitism young within a nest will be correlated with the relatedness of the social pair. I predict that genetically dissimilar social mates will have a lower percentage of extra-pair and quasi-brood parasitism young in comparison to more genetically similar social mates. The results will be discussed.

**SAT16.4 Slager, David**, (The Ohio State University, Columbus, United States); Rodewald, Paul (The Ohio State University, Columbus, OH, United States); Heglund, Patricia (US Fish and Wildlife Service, La Crosse, WI, United States)

#### HABITAT-DEPENDENT STOPOVER DURATION IN THE NORTHERN WATERTHRUSH (*PARKESIA NOVEBORACENSIS*)

Although events during migration can influence arrival timing and subsequent reproductive success, relatively little is known about how habitat can influence stopover duration in avian migrants. We investigated how habitat suitability, energetic condition, and sex mediate stopover duration. In spring 2009-2010, we captured, measured, and attached radio-transmitters to 43 transient Northern Waterthrushes at Trempealeau National Wildlife Refuge, Wisconsin, USA; a collected tail feather was used for molecular sexing (F=15, M=18, U=10). We experimentally translocated individuals to 4 forested release points, including 2 in bottomland (suitable) habitat and 2 in upland (unsuitable) habitat. Minimum stopover duration as determined by radio-telemetry was  $4.0 \pm 0.4d$  (n=31). We used

size-adjusted body mass as an index of energetic condition. We used generalized linear models within an AICc framework to model the influence of release point habitat, energetic condition, and sex on minimum stopover duration. The models indicated that waterthrushes stopped over longer when experimentally released in more suitable bottomland forest habitat ( $\beta = 1.495 \pm 0.525$  SE) and when in lower energetic condition ( $\beta = -0.268 \pm 0.125$  SE); sex was uninformative ( $\beta = 0.553 \pm 0.689$  SE). These results suggest that the suitability of the habitat birds initially encounter upon landfall can mediate departure decisions independent of energetic condition. The idea that the habitat where a migrant makes landfall may influence stopover duration highlights the need to conserve high quality stopover habitats across species' migration routes.

**SAT14.3 Slater, Gary**, (Ecostudies Institute, Mount Vernon, United States); Bob, Altman (American Bird Conservancy, Corvallis, OR, United States); Foley, Kathleen (San Juan Preservation Trust, Lopez Island, WA, United States)

#### REINTRODUCTION OF A SHORT-DISTANCE MIGRANT, THE WESTERN BLUEBIRD, TO NORTH PUGET SOUND, WASHINGTON

Avian reintroductions are an important conservation tool, but landbird reintroductions are substantially underrepresented compared to other avian taxa, which hinders progress in improving the value and efficacy of landbird reintroductions. We conducted a 5-year reintroduction (2007-2011) of Western Bluebirds (*Sialis mexicana*) in the prairie-oak ecosystem on San Juan Island, Washington. We compared four translocation strategies and investigated factors associated with the successful establishment of translocated individuals. We also evaluated preliminary reintroduction success by comparing demographic parameters between the reintroduced and reference populations. Ninety-nine adults and 35 dependent juveniles were translocated and released to the reintroduction site. Among the four release methods, the percentage of released adults that established a breeding territory ranged from 13-65%. When translocating pairs, the use of large aviaries with a longer holding period (7-21 days) was more effective than the use of small aviaries with a shorter holding period (4-5 days); translocation of pairs or pairs with dependent young appeared equally effective; translocation of single adult females was the most successful technique. As of 2011, 5 of 26 (19%) translocated juveniles returned to San Juan Island and established a breeding territory. Demographic parameters indicated preliminary success in the establishment of a self-sustaining population. Population size and the proportion of non-translocated individuals increased in each year of the project and reproduction and survival parameters were similar to other Pacific Northwest populations.

**SAT14.8 Smetzer, Jennifer**,\* (University of Massachusetts Amherst, Montague MA, United States); King, David; Robert, Brooks (USDA Forest Service Northern Research Station, Amherst, Amherst, United States); Timothy, Randhir (University of Massachusetts Amherst, Amherst, United States)

#### SCIENCE-BASED MANAGEMENT OF SHRUBLAND BIRDS USING DYNAMIC OPTIMIZATION ON VERMONT'S GREEN MOUNTAIN NATIONAL FOREST

Birds that breed in early-successional habitat are declining throughout the northeastern United States. The Green Mountain National Forest (GMNF) has identified early-successional habitats and their associated bird communities as a high management priority. In this study, we described the manner in which treatment method, time since last treatment, and retained tree cover influenced bird abundance and habitat conditions in

even-aged timber harvests on the GMNF, and in permanent wildlife openings maintained through mechanical treatment and prescribed burning. We collected data on bird abundance using ten minute 50m radius point-counts, and vegetation data with a point-intercept method. N-mixture models were used to relate bird abundance to management variables. These abundance models were then applied in a mixed integer optimization model to determine a treatment regime that maximizes the “bird conservation value” of shrubland openings. Both silvicultural and wildlife openings provided habitat for shrubland species of conservation concern, though birds were least abundant in silvicultural openings. We found little difference in bird abundance among burned and mechanically treated openings, despite pronounced differences in habitat. There were significant negative relationships between bird abundance and retained tree cover for seven out of eight focal species. Time since treatment was an important management variable for all species, and each peaked at different times post treatment. These results suggest that providing habitat for the entire suite of shrubland species requires maintaining a range of early-successional conditions across the landscape through carefully timed management events. Our optimization model provides a new approach for quantitatively determining a treatment regime that can maximize shrubland bird abundance, while accounting for the habitat needs of multiple species.

**F7.3 Smit, Ben,** (DST/NRF Percy FitzPatrick Institute, Department of Zoology and Entomology, University of Pretoria, Hatfield, South Africa); Harding, Craig T (DST/NRF Percy FitzPatrick Institute, Rondebosch, South Africa); Hockey, Phil AR (DST/NRF Percy FitzPatrick Institute, Rondebosch, South Africa); McKechnie, Andrew E (DST/NRF Percy FitzPatrick Institute, Department of Zoology and Entomology, University of Pretoria, Hatfield, South Africa)

#### BODY TEMPERATURE REGULATION DURING THE HEAT OF THE DAY IN FREE-LIVING WHITE-BROWED SPARROW-WEAVERS IN THE KALAHARI DESERT

Birds in hot desert environments often face the predicament of maintaining an adequate hydration state while regulating body temperature ( $T_b$ ) below lethal limits via evaporative heat loss. We assessed the effects of air temperature ( $T_{air}$ ) and humidity on  $T_b$  in 16 free-living White-browed Sparrow-Weavers (*Plocepasser mahali*; a 42-g non-drinking desert insectivore) during summer (maximum  $T_{air}$  range: 24° to 39.3°C) in the Kalahari Desert of South Africa, using surgically implanted miniature data loggers. Body temperature was typically regulated between 40° and 41.7°C (representing modal body temperature,  $T_{mod}$ ) during the cool early morning period. However, during the warmest part of day (12:00 to 18:00)  $T_b$  was significantly related to both  $T_{air}$  and humidity. During periods of high  $T_{air}$  and/or low vapour pressure deficits, mean and maximum  $T_b$  were up to 1.5° and 2.5°C respectively above  $T_{mod}$ . Focal observations revealed that the birds maintained high levels of foraging activity (30 - 50% of time) throughout the warmest part of the day, and contrary to expectations, did not show a significant decrease in foraging as  $T_{air}$  increased. However, heat dissipation effort (% time spent panting) increased significantly with increasing  $T_{air}$ , suggesting a trade-off between thermoregulation and foraging. Our findings suggest that small changes in  $T_{air}$  and humidity can have significant effects on thermoregulation even when  $T_{air}$  does not exceed avian  $T_b$ .

**W8.1 Smith, Brian Tilston,** (Museum of Natural Science, Louisiana State University, Baton Rouge, United States);

Prejean, Jesse (Museum of Natural Science, Louisiana State University, Baton Rouge, United States); Brumfield, Robb T.; McCormack, John E. (Museum of Natural Science, Louisiana State University, Baton Rouge, LA, United States); Cuervo, Andres () Museum of Natural Science, Louisiana State University, Baton Rouge, United States); Derryberry, Elizabeth (Museum of Natural Science, Louisiana State University, Baton Rouge, LA, United States); Hickerson, Mike (Biology Department, Queens College, City University of New York, Baton Rouge, LA, United States); Xie, Xiaou (Biology Department, Queens College, City University of New York, New York, NY, United States); Aleixo, Alexandre (Coordenação de Zoologia, Museu Paraense Emílio Goeldi, Belem, Brazil); Pérez-Emán, Jorge (Instituto de Zoología y Ecología Tropical, Universidad Central de Venezuela, Caracas, Republic of Palau); Cadena, Carlos Daniel; Flórez-Rodríguez, Alexander (Laboratorio de Biología Evolutiva de Vertebrados, Departamento de Ciencias Biológicas, Universidad de los Andes, Bogota, Columbia); Burney, Curtis W (Museum of Natural Science, Louisiana State University, Baton Rouge, United States); Fields, Sam (Museum of Natural Science, Louisiana State University, Baton Rouge, LA, United States)

#### COMPARATIVE PHYLOGEOGRAPHY OF LOWLAND NEOTROPICAL BIRDS WITH CROSS-ANDES DISTRIBUTIONS

The Neotropical lowlands harbor extraordinary avian diversity. Most models proposed to explain the diversification of this avifauna invoke large-scale, tumultuous historical events (e.g. uplift of the Andes, Pleistocene forest refugia) that fragment the distributions of widespread species. Although phylogeographic analyses often detect genetic variation that is structured by prominent geographic barriers, it is unclear if these barriers played a primary role in diversification or are simply structuring genetic variation that arose via other processes. A growing number of comparative phylogeographic studies in other organisms are finding that species having the same distribution rarely exhibit the same temporal or spatial patterns. Instead, individual phylogeographic histories reflect idiosyncratic responses that are driven by species ecology and stochasticity. Here, we present a comparative phylogeographic analysis of 27 widely distributed lowland bird species. We calculated levels of genetic structure in each species, and tested spatial and temporal patterns of diversification across prominent biogeographic barriers. We found a high degree of variation in patterns of phylogeographic structure and divergence times across biogeographic barriers, observations that are inconsistent with shared history. Analyses designed to detect the sources of this idiosyncratic spatial and temporal variation found that factors such as species ecology and geographic origin play important roles in determining the amount of genetic structure across the landscape and the timing of diversification across barriers. Our results suggest that cataclysmic events are not needed to explain the diversification of the Neotropical avifauna. Instead, a population model invoking heterogeneity in historical and contemporary landscapes and time may be sufficient.

**PS1.140 Smith, Jennifer,** (Virginia Tech, Lake Placid, United States); Fraser, James (Virginia Tech, Blacksburg, VA, United States); Morrison, Joan (Trinity College, Hartford, CT, United States)

#### A HABITAT MODEL TO ASSIST IN THE CONSERVATION OF CRESTED CARACARA

A small isolated population of Crested Caracara (*Caracara cheriway*) occurs in south-central Florida and is listed as threatened as the result of habitat loss and degradation. Evaluating the effects of land conversion on Crested Caracaras can be challenging since most pairs nest on privately owned land that is often inaccessible to surveyors. To assist in the monitoring of this population we quantified landscape characteristics in 1.78-km radius plots (the area equivalent to the average Crested Caracara home range) centered on 51 recently active nests. Using logistic regression we constructed a model to predict the occurrence of breeding Crested Caracara across their known range in south-central Florida. We then examined how well the model predicted the occurrence of breeding Crested Caracara using the leave-one-out cross-validation procedure. The best model indicated that the percentage of improved pasture was positively associated with the occurrence of breeding Crested Caracaras and that breeding Crested Caracara avoided areas of upland treed habitat that exceeded 30 m<sup>2</sup>. Cross-validation indicated that this model was 78% accurate at predicting nest occurrence (when the probability of detection >50%). This model can be used to predict the probability of Crested Caracaras nesting at land conversion projects sites and to direct nest searching thus avoiding searching in areas where Crested Caracaras are unlikely to occur.

**S2.11 Smith, Joseph**, (Nature Conservancy, Cape May, United States);

**MIGRATORY ECOLOGY AND CONNECTIVITY OF EASTERN WILLETS BREEDING IN DELAWARE BAY SALT MARSHES**

We tracked the migration of eastern willets (n =9) breeding in salt marshes of the Delaware Bay, New Jersey using geolocators over three breeding seasons. South-bound migration consisted of a single 3-day trans-Atlantic flight to stopover sites in northern South America (Guyana, Suriname, and French Guiana). After 10-22 days of stopover, these birds made a final flight to wintering destinations in mangrove-dominated landscapes of northern Brazil, with 7 of 9 birds overwintering in Maranhao state. For one individual tracked in two successive years, we confirmed stopover and wintering site fidelity. Two of the tracked birds were a mated pair. These individuals used stopover sites and wintering sites in South America that were within 100km of each other, but they migrated separately. North-bound migration consisted of a non-stop flight to the southeastern and mid-Atlantic U.S. coast, with a stopover of up to a week before a final flight to breeding sites at the Delaware Bay. At a broader scale, we examined non-breeding season recoveries of willets banded in the eastern United States and Canada (1957 -1989, n = 8). All recoveries were in Suriname, French Guiana, or northern Brazil. These two lines of evidence suggest strong migratory connectivity for eastern willets between breeding sites in eastern North America and wintering sites in northern South America and help delineate the non-breeding distribution of eastern and western willet subspecies.

**T11.5 Smith, Kathryn**, (Texas A&M University, College Station, United States); Cain, James (New Mexico State University, Las Cruces, United States); Morrison, Michael (Texas A&M University, College Station, United States)

**NESTING ECOLOGY OF THE BLACK-CAPPED VIREO IN SOUTHWEST TEXAS**

The Black-capped Vireo (*Vireo atricapilla*) is an endangered songbird with a current known breeding range from central Oklahoma south through Texas and into the Mexican states of Nuevo Leon and southwestern Tamaulipas. Most of the intensive studies on Black-capped Vireos have been in central

Texas and Oklahoma, a region characterized primarily by oak-juniper woodlands and live oak savannahs. There is little information about nesting ecology of the federally endangered Black-capped Vireo in the southern and western region of their breeding range, which is characterized by xeric thornscrub and patchy low-growing vegetation. We mapped territories and monitored 119 Black-capped Vireo nests across seven study sites in 2009 and 2010 in Val Verde County, Texas in the Devil's River region on the western edge of the Edwards Plateau. We observed 69 nests with cameras to identify nest predators. Productivity of Black-capped Vireos in the Devils River area appeared to be heavily influenced by weather, particularly precipitation during the breeding season. Mayfield estimates of daily survival rate ( $\pm$  SE) for incubation and nestling periods combined were  $0.947 \pm 0.007$  (95% CI = 0.931-0.959) and  $0.968 \pm 0.007$  (95% CI = 0.950-0.980) in 2009 and 2010, respectively. Clutch size was significantly smaller in 2009 ( $3.4 \pm 0.09$ ) than in 2010 ( $3.8 \pm 0.07$ ). Both nest depredation and parasitism by Brown-headed Cowbirds (*Molothrus ater*) were >10% higher in 2009 than in 2010. Species identified that have not been previously observed as Black-capped Vireo nest predators were bobcat (*Lynx rufus*), common raccoon (*Procyon lotor*), Greater Roadrunner, and the greater arid-land katydid (*Neobarrettia spinosa*). Nest building and incubation began 1-2 weeks earlier in the Devil's River area than in other areas being monitored during the same years in Texas, thus, the breeding season is longer for Black-capped Vireos in the Devil's River region. Black-capped Vireos in the region also had an advantage over vireos breeding in central Texas where parasitism pressure and initial incubation began simultaneously in 2009 and 2010, because parasitism by cowbirds was delayed 1 – 2 weeks after the commencement of incubation.

**PS1.52 Smith, Kimberly**, (University of Arkansas, Fayetteville, United States); Davis, Kelly (University of Arkansas, Fayetteville, United States)

**SPRING ARRIVAL OF 8 SPECIES IN FAYETTEVILLE, ARKANSAS 1844-1886, WITH SPECIAL REFERENCE TO RUBY-THROATED HUMMINGBIRDS TODAY**

Jacob M. J. Smith was a florist who lived in Fayetteville from 1836 to 1878. Starting in 1844, he began a diary where he recorded nearly daily weather data, first arrival of 8 species of birds in spring, and first flowering of over 100 plants until his death in 1878. William Baerg, a University professor, recorded first spring arrivals in Fayetteville from 1924-1928, 5 of which were recorded by Smith. There were no differences in average arrival date for the 5 species in common between Smith and Baerg. No modern data exist for first arrival of 7 species, but 6 datasets from the 1990s to 2010 show that Ruby-throated Hummingbirds are arriving about 2 weeks earlier in northwestern Arkansas now than they did 150 years ago.

**SAT8.3 Smith, Robert**, (The University of Scranton, Scranton, United States); Carrey, Michael (The University of Scranton, Scranton, PA, United States)

**THE INFLUENCE OF INTRINSIC AND EXTRINSIC FACTORS ON ARRIVAL TIMING AND SEASONAL REPRODUCTIVE PERFORMANCE IN FIELD SPARROWS (SPIZELLA PUSILLA)**

Timing of spring migration, and consequently arrival at the migratory destination, is a result of interactions between intrinsic and extrinsic factors operating both en route as well as prior to the migratory event. Here we take advantage of a long-term (22 yr) dataset documenting arrival timing and breeding biology of Field Sparrows to answer questions about how

intrinsic (sex and age) and extrinsic [(average monthly temperatures experienced while en route, North Atlantic Oscillation Index (NAO)] factors may have influenced arrival timing, onset of breeding and correlates of seasonal reproductive performance. We found that age and sex were related to arrival timing, with males preceding females and older birds arriving before younger individuals to breeding grounds in northeastern Pennsylvania. We did not, however, find a significant age effect on our measured reproductive parameters (clutch size and egg volume). Both mean April temperatures south of our study area and NAO were related to when an individual arrived at our study area. Females arriving early at our site initiated clutches earlier and fledged more young. Moreover, after controlling for female arrival day we found that NAO and temperatures experienced south of our study area were related to female clutch size but not average egg volume. Our results are congruent with the increasing evidence suggesting that events occurring during one phase of the avian annual cycle (e.g., spring migration) may carry over and affect events in subsequent phases (e.g., breeding season).

**F9.2 Smith, Susan**, (Rochester Institute of Technology, Rochester, United States); Miller, Allyson; Pagano, Todd (Rochester Institute of Technology, Rochester, NY, United States)

#### SEASONAL AND SITE DIFFERENCES IN REFUELING RATES OF SONGBIRDS DURING MIGRATION STOPOVER NEAR THE SOUTH SHORE OF LAKE ONTARIO

We investigated seasonal differences in refueling performance of migrating songbirds at the Braddock Bay Bird Observatory, an important stopover site on the south shore of Lake Ontario. We also compared refueling rates of birds captured at Braddock Bay with birds captured at an inland site with lower fruit abundance during fall migration. We measured plasma metabolites of captured birds as indicators of refueling rates (plasma triglyceride) and nutritional state (plasma uric acid). At Braddock Bay, Catharus thrushes had higher plasma triglyceride and lower plasma uric acid in fall compared to spring, whereas Red-eyed Vireos had higher plasma triglyceride in spring compared to fall but exhibited no seasonal differences in plasma uric acid. Seasonal differences in refueling and diet were not evident for White-throated Sparrows and Blackpoll warblers, although sparrows had higher plasma uric acid in the spring suggesting they had more protein their diet compared to birds captured during fall migration. Plasma triglyceride concentrations were higher in Blackpoll Warblers and White-throated Sparrows captured at Braddock Bay, where fruit abundance is high during the fall, compared to birds captured at an inland site with lower fruit abundance. Our data suggest that seasonal differences in refueling performance for some species may be linked to diet and that local variation in stopover site use is related to fruit abundance in the fall. Results of this study emphasize the importance of considering seasonal and local differences in food availability when managing stopover sites to provide high-quality habitat across seasons for migrating songbirds.

**PS2.66 Smits, Judit**, (University of Calgary, Calgary, Canada); FINAL EFFORT TO SAVE CANADIAN POPULATIONS OF GREATER SAGE GROUSE (CENTROCERUS UROPHASIANUS): AN INTERNATIONAL, INTERDISCIPLINARY RECOVERY EFFORT

The headline in a local newspaper “Industry blamed for bird’s demise; Sage grouse on path to extinction in Alberta” succinctly

describes the challenge that our interdisciplinary group of university researchers, provincial and state governments are addressing. We are applying conservation strategies at a regional scale to stabilize and, we hope, increase this subpopulation of the critically endangered Greater Sage Grouse (*Centrocercus urophasianus*) in southern Alberta. After a pilot effort in year I with 9 introduced birds, in 2012 30 birds will have been translocated. If the program is showing success, we plan to expand to a 4 year program to augment this population on silver sagebrush ecosystems of southern Alberta. Primarily adult females are being captured from large, active leks in southcentral Montana. After health examinations, plus blood, choanal, cloacal and fecal samples for disease and parasite testing, the birds are identified, radio-collared and released onto the remaining, active leks in southern Alberta. Serology is carried out for common and important pathogens. Spatial tracking of the birds is continuous, as their distribution, reproductive performance, brood rearing, and survival are followed. Recognizing the causal role of energy and agriculture developments in fragmenting sage-grouse habitat, industry is working with the recovery team to reclaim habitat and connectivity between adjacent sage-grouse populations. The success of this program is dependent upon its cohesive, interdisciplinary and collaborative nature, involving government agencies (Alberta Sustainable Resource Development, Montana Fish, Wildlife & Parks), academia (Veterinary Medicine, Environmental Design, Geography, U of Calgary) and the energy industry.

**PS1.15 Soberanes, José Manuel**, (UNAM, Tlalnepantla de Baz, Mexico); Arizmendi, María del Coro (UNAM, Tlalnepantla de Baz, Mexico)

#### THE GREEN MACAW (ARA MILITARIS), AND ITS ECOLOGICAL FUNCTION IN THE CONSUMPTION OF SEEDS AND FRUITS

In general the Psittacidae is considered as seed predators, therefore we studied the consumption of seeds and fruits of the Macaw (*Ara militaris*) in captivity. In the area of study, the vegetation is composed of low deciduous forest, Xeric scrublands, forest of oak and pine forest. From the data obtained from field observations from March 2005 to March 2007 in Santa Maria Tecomavaca (SMT) and in San Juan Coyula (SJC), species of plants consumed by the macaws were selected (*Bursera aptera*, *B. schlehtendalii*, *B. aloexylon*, *Ceiba aesculifolia* var. *parvifolia* in the town of SMT, and *Opuntia pilifera*, *Opuntia ficus* and *Stenocereus pruinosus* in the town of SJC) of which were collected ripe fruit and seeds. Seeds witness getting a percentage of germination between 60% to 93% were planted. We used 5 individuals of *Ara militaris*, which are in the collection of birds in the Zoo, Africam Safari in Valsequillo (Puebla, Mexico), and provided them seeds and fruits collected in field. It was noted how the handling of food and how to obtain the endosperm with Bill before passing through the digestive tract. Met the partial or total destruction of the seed in fruit with single seed like “copalillo” species, however, in the fruit with several seeds (tunas and pitayas) found that ingesting the fleshy mesocarp, the macaws not selected seeds and ingested them destroyed only a few coming several of these in the digestive tract. The excreta collected presented fragments of seeds, and seeds complete; These were planted and waited the germination of them finding no germination after a period of 30 days. The results indicate that you *Ara militaris* is a predator of the studied species seeds.

**PS2.214 Soberanes-Gonzalez, Carlos Alberto,** (UNAM, Tlalnepantla de Baz, Mexico); Arizmendi, María del Coro (UNAM, Tlalnepantla de Baz, Mexico)

#### THE MILITARY MACAW AT THE SABINO CANYON, OAXACA: POPULATION RELATIONSHIPS WITH ENVIRONMENTAL AND ECOLOGICAL VARIABLES

In birds, it is known that nest successful and chick production is correlated with food availability, and food availability is correlated with climatic variables as temperature and precipitation. Parrots and allies (Psittacidae) follow fruit abundance spatial and temporally, and their nesting coincides with season of best fruit production or best fruit availability. But, when drastic climatic variations occur, fruit phenology and food availability could vary, affecting parrot populations. At Tehuacán-Cuicatlán Biosphere Reserve inhabits one of the biggest populations of Military macaw in México (around 100 individuals), that realize spatial and temporal movements around the protected area. From February to October, population arrives to the Sabino Canyon to rest, feed, breed, and use cliff holes as nests. Sabino Canyon is a 200 m cliff surrounded by deciduous vegetation; the climate is dry and dominated by highly discrete and deeply variable rainy season that could create temporal and spatial changes in abundance and availability of food resource. The conditions after exposed, represents an excellent opportunity to realize a medium-term study to know how the Sabino Canyon climate and food availability affects the Military macaw population structure. Our objectives were: 1) To know the Military macaw population variation along time, and 2) to establish the relationship between Military macaw population with the food availability and inter-annual changes in climate at the Sabino Canyon. We found significant differences between seasons, between years and between seasons and years, indicating that not all the population arrives year to year to the Sabino Canyon. High temperatures, flower production of *Plumeria rubra* and fruit production of *Ceiba aesculifolia*, were the most important factors related with the reproductive season of military macaw at the Sabino Canyon. In general, the food offer remains during all macaw staying at the Sabino Canyon, but the flowers of *Plumeria rubra* was the item with the strongest relationship with macaw abundance during reproductive season. The presence of Military macaw at the Sabino Canyon were related with climatic and ecological variables, nevertheless, chick production was not related with the factors included in this study, because this recruitment were so low in all years.

**PS1.141 Solomon, Lauren,** (Kauai Forest Bird Recovery Project, Kalaheo, United States); Crampton, Lisa; Hammond, Ruby (Kauai Forest Bird Recovery Project, Hanapepe, United States); Roberts, Pauline (Sapphos Environmental, Inc, Pasadena, Canada)

#### TERRITORY SELECTION BY PUAIOHI: INFLUENCE OF FOOD ABUNDANCE, NEST SITES, AND FOREST COMPOSITION AND STRUCTURE

The critically endangered Puaiohi, *Myadestes palmeri*, is the only extant frugivorous songbird native to Kaua'i. Facing myriad anthropogenic threats, and thought to number only a few hundred individuals, it is confined to the remote Alaka'i Wilderness above 1000-m elevation. Breeding pairs establish territories along deeply incised streams and typically nest on steep cliffs along these streams. The relative influence of topography, vegetation, food, and availability of suitable nest sites on Puaiohi space use and distribution is unknown. We located nests from 2007-2011 and spot-mapped territories from 2009-2011 along two streams and evaluated the distribution of cliff walls, food, and vegetation within used (territories) and

unused sections of streams. The number (min: 18, max: 22 territories) and location of territories was similar among years, and nests (N=87) and nest walls (N=48) were often reused. Our results suggest that Puaiohi prefer larger nest walls; walls with nests were significantly taller ( $12.9 \pm 5.6$  m) than walls without nests ( $P = 0.02$ ) and walls with nests used multiple times were larger than walls with nests used once. We surveyed food and vegetation in 2010 at 35 plots (18 inside territories, 17 in unused areas) and initial results suggest that fruit of two species (*Leptocophylla tameiameia* and *Broussaisia arguta*) influence territory distribution. We discuss how such preferences restrict use of streams outside their current range and assess implications for management, including suitability of release sites for future Puaiohi translocations.

**S11.7 Soos, Catherine,** (Environment Canada, Saskatoon, Canada); Harms, Naomi Jane (University of Saskatchewan, Saskatoon, SK, Canada); Gilchrist, Grant (Environment Canada, Ottawa, ON, Canada); Iverson, Samuel (Carleton University, Ottawa, ON, Canada); Foster, Jeffery (Center for Microbial Genetics & Genomics, Northern Arizona University, Flagstaff, Arizona, Canada); Bortolotti, Gary R. (University of Saskatchewan, Saskatoon, SK, Canada); Forbes, Mark (Carleton University, Ottawa, ON, ON, Canada)

#### EMERGENCE OF AVIAN CHOLERA IN THE EASTERN CANADIAN ARCTIC: INVESTIGATING ORIGINS, RESERVOIRS, SPREAD, IMPACTS, AND RISK FACTORS

Since the emergence of avian cholera in the largest northern Common Eider breeding colony in Canada in 2005, significant annual mortality, ranging from 5-36% of breeding females, has been observed. Multiple unrelated serotypes of *Pasteurella multocida*, the causative agent, have been detected within and between years suggesting multiple introductions of this pathogen into the population. A multidisciplinary research team was assembled to investigate the ecology of this pathogen at the individual, population, community, and larger geographic scales, with the objective of identifying ultimate origins and proximate sources (i.e., avian or environmental reservoirs) of this pathogen; investigating the spread of the disease in the eastern Canadian arctic; investigating the impacts of the disease on the affected eider population; investigating the impacts of pre-breeding infection on survival and reproduction during outbreaks; investigating the effects of historical stress (as measured by feather corticosterone) on survival and reproduction during outbreaks; and investigating the relationship between annual climatic variation and stress responses to evaluate possible mechanisms for how changes in climate may indirectly impact on host survival and reproduction during disease outbreak events. Of thousands of samples collected from multiple species and locations in Canada's eastern arctic since 2007, *P. multocida* DNA has been detected in apparently healthy birds (eiders, geese, gulls) and in the environment before and during outbreaks. To identify origins, genotyping techniques are being used to investigate relatedness among isolates obtained from apparently healthy carrier birds and from recent outbreaks in the arctic and previous outbreaks across North America. Preliminary results using multi-locus sequence typing show clear differentiation among, and some variation within, serotypes. Repetitive element palindromic PCR assays are currently being explored to compare isolates of the same serotype at a finer resolution. Preliminary feather corticosterone analyses reveal significant annual variation, which is currently being examined in relation to climatic variables during the period of feather growth, and in relation to reproduction and survival during avian cholera outbreaks.

**PS2.194 Sorenson, Lisa**, (Society for the Conservation and Study of Caribbean Birds, Boston, United States); Haynes-Sutton, Ann (Society for the Conservation and Study of Caribbean Birds, Arlington, United States); Rivera-Milan, Frank (Ecologist, Laurel, United States); Gerbracht, Jeff (Cornell Lab of Ornithology, Ithaca, United States); Wheeler, Jennifer (Society for the Conservation and Study of Caribbean Birds, Arlington, United States)

#### PROMOTING CARIBBEAN WATERBIRD AND WETLAND CONSERVATION THROUGH THE CARIBBEAN WATERBIRD CENSUS (CWC)

The Caribbean is an archipelago of ~27 countries including thousands of islands that provide habitat for both long and short distance migrant, wintering waterbirds, as well as breeding residents and endemics. Good information about the distribution and abundance of waterbirds throughout the region and critically important sites is lacking. In 2011, the Society for the Conservation and Study of Caribbean Birds (SCSCB) established the Caribbean Waterbird Census (CWC), a region-wide waterbird and wetland monitoring program to begin to address this gap. The goal of the program is to promote the conservation and management of resident and migratory waterbirds and their wetland habitats through monitoring and to build capacity of local partners to participate in monitoring and protect, manage, and conserve their wetlands. The CWC offers a hierarchical and flexible approach to monitoring (employing levels of monitoring) that enables the user to choose the protocol and extent of participation in the program that is best suited to their objectives, available resources and capacity. The basic CWC protocols (Level 2 – area search and point count) include measures of detection probability, which are essential for accounting for bias in monitoring. To support this program, SCSCB has been holding training workshops on how to count waterbirds, and has developed a manual that includes standard monitoring protocols for waterbirds and wetlands, Caribbean Waterbird Census Manual: Promoting Conservation of Waterbirds and Wetlands through Monitoring. The first and second region-wide CWC counts were held during a 3-week period from January 14th to February 3rd, 2011 and 2012, however, participants are encouraged to count birds year-round especially during migration periods, in order to identify key stopover sites. We provide an overview of the monitoring protocols, training workshops and small grants program, and report the results of the first two regional counts. Plans for expansion will be discussed, including how the results can be applied to conservation and integrated with the existing Neotropical Waterbird Census long underway in South America and in development in Central America.

**F6.5 Sorenson, Michael**, (Boston University, Boston, United States); DaCosta, Jeffrey; Kuras, Evan; Stryjewski, Katherine (Boston University, Boston, MA, United States); Balakrishnan, Christopher (East Carolina University, Greenville, NC, United States); Butler, Naomi (Boston University, Boston, MA, United States); Spottiswoode, Claire (University of Cambridge, Cambridge, United Kingdom)

#### EXTRAORDINARILY DIVERGENT, HOST-SPECIFIC MTDNA LINEAGES IN GREATER HONEYGUIDE AND CUCKOO FINCH: IMPLICATIONS FOR THE GENETICS OF HOST-SPECIFIC ADAPTATION

A long-standing hypothesis suggests that host-specific adaptations in brood parasitic species associated with multiple hosts might be coded on the maternally inherited W chromosome. The idea originated as an explanation for the

maintenance of host-specific “gentes” in the Common Cuckoo (*Cuculus canorus*), but genetic evidence to date has been both indirect and equivocal. An alternative model of divergence with gene flow requires some level of assortative mating between males and females reared by the same hosts combined with selection on host-specific traits such as egg or nestling mimicry, a model supported by the available genetic data for indigobirds (*Vidua* spp.). We recently reported (Spottiswoode et al., PNAS, 2011) the coexistence of highly divergent mtDNA haplotypes in the Greater Honeyguide (*Indicator indicator*); ancient female lineages (~15% divergent in ND2 sequence) are perfectly associated with ground-nesting and tree-nesting hosts, respectively, but show little or no differentiation at nuclear loci. Analyses of the Cuckoo Finch (*Anomalospiza imberbis*) reveal a similar pattern; in Zambia, female lineages associated with *Prinia* and *Cisticola* hosts, respectively, are ~9% divergent in ND2 sequence. These results for Greater Honeyguide and Cuckoo Finch contrast markedly with the much lower level of host-related mtDNA differentiation in the Common Cuckoo and suggest a better fit to the expectations of the W chromosome hypothesis. While evidence for the latter remains entirely indirect, hypothetical selective sweeps of W chromosome genes provide an intriguing hypothesis for the elevated rates of mtDNA sequence evolution we have observed in honeyguides and parasitic finches. Challenges for directly testing the W chromosome hypothesis will be discussed.

**PS1.4 Sosa-Lopez, Jose Roberto**, (University of Windsor, Windsor, Canada); Mennill, Daniel (University of Windsor, Windsor, ON, Canada)

#### THE VOCAL BEHAVIOUR OF THE BROWN-THROATED WREN (*TROGLODYTES AEDON BRUNNEICOLLIS*): COMPLEX SONGS AND INSIGHTS ON THE USE OF SYNTACTIC RULES

Empirical descriptions of vocal behaviour are needed for understanding the biology of animal communication, patterns of geographic variation, adaptation, speciation, population demography, responses to anthropogenic disturbance, and the role of genetics and social experience in acquiring behaviour. In this study, we provide the first detailed analysis of the vocal behaviour of the Brown-throated Wren (*Troglodytes aedon brunneicollis*), a neotropical songbird found in oak forests in the highlands of Mexico and United States. While some consider this taxon a subspecies of the Northern House Wren, many feel that it is a distinct species. Careful description of their acoustic behaviour is important for resolving this unanswered question. We describe the fine structural characteristics of this species' song, assess repertoire size in terms of both song types and syllable types, and estimate repertoire sharing among neighbours. We investigate the relationship between shared syllables and geographic distance, evaluate diel variation in vocal output, and explore whether these wrens follow syntactic rules. Our analyses reveal that Brown-throated Wrens have a finite repertoire of syllable types and that these are combined following specific syntactic rules. In contrast, we show that song repertoire is not fixed; birds recombine their syllables to produce highly variable song types. Our results suggest that this species uses syllables as the basic unit for composing songs. Our study provides the first comprehensive description of the vocal behaviour of the Brown-throated Wren and contributes insight into the organization of song composition in tropical birds.

**PS1.153 Soto-Rojas, Octavio**, (Facultad de Biología, Universidad Michoacana de San Nicolas de Hidalgo, Morelia, Mexico); Salgado-Ortiz, Javier (Facultad de Biología, Universidad Michoacana de San Nicolas de Hidalgo, Morelia,



Mexico); Lougheed, Stephen (Department of Biology, Queen's University, Kingston, ON, Canada)

#### LIFE HISTORY ATTRIBUTES OF A BREEDING POPULATION OF THE LOGGERHEAD SHRIKE (*LANIUS LUDOVICIANUS*) FROM CENTRAL MEXICO.

The breeding biology of the Loggerhead Shrike has been well studied in Canada and United States of America, however data are lacking for Mexico where a number of distinct subspecies exist. In this study, we describe for the first time, life history attributes of a breeding resident population from central Mexico. Breeding data were collected from February to June of over three breeding seasons 2007-2009 within agricultural landscapes in the state of Michoacan. We found nests primarily using behavioural cues as well as by direct scanning of vegetation. To quantify breeding aspects we checked nests every third day to determine the laying date of the first egg, clutch size, duration of incubation and brooding periods, number of eggs hatched, fledging dates and nesting success. The average date of clutch initiation was 28 March with no annual variation among years. The earliest clutch recorded was 21 February 2009 and the latest on 3 June 2007; the breeding season extended 4 months (late February to early June). The majority of clutches were initiated during the final part of the dry season (March-April). The mean clutch size was 4.1 eggs (range 2-5). Incubation averaged 18.2 days and brooding 16.5 days. Nesting success for the three years combined was 63.7 %. Successful nests averaged 1.6 fledglings. Depredation was the main cause of nest failure (33.8 %). Overall, the life history attributes observed in our population are roughly comparable to those reported in other populations in the United States.

**PS1.108 Spellman, Garth,** (Black Hills State University, Spearfish, United States); Kennedy, Kyle; McCallister, Joseph; Murphy, Amanda; Nies, Jason; Sheets, Jordan (Black Hills State University, Spearfish, United States)

#### INSIGHTS INTO THE SHARED EVOLUTIONARY HISTORY OF BIRDS AND THEIR GUT MICROBIOTA

Birds have been overlooked in vertebrate gut microbial research, but the limited existing research on bird gut microbiota suggests a strong genetic component to community composition and diversity. Thus, birds should be an excellent system in which to study shared evolutionary history between hosts and their symbiotic microbial communities. Also, the distinctiveness of avian gut microbial communities suggests a survey of avian gut microbial diversity is needed and will likely reveal a considerable number of novel microbial assemblages. We examined gut microbial diversity in 26 species of bird representing 20 different avian families and 2 orders (Passeriformes and Piciformes). Two species were sampled in triplicate and across the breeding season to account for individual and temporal variation in gut microbial diversity within a species. Gut microbial community diversity for each species was ascertained through Roche 454 pyrosequencing of 16S amplicons. To examine the relationship between phylogeny and microbial  $\beta$ -diversity, we compiled full cytochrome b sequence data for each bird species from Genbank and calculated the uncorrected sequence divergence for each pairwise comparison. Estimates of  $\beta$ -diversity (measured by phylogenetically informed Unifrac distances) were calculated between the gut microbial communities of each host. Linear regression analysis of phylogenetic distance and  $\beta$ -diversity estimates support a significant positive relationship for comparisons between all gut microbial Phyla, Firmicutes, and Proteobacteria, but not Bacteroidetes. Further examination of the relationship between phylogeny and gut microbial diversity within Firmicutes and Proteobacteria (i.e., Clostridia and

Bacilis) demonstrates an even tighter correlation, which is significant given these genera are considered of great importance to vertebrate gut function. Regression plots possessed large residuals, so to account for other variables we tested for a significant relationship between preferred diet and habitat using t-tests with Unifrac distances and these categories. Neither diet ( $p=0.64$ ) nor habitat ( $p=0.14$ ) was significantly associated with microbial diversity; however, insectivores possessed more similar (lower Unifrac distances) microbial assemblages than granivores. Our data provide evidence for shared evolutionary history between birds and their gut microbiota.

**W17.11 Squires, Kelly,** (Simon Fraser University, Vancouver, Canada); Lertzman, Ken (Simon Fraser University, Vancouver, BC, Canada); Bunnell, Fred (University of British Columbia, Vancouver, Canada)

#### DEMISE OF A PARADIGM? WHY 'HABITAT THRESHOLDS' DON'T TELL US HOW MUCH HABITAT IS ENOUGH

'How much habitat is enough?' has been referred to as the most important question for conservation biology. Researchers have tried to identify quantitative goals for land protection from 'thresholds' in species-habitat models. To provide a critique of habitat threshold studies, we reviewed 48 empirical studies and conclude that thresholds identified from species-habitat models have not provided reliable estimates for land protection. The majority of authors equated thresholds in territory-scale models of species presence-absence with landscape-scale thresholds in probability of population persistence. Sample size equals one for inferences of landscape-scale processes derived from a territory-scale study; inferences are especially weak from studies of vagile species like birds (48% of the studies). Alternative hypotheses were tested in only three of the 31 studies in which habitat loss was equated with declines in forest cover. All three studies found unimodal responses of birds to forest cover, revealing that the common assumption of a monotonic relation between forest cover and habitat loss, and insufficient testing for alternatives, have precluded reliable inferences of habitat loss effects. Major inconsistency in interpretations of threshold responses were found - authors of over half of the studies visually identified 'thresholds' from linear models. We conclude that the habitat thresholds paradigm has resulted in confused efforts to define management goals using species responses to vegetation. We propose an alternative framework, based on the premise that inferences and management guidelines be limited to the scale at which species were observed.

**PS2.101 Squires, Kelly,** (Simon Fraser University, Vancouver, Canada); Shewan, Julia (Unaffiliated, Vancouver, Canada)

#### OFF-ROAD SURVEYS IN THE MIXEDWOOD BOREAL FOREST RESULT IN HIGHER QUALITY HABITAT MODELS THAN THE ROADSIDE BREEDING BIRD SURVEY

The roadside Breeding Bird Survey (BBS) is one of the most widely applied conservation data sets in North America. Data generated from the roadside Breeding Bird Survey (BBS) have been used to predict the responses of bird species to forest habitat. However, habitat models generated from bird surveys along roads may be biased due to roadside habitat structures and processes that differ from the forest interior. We tested the reliability of habitat models derived from roadside data by comparing them with models generated from forest interior surveys. Roadside BBS and off-road surveys were conducted within the mixedwood boreal forest of northeastern BC from

2002 to 2009. Habitat models were derived by relating the presence-absence of commonly-detected species to the deciduous-conifer ratio of old (> 100 years) forest stands. We compared the shapes of predicted responses by comparing slopes, support for non-linearity, and by using segmented regression to determine ‘change points’ in the relationships. We assessed model quality using measures of predictive and explanatory ability. Response shapes differed for six of the sixteen species commonly-detected along roadsides and in forest interiors. In particular, linear models for three species (dark-eyed junco, red-breasted nuthatch, western tanager) were derived from roadside surveys, in contrast to non-linear models from forest interior data. Change points were similar between both models sets, but more change points were identified in forest interior models. Models generated from off-road data had higher predictive and explanatory ability for twelve of the sixteen species. Higher variation and thus lower quality of roadside models generally resulted from more detections of deciduous-associates in conifer-dominated stands along roads, where shrubs were more abundant relative to forest interiors. These results suggest that models relating bird species to the composition of forest interiors rather than roadside forests are more reliable tools for predicting impacts of disturbances like logging that alter forest composition.

**PS1.203 St. Clair, Colleen Cassady**, (University of Alberta, Edmonton, Canada); Habib, Thomas; Shore, Bryon (Canada)  
SPATIAL AND TEMPORAL CORRELATES OF MASS BIRD MORTALITY IN THE OIL SANDS OF ALBERTA

On three occasions in the past 30 years, mass mortality of migratory birds has been recorded in the oil sands region of Alberta. These events occurred in both spring (May 1979 and April 2008) and fall (October 2010). We examined the weather correlates of all three events and conducted a more detailed examination of both spatial and temporal factors for the five tailings ponds at which birds landed in the final event. Easterly winds, which are unusual in the region, occurred in the day prior to all three events. Temperature and barometric pressure dropped precipitously in the days before the 2008 and 2010, but not the 1979, events. For the 2010 event, dead birds were recovered at ponds that were close to the Athabasca River with lesser coverage by acoustic deterrents. Within ponds, mortalities were concentrated on downwind locations within 200 m of shore. All mortalities appear to have occurred at night in the vicinity of anthropogenic light, which typifies sites of mining activity where residual bitumen is more likely to occur. We suggest that geographical, meteorological, physiological and operational variables act together to create a ‘perfect storm’ of vulnerability for migratory birds in the oil sands.

**SAT10.1 St. Clair, Toby**, (Simon Fraser University, Burnaby, Canada); Baird, Patricia; Bendell, Leah (Simon Fraser University, Burnaby, BC, Canada)  
INVESTIGATING SOURCES AND RISK OF METAL EXPOSURE TO DUNLINS (*CALIDRIS ALPINA*) IN THE FRASER RIVER DELTA, BRITISH COLUMBIA

Estuaries receive deposition of suspended sediments and organic matter from aquatic systems. Heavy metals bound to such deposits accumulate in estuarine sediments. For coastal biota, risk of exposure to toxic quantities of metals is further elevated in coastal regions with dense human populations. Dunlins (*Calidris alpina*) are migratory sandpipers that feed variably in intertidal and agricultural areas on biofilm, insects, worms, gastropods, and other marine invertebrates. We analyzed cadmium, copper, and zinc levels in Dunlin gizzard contents from individuals captured in the Fraser River Delta, adjacent to

Vancouver, British Columbia, to assess the level of exposure and investigate the contribution of metals from different prey and habitat types. Daily metal exposure was calculated based on energetic needs (~105-130 KJ/day), and the energetic concentrations of food items relative to metal concentrations. Cadmium exposure was greater for Dunlin foraging in intertidal habitat as compared to those feeding in agricultural habitat. While ingested biofilm and associated sediments had significantly higher cadmium concentrations ( $7.4 \mu\text{g/g} \pm 1.9(\text{SD})$ ) than other food types, mud snails had a slightly higher amount of cadmium relative to their energetic contribution to Dunlin diet ( $0.74 \mu\text{g/Kj} \pm 0.15(\text{SD})$ ). Daily metal exposure was found to be less than the “lowest observed adverse effect levels” (LOAEL) for avian species in laboratory settings, but higher than “no observed adverse effect levels” (NOAEL) of cadmium for an all mud snail diet in Boundary Bay, BC and higher than zinc NOAELs for a biofilm diet and terrestrial diet at the Vancouver International Airport. The Fraser River Delta serves as a refueling stopover site for much of the Pacific Dunlin population as well as hundreds of thousands of other sandpipers during migration periods, broadening the implications of this research.

**SAT6.2 Stahl, Justyn**, (Institute for Wildlife Studies, San Diego, United States); Desnoyers, Nicole; Bridges, Andrew (Institute for Wildlife Studies, San Diego, CA, United States); Garcelon, David (Institute for Wildlife Studies, Arcata, CA, United States); Booker, Melissa (U.S. Navy, Coronado, CA, United States)

THE BENEFITS OF EARLIER NESTING IN THE SAN CLEMENTE LOGGERHEAD SHRIKE

The San Clemente Loggerhead Shrike is a federally endangered songbird, endemic to San Clemente Island, the southernmost of the California Channel Islands. Habitat loss and the introduction of non-native predators resulted in the near extinction of the subspecies. The U.S. Navy’s multifaceted recovery program has resulted in an increase from a low of 14 adults in 1998 to 179 in 2009. One current goal in the recovery program is determining which aspects of the recovery effort are most important for continued persistence of the population. Previous work has illustrated the positive effect of predator control on the reproductive success of nesting shrikes. Understanding the timing of predator control treatments may further enhance the Navy’s efforts to recover this population. We analyzed data for 440 nests from 2001–2011 to test for an effect of hatch date on nesting success, reproductive output, and the proportion of fledglings surviving to independence. Because of established protocol limiting the number of visits to active nests, accurate phenology data are only available for nests containing nestlings. We compared nests that hatched on or prior to the median hatch date to those that hatched after the median hatch date within each year, and then pooled data across years to control for variation in timing of nest initiation across years due to rainfall patterns. We found no difference in nesting success relative to median hatching date (76.9% before, 79.0% after). However, the number of young that fledged from successful nests was significantly higher for earlier nests: early nests fledged 3.8 fledglings and 3.0 independent offspring, compared to the 3.2 and 2.2 produced by late nests. Further, the proportion of fledglings surviving to independence was higher in earlier nests (79.7% vs. 68.1%), suggesting a survival advantage for offspring that hatch earlier in the year. These findings indicate that, while there does not appear to be a substantial difference in predation rates at the nestling stage throughout the breeding season, earlier nests produce more offspring and should receive preferential predator protection.

**F9.5 Stanley, Calandra,\*** (York University, Toronto, Canada); MacPherson, Maggie (Tulane University, New Orleans, LA, United States); Fraser, Kevin; McKinnon, Emily; Stutchbury, Bridget (York University, Toronto, ON, Canada)

**REPEAT TRACKING OF INDIVIDUAL WOOD THRUSH (HYLOCICHLA MUSTELINA) REVEALS CONSISTENT MIGRATION TIMING BUT FLEXIBILITY IN ROUTE**

Tracking repeat migratory journeys of individual animals is required to assess phenotypic plasticity of individual migration behaviour in space and time. We used light-level geolocators to track the long-distance journeys of migratory songbirds (wood thrush, *Hylocichla mustelina*), and, for the first time, repeat journeys of individuals. We compare between- and within-individual variation in migration to examine flexibility of timing and route in spring and autumn. Date of departure from wintering sites in Central America explained much of the variation (71%) in arrival date at North American breeding sites. Spring migration showed high within-individual repeatability in timing, but not in route. In particular, spring departure dates of individuals were highly repeatable, with a mean difference between years of just 3 days. Autumn migration timing and routes were not repeatable. Our results provide novel evidence of low phenotypic plasticity in timing of spring migration, which may limit the ability of individuals to adjust migration schedules in response to climate change.

**F16.7 Stanton, Richard,\*** (Department of Fisheries and Wildlife Sciences, University of Missouri-Columbia, Columbia, Canada); Dylan, Kesler (Department of Fisheries and Wildlife Sciences, Columbia, United States); Thompson III, Frank (United States Forest Service, Columbia, United States)

**RANGE EXTENSION AND HABITAT RESTORATION: DOES 'HILDEN'S PRINCIPLE' APPLY TO RESIDENT BIRDS?**

Theory predicts that birds are more stenotopic at the margins of an expanding range, occupying the best habitats first (Hilden, O. 1965. Habitat selection in birds: a review. *Annales Zoologici Fennici* 2:53-75). However, this theory may not apply to resident birds. For example, natural history traits associated with limited movement might cause resident birds to consistently occupy marginal habitats at the edge of their expanding range. We identified a Brown-headed Nuthatch (*Sitta pusilla*) range extension front where a patchwork of apparently suitable habitat was recently established by restoration efforts. We used occupancy modeling of survey data to test Hilden's Principle against competing models. Brown-headed Nuthatch presence was best predicted by models that incorporated connectivity of restored habitats and the range extension process. We also provide evidence of an abrupt change in the extent of cooperative breeding between established populations and the range extension front. This suggests a rapid, facultative shift in behavior that aligns with theory suggesting that helpers delay dispersal until breeding opportunities are available. We discuss the need to explicitly model dispersal with this possibility in mind, since any theory regarding mating systems and dispersal as fixed over short time intervals is likely mistaken, contributing to our persistent failure to predict the dynamics of species invasions and range extensions.

**T16.12 States, Sarah,** (Cornell University, Ithaca, United States); Hochachka, Wesley (Cornell Laboratory of Ornithology, Ithaca, United States); André, Dhondt (Cornell Laboratory of Ornithology, Ithaca, NY, United States)

**VARIATION IN PATHOGEN DISTRIBUTION ACROSS HOSTS DRIVES INFECTION RATES IN HOUSE FINCHES (CARPODACUS MEXICANUS) BY THE BACTERIUM MYCOPLASMA GALLISEPTICUM**

Variation within a group of hosts, such as sex, the number of individuals already infected, or the total pathogen load, likely drives rates of pathogen transmission. However, because bird feeders are often sites at which pathogen transmission can occur, the structure of the feeder itself, through its effect on interaction rates between birds and densities of pathogen accumulated from indirect transmission, may also have an important influence on disease dynamics. We examine the relative importance of the type of bird feeder, in contrast to these other factors, in determining the probability that individual House Finches (*Carpodacus mexicanus*) will become infected with the bacterium *Mycoplasma gallisepticum*, which causes conjunctivitis in the finches. Using weekly health status data collected from five groups of experimentally-infected captive house finches, we fit multi-state mark-recapture models to determine the factors predicting individual infection rates. Our results indicate that the total amount and distribution of the pathogen within a group of hosts influences the probability that an individual becomes infected. We also found no differences in individual rates of infection between two distinctly different feeder types. These results suggest that heterogeneities within the group itself, not simply association patterns due to feeder structure, can drive variation in rates of pathogen transmission.

**PS2.213 Steele, Marla,** (University of Arkansas, Fayetteville, United States);

**STATUS AND DISTRIBUTION OF PALLAS'S FISH EAGLE IN ASIA**

The Pallas's Fish Eagle (*Haliaeetus leucoryphus*) is a globally vulnerable species, classified by the IUCN Red List with a decreasing population trend. Prior to the 1900's, Pallas's Fish Eagle was considered common throughout Asia. Its historical range extended from the Caspian Sea to China and from Russia to India and Myanmar. Currently, BirdLife International estimates a decreasing overall population of 2,500–9,999 individuals. The species is lacking in population abundance and range information. Furthermore, its seasonal movements and migration patterns are complex and severely data deficient. Conflicting observations suggest the potential for two separate breeding migrant populations located in the north, around Mongolia and Kazakhstan, and the south, Pakistan to Myanmar, whose range overlaps around the Himalayas with inverse breeding seasons based upon climate factors, such as the timing of the spring thaw and the onset of the East Indian monsoon. This presentation discusses current known status and distribution of Pallas's Fish Eagle in Asia, including preliminary data collected from population surveys in northeast India and western Mongolia. These results will serve as a foundation for future studies of Pallas's Fish Eagle migration in the current northern and southernmost population range.

**F1.3 Stenhouse, Iain,** (Biodiversity Research Institute, Gorham, United States); Williams, Kate (Biodiversity Research Institute, Gorham, ME, United States)

**SUPER HIGH-DEFINITION VIDEO AERIAL SURVEILLANCE AND ANALYSIS: CAPABILITIES AND RESULTS FOR OFFSHORE MID-ATLANTIC WATERS**

Aerial surveillance employing gyroscopically stabilized high-definition video cameras has become a cost effective method for broad-scale environmental and wildlife surveys. Multiple video cameras mounted on the underside of twin-engine aircraft

capture extremely high-resolution images which are examined and reviewed by an experienced ground-based team, and targets identified to the lowest taxonomic group onscreen. Videography is linked to a GPS system that provides each frame with a precise geographical location, and parallax technology allows for the estimation of flight height of avian targets. Compared with traditional direct observational aerial surveys, the advantages of this innovative technique are many, including: increased accuracy, faster coverage, less disturbance, improved quality control, auditable data, and safer flying at higher elevations. We recently initiated the first broad-scale use of this technique in North America to survey marine birds, marine mammals, and sea turtles in the offshore waters of the mid-Atlantic region. Here, we present preliminary results from these surveys in U.S. waters, highlighting the accuracy and ease of identification of different taxonomic groups, as well as the challenges faced. We provide recommendations on the application of this technique moving forward.

**PS1.62 Stewart, Becky,** (Bird Studies Canada, Sackville, Canada);

#### FROM DATA TO CONSERVATION: USING "CITIZEN SCIENCE" MONITORING AND RESEARCH TO ADVANCE STEWARDSHIP AND CONSERVATION ACTION IN THE MARITIME PROVINCES

Multi-agency partnerships and citizen-science-based research and monitoring projects have been used to provide data essential to directing management and conservation, and, to evaluate and direct on-the-ground efforts for birds and their habitats. In the Maritimes provinces, data gathered by partners and volunteers, through Bird Studies Canada's programs have had direct conservation impacts at regional and national scales. Programs include: the Nova Scotia Piping Plover Conservation Program, the High Elevation Landbird Program, Maritimes Swiftwatch and the Maritimes Breeding Bird Atlas. While the questions addressed and methodologies employed vary by project, the results of each have been used to identify priorities, inform policy and direct management at multiple scales. In addition, each program has used a combination of staff and volunteers to gather enormous, geo-spatial, and often long-term, datasets. Here, we review the results of these projects, highlighting the links between the data gathered and ongoing conservation, stewardship and monitoring efforts for several bird species, including species at risk. Successes, challenges and limitations are discussed. In addition, the added value of community "buy-in" from both public and private sectors, given its potential implications for project success and the lifespan of conservation impacts, merits additional consideration in project planning.

**F3.1 Stewart, Laura R.,** (Texas A&M University, College Station, United States);

#### THE IMPACT OF A FOREST PATHOGEN ON THE ENDANGERED GOLDEN-CHEEKED WARBLER

Forest pathogens can substantially modify the vegetative characteristics of the stands in which they occur. These changes can in turn alter the extent to which animals utilize impacted areas. Oak wilt is a fatal disease of oaks that occurs throughout most of the breeding range of the federally endangered golden-cheeked warbler but whose impact is poorly understood. I investigated the influence of oak wilt on habitat selection and quality for golden-cheeked warblers then used remote sensing to estimate the amount of potential habitat currently affected by oak wilt and the amount of habitat at risk of being affected in the near future. I found proportional occupancy and territory density in unaffected areas to be, respectively, 3.5 and 1.8 times that of affected areas. Pairing success was 27% lower for territories

containing oak wilt but fledging success was not affected. I estimated that 6.9% of potential golden-cheeked warbler habitat and 7.7% of the total area within my study region was affected by oak wilt in 2008. By 2018, I predicted that 13.3% of potential golden-cheeked warbler habitat and 16.0% of the study region would be affected by the disease. My results suggest that the presence of oak wilt negatively influences habitat selection and quality for golden-cheeked warblers. Additionally, oak wilt frequently occurs in golden-cheeked warbler habitat and will continue to spread into warbler habitat in the coming years. Future management efforts should address the threat oak wilt poses to golden-cheeked warblers by incorporating applicable preventative measures.

**W15.11 Stiles, Gary,** (Instituto de Ciencias Naturales, Universidad Nacional de Colombia, ); Alejandro Rico-Guevara

The cutting edges (tomia) of hummingbird bills may display a series of minute serrations, whose function has remained uncertain. We examined ca. 2000 specimens representing 96% of the genera and 57% of the species of hummingbirds to determine the form and distribution of tomial serrations. Presence or absence of serrations was nearly always consistent within genera; ca. 90% of the genera possessed serrations. We found three tomial classes that differed in size, shape, number, orientation and distribution of the serrations along the bill, as well as in their mode of replacement during the annual molt of the rhamphotheca. Class A tomia mostly had higher, sharper serrations present along a greater proportion of the tomia, and males often differed from females in the height, number, orientation and distribution of serrations. Class B tomia had mostly lower, fewer "saw-toothed" serrations present or best developed in a restricted zone near the bill tip and were sexually monomorphic; class C tomia were unserrated. Mapping tomial type on a recent phylogeny of hummingbirds, class C occurred in the basal clade and in a few genera in other clades; class A tomia occurred in all members of one clade and in scattered genera in three others, whereas class B tomia predominated in six of the eight major clades. We found no convincing evidence that serrations function in nectar robbing, preening, gathering nest material or arthropod capture, but class A serrations might function in male-male aggression. Class B serrations appear to function in removing nectar from the tongue with each lick during visits to flowers.

**F15.2 Stocking, Jessica J,** (North Carolina State University, Raleigh, United States); Simons, Theodore R. (North Carolina State University, Raleigh, NC, United States)

#### COMPARISON OF NEST SUCCESS AND CHICK GROWTH ON TRADITIONAL AND NON-TRADITIONAL ISLAND SITES FOR THE AMERICAN OYSTERCATCHER IN NORTH CAROLINA

The American Oystercatcher ( *Haematopus palliatus* ) is an important indicator of ecological conditions on Atlantic coast beaches. Because of its conspicuousness and site fidelity, it is an ideal study species for monitoring factors affecting the conservation and management of beach-nesting birds. Historically, *H. palliatus* is thought to have nested preferentially on outer beaches but appears to be exhibiting increased habitat plasticity in recent decades. The shift in habitat use could be a response to development, predation or human disturbance, and is likely a combination of factors. This study provides information about the viability of non-traditional, interior dredge islands as possible population sources and replacement nesting habitat for this beach-nesting shorebird. Dredge islands offer novel habitats that are largely devoid of resident mammalian predators. However, these sites often have

potential avian nest predators nesting in close proximity to oystercatchers. An additional tradeoff is that food sources are often a greater distance to nesting habitat on dredge islands, requiring lengthy food acquisition trips by adults during nesting and chick-rearing phases. Between 2009 and 2011, we monitored 437 barrier nests and 143 dredge nests and collected measurements on chicks during the pre-fledging phase. We hypothesized that nest success and chick growth would be suppressed on dredge islands compared to barrier islands. We did not find support for a difference in growth rates between dredge and barrier chicks; it appears that dredge island chicks that survive the first few days after hatch receive adequate nutrition to grow at rates similar to chicks in barrier territories. Daily survival rates of barrier nests were slightly lower than dredge nests, but barrier territories/pairs fledged nearly twice as many chicks per successful nest. If food constraints are inhibiting productivity on dredge islands, they are not expressed in the growth of chicks. However, fewer chicks produced by dredge-nesting pairs could indicate a life history change associated with the tradeoffs of nesting in non-traditional habitats.

**PS2.145 Stoklosa, Samantha, \*U** (The Ohio State University, Columbus, United States);

**DETERMINING HIGH-QUALITY HABITATS FOR AVIAN SPECIES: AGE RATIOS AND CONDITION OF RED-WINGED BLACKBIRDS ON THE ISLANDS OF LAKE ERIE**  
Older organisms with more foraging experience tend to be in better condition than more inexperienced organisms. This is reinforced by the tendency of older animals to have higher-quality territories, due to their greater experience or larger size. Therefore, older RWBLs should be in better condition and live in higher-quality habitats. Data were collected on age, body mass, and tarsus in order to determine the age ratios and condition of male and female Red-winged Blackbirds on Gibraltar, South Bass, North Bass, and Middle Bass Island of Lake Erie, Ohio. There tended to be a bias towards younger males than older males on most islands. There was a bias towards older females on all of the islands. Older males tended to be in better condition than younger males. Based on these results older males are in better condition and potentially have the ability to seek out higher-quality habitats. Poor-quality habitats could also have an effect on the condition of both male and female Red-winged Blackbirds. More data would need to be collected in order to determine female condition compared to both age and the different islands. Current trends also suggest that South Bass Island and North Bass Island may provide better habitat, but again, more data will be needed in coming years.

**F5.1 Stoleson, Scott**, (USFS Northern Research Station, Irvine, United States); Nuttle, Tim (Indiana University Of Pennsylvania, Indiana, PA, United States); Yerger, Ellen (Indiana University Of Pennsylvania, Indiana, United States); Ristau, Todd (USFS Northern Research Station, Irvine, United States)

**GHOSTS OF HERBIVORY PAST: LEGACY EFFECTS OF WHITE-TAILED DEER ON FOREST BIRDS COMMUNITIES**

Herbivores such as white-tailed deer (*Odocoileus virginianus*) can alter the structure and composition of plant communities on the forest floor. We tested the hypothesis that these top-down perturbations by herbivores can cause long-term changes in plant communities that ricochet back up the new food chain that depends on them. In a large-scale, 30-yr controlled field experiment, we show that 10 years of top-down control by deer

at varying densities created contrasting forest seedling communities that subsequently exerted bottom-up effects that ricochet back up 3 trophic levels 20-30 years later. Higher deer densities during stand initiation caused significant reductions in tree species diversity, canopy foliage density, canopy insect density, and bird density in young (ca. 30 yr old) forests. We suggest both abundance and types of caterpillars present in a stand influenced bird communities. Because recruitment of trees from seedlings to the canopy occurs over a relatively brief period (about 10 years), while membership in the canopy lasts an order of magnitude longer, our results indicate that even short-term variation in deer density may cause centuries-long disruptions to forest ecosystem structure and function. Consequently, such legacy effects on communities may persist long after deer densities become effectively controlled, obscuring causal relationships.

**SAT9.3 Stouffer, Philip**, (Louisiana State University, Baton Rouge, United States); Johnson, Erik (National Audubon Society, Baton Rouge, LA, United States); Bierregaard, Richard (Biological Dynamics of Forest Fragments Project, Manaus, Brazil)

**THEY BREED ALL THE TIME; DOES IT MATTER? A SEASONAL BREEDING BY UNDERSTORY BIRDS IN CENTRAL AMAZONIAN BRAZIL**

Although it has long been recognized that many tropical birds don't share the same narrow breeding periods as temperate birds, conventional thinking considers tropical breeding seasons to be discreet events generally governed by rainfall seasonality. We used a database of >31000 captures of 104 species collected over 17 years in rainforest near Manaus, Brazil to examine timing of breeding within and across species. The proportion of individuals with active incubation patches peaked at about 7% in the dry season. This was about twice as high as the lowest rate, during the late wet season. As samples within species accumulated, it became apparent that most (but not all) species can breed at almost any time of year, even for species with strong seasonal peaks. Among the 10 species with at least 50 incubation patches, all bred in at least 9 months, and seven bred in 11 or 12 months. Earlier results from the same dataset showed that many species, especially antbirds, have extremely protracted molts that regularly overlap breeding. Collectively, the molt and breeding data suggest that the annual cycle of some equatorial birds, particularly suboscines, differs fundamentally from temperate species. Individuals within a species may initiate breeding at much different times, indicating that they are not responding to a common exogenous cue. Similarly, molt is not associated with a period of physiological inability to breed, nor does it necessarily follow breeding. Much work remains to determine mechanisms regulating breeding and molt, how these processes integrate into life histories, and whether these patterns help explain avian diversity.

**S1.8 Stralberg, Diana**, (University of Alberta, Edmonton, Canada); Bayne, Erin; Schmiegelow, Fiona; Sólmos, Péter (University of Alberta, Edmonton, AB, Canada); Cumming, Steve (Université Laval, Quebec, PQ, Canada); Matsuoka, Steve; Fontaine, Patricia (University of Alberta, Edmonton, AB, Canada); Song, Samantha (Environment Canada, Edmonton, AB, Canada)

**FOREST PASSERINE DISTRIBUTION MODELS AND CLIMATE CHANGE PROJECTIONS FOR BOREAL NORTH AMERICA: ADDRESSING CHALLENGES AND UNCERTAINTIES**

Avian point-count survey data assembled across biomes and continents can provide an important resource for detecting and projecting the effects of global climate change on avian species' distributions and patterns of relative abundance. This is especially true within the remote boreal forest region of North America, where the magnitude of projected change is high but distributional knowledge is limited. Recent methodological advances and increases in data availability have improved prospects for accurate models of current species' distributions. However, there are many challenges associated with applying current models to future change scenarios. We address several of these with boreal bird examples. (1) The choice of climate space considered for model development may have significant impacts on change projections. To delineate the appropriate climate space for model development and prediction, we identified the locations of current analogues for a range of potential future boreal climates, as well as the potential for future climates with no modern analogue. (2) The potential for future decoupling of correlated climatic indices makes variable selection particularly important in a climate-change context. We have employed a combination of a priori mechanistic hypotheses and statistical variance partitioning to develop parsimonious models for projection purposes. (3) Distributional shifts in avian habitat specialists will likely depend upon the pace and extent of vegetation changes. Thus we have evaluated the extent to which boreal birds are climate- vs. vegetation-limited, and have considered a range of scenarios with respect to the extent and nature of future vegetation change.

**PS1.103 Stratford, Jeff**, (Wilkes University, Wilkes-Barre, United States); Stanton, Rebecca; Lamoreaux, Nathaniel; Bartlow, Christopher; Parikh, Nipa; Biggers, William (Wilkes University, Wilkes-Barre, United States)

**NO EVIDENCE OF CONTAMINATION FROM NATURAL GAS DRILLING IN TERRESTRIAL BIRDS**

In 2011, we captured nearly 300 birds of 20 species along streams in watersheds with and without active gas drilling. Glutathione s-transferase (GST) enzyme activity in animal tissues has been demonstrated to serve as a good indicator of oxidative stress as a result of exposure to environmental toxins. GST levels were not influenced by sex (Wilcoxon sign rank test,  $W = 38$ ,  $p = 0.89$ ) or mass (Spearman rank correlation, correlation = 0.38,  $df = 15$ ,  $p = 0.14$ ). Watershed type did not influence GST levels when all species were pooled together (Wilcoxon signed rank test,  $V=62$ ,  $p = 0.52$ ). When species that were unlikely involved in the stream food web were excluded, there was no effect of watershed type (Wilcoxon signed rank test,  $V=20$ ,  $p=0.82$ ). One drawback of our design was few captures of the same species in both impacted and non-impacted watersheds. Our 2012 goal is to focus our research on three species most likely to be exposed to any contaminants if present: tree swallows (*Tachycineta bicolor*), common yellowthroat (*Geothlypis trichas*), and song sparrows (*Melospiza melodia*).

**T11.8 Streby, Henry**, (Minnesota Cooperative Research Unit, St Paul, United States); Andersen, David (USGS Minnesota Cooperative Research Unit, St Paul, MN, United States)

**THINKING OUTSIDE THE NEST: THE IMPORTANCE OF FULL-SEASON RESEARCH FOR UNDERSTANDING PRODUCTIVITY AND HABITAT ASSOCIATIONS OF MIGRATORY SONGBIRDS**

Most of what we know about productivity and habitat associations for Neotropical migratory songbirds is from data on singing males and nesting females. I will discuss general results from my research that demonstrate why nest data alone can be

inadequate and misleading when measuring productivity and why observations of singing males can be inadequate and misleading when describing habitat associations. I will discuss results from full-season – nesting period and post-fledging period – studies of ovenbirds (*Seiurus aurocapilla*) and golden-winged warblers (*Vermivora chrysoptera*), both of which are considered area-sensitive, habitat specialists based on observations of singing males and nesting females. The overarching message from both studies is that nearly all conclusions drawn from data collected during the nesting season can be strongly contradicted by data collected during the post-fledging period. Importantly, data from the post-fledging period can be just as misleading when considered alone. I will discuss how treatment effects, edge effects, effects of blow-fly infestation, predator-prey relationships, population growth models, source-sink dynamics, and species-habitat associations based solely on nesting-season data might be at best under-informing and at worst misleading management and conservation efforts. On the bright side, my results suggest that “mature-forest specialist” ovenbirds and “early-successional specialist” golden-winged warblers do not necessarily require competing and mutually exclusive habitat management.

**PS2.181 Stromko, Caitlyn**, (York College of Pennsylvania, York, United States); Kleiner, Karl (York College of Pennsylvania, York, PA, United States)

**DO NORTHERN SAW-WHET OWLS (AEGOLIUS ACADICUS) MAINTAIN KIN ASSOCIATIONS DURING FALL MIGRATION?**

Kin associations in bird species are used to promote fitness and to impact social and reproductive behavior. Migratory birds that maintain post-fledging kin associations often do so to structure the formation of their flocks. Terns, cranes, geese, swans, and other waterfowl are known to migrate together in family groups of parents and young. However, little is known about the kin associations of owls. In this study, we used a genetic analysis to examine fall migrating hatch year Northern Saw-whet Owls (*Aegolius acadicus*) that were captured in the same net check or on the same night to answer the question: do Northern Saw-whet Owls maintain kin associations during annual migration? Breast feathers were sampled from hatch year Northern Saw-whet Owls during the fall migrations of 2004-2006. Banding stations were located in Montana and Pennsylvania. A 711 nucleotide base pair fragment of the tRNA-Glu/control region of the mitochondrial DNA was sequenced and used to produce a phylogenetic tree to detect closely related individuals. No owls captured in the same net check or on the same night had the same genetic sequence. Only one potential sibling pair based on sharing an identical genetic sequence was revealed, but the two owls were caught in different states during the same migration year. Based on our sampling it does not appear that sibling Northern Saw-whet Owls maintain kinship after fledging, suggesting migratory behavior is instinctual rather than learned. These data hint at nomadic behavior in Northern Saw-whet Owls.

**W15.4 Stryjewski, Katherine**, \* (Boston University, Boston, United States); Sorenson, Michael (Boston University, Boston, MA, United States)

**SPECIATION GENOMICS OF AN EXTRAORDINARY AVIAN RADIATION, THE LONCHURA MUNIAS IN PAPUA NEW GUINEA**

A clade of 12 “munia” species (genus *Lonchura*) occurs in Papua New Guinea (PNG), Australia, and nearby islands.

Preliminary molecular analysis reveals that this group represents an extraordinary example of a recent and rapid speciation. Based on data from the mitochondrial ND2 gene, average sequence divergence across the basal node of this clade is only 1.2%, making it one of the most striking examples of rapid radiation in birds. The 12 species are morphologically diverse, varying primarily in plumage coloration but also in bill size, and they are particularly notable for the extent of sympatry between closely related forms; 10 of the 12 species broadly co-occur with at least one other species in the same clade. We sampled nine populations of five *Lonchura* species from Australia and PNG (following fieldwork in Feb/March 2012, this will increase to 14 populations of eight species) and collected ND2 sequences for 177 individuals. The data suggest a complex history, likely involving both incomplete lineage sorting and recent introgression. Strikingly, sympatric populations of different species often share haplotypes, whereas allopatric populations of the same species often do not. We used a double-digest RAD-seq (Restriction-site Associated DNA sequencing) protocol that our lab developed to analyze genome-wide patterns of divergence between the two Australian species. We sequenced 12 samples of each species and recovered a common set of 1,520 variable loci with a total of 3,711 SNPs. The overall  $F_{ST}$  value for these loci was only 0.0146 and no fixed differences between the two species were found, reflecting a high degree of shared ancestry and introgression following secondary contact. However, we identified four outlier loci with  $F_{ST}$  values of  $\sim 0.4$  or more that exhibit signatures of selection. These outliers, which map to four different chromosomes, may be linked to genes involved in trait differences between the two species or genes that experienced selection during divergence. Ongoing work will make use of improved sequencing technology to obtain far larger amounts of genomic data for all 12 species in the *Lonchura* radiation. This system appears to challenge a basic assumption of molecular systematics—that neutral genomic variation accurately reflects the history of speciation—and it provides a unique opportunity to uncover loci involved in phenotypic diversification.

**T17.8 Stumpf, Katie**, (Northland College, Ashland, United States); Theimer, Tad (Northern Arizona University, Flagstaff, United States); McLeod, Mary Anne; Tom, Koronkiewicz (SWCA Environmental Consultants, Flagstaff, United States)

#### MOVEMENT PATTERNS AND GENETIC ANALYSES REVEAL DIFFERENT PATTERNS OF POPULATION STRUCTURING OF SOUTHWESTERN WILLOW FLYCATCHERS

Estimates of population connectivity often are based on demographic analysis of movements among subpopulations, but this approach may fail to detect rare migrants or overestimate the contribution of movements into populations when migrants fail to successfully reproduce. We compared movement data of endangered Southwestern Willow Flycatchers among isolated populations in Nevada and Arizona from 1997 to 2007 to genetic analyses of samples collected between 2004-2008 to determine the degree to which these two methods were concordant in their estimates of population structuring. Based on individual movement patterns of 13 adult movements and 23 juvenile dispersals, we predicted that genetic analyses would show significant population structuring between a northern (Nevada) deme and a southern (Arizona) deme. We genotyped 93 individuals at 7 microsatellite loci and used two different Bayesian clustering programs, STRUCTURE and GENELAND, to predict population structure. Both clustering algorithms produced similar results that differed from predictions based on

movements; the only population structure detected indicated a cluster containing birds breeding in Pahrnagat National Wildlife Refuge, the northern-most Nevada site, which was distinct from all other populations. These results highlight that estimates of subpopulation connectivity based on demographic analyses may differ from those based on genetics, suggesting either temporal changes in the pattern of movements, the importance of undetected movements or differential contribution of migrants to the subpopulations they enter. Further studies will be required to elucidate which of these mechanisms are most likely in this system.

**PS1.163 Stutchbury, Bridget**, (York University, Toronto, Canada); Stanley, Calandra (York University, Toronto, Canada); Maggie, MacPherson (York University, Toronto, ON, Canada); McKinnon, Emily (York University, Toronto, Canada); Fraser, Kevin (York University, Toronto, ON, Canada); Marra, Peter (Smithsonian Institution, Washington, DC, United States); Studds, Colin (Smithsonian Institution, Washington, DC, United States); Diggs, Nora (Smithsonian Migratory Bird Center, Washington, DC, United States)

#### USING GEOLOCATORS TO LINK FINE SCALE SEASONAL CONNECTIVITY TO POPULATION DECLINES IN THE WOOD THRUSH

Many species of migratory songbirds are experiencing strong population declines and conservation efforts have been hampered by the difficulty of identifying specific wintering sites of breeding populations. We used geolocators deployed on Wood Thrushes (*Hylocichla mustelina*) to quantify fine-scale connectivity patterns of multiple populations across the breeding and tropical wintering range and then evaluated how tropical habitat loss affects breeding population dynamics. We found a significant pattern of fine-scale connectivity between breeding and wintering sites ( $n = 59$  birds tracked) with an overall pattern of parallel, leapfrog migration. Almost all Wood Thrushes from one breeding population in northwestern Pennsylvania wintered in the same region in northeastern Honduras and eastern Nicaragua (83-86°W). However, most birds wintering at a single site in Costa Rica subsequently bred in the northeastern portion of the breeding range (New York, Vermont, etc.) whereas all birds tracked from a site in southern Belize migrated to central or southern breeding populations. Although Wood Thrushes are declining throughout most of their breeding range, populations in the central eastern U.S. show a more modest decline (-0.8%/yr) compared with northeastern (-3.1%/yr) and southeastern (-2.6%/yr) breeding populations perhaps because Nicaragua and Honduras has far more remaining forest cover than other parts of the winter range. We also show that stopover connectivity is very low as eastern breeding populations follow a similar loop migration route.

**SAT8.2 Stutzman, Ryan\*** (University of Nebraska-Lincoln; Nebraska Cooperative Fish and Wildlife Research Unit, Lincoln, United States); Skagen, Susan (U.S. Geological Survey, Fort Collins, CO, United States); Fontaine, Joseph (U.S. Geological Survey-Nebraska Cooperative Fish and Wildlife Research Unit, Lincoln, NE, United States)

#### STOPOVER BEHAVIOR OF MIGRATORY SHOREBIRDS: ARE AGRICULTURAL FIELDS AN AVIAN QWIK-E-MART?

Migratory shorebird populations may be vulnerable to habitat perturbation because novel land-use practices have the potential to independently affect avian food resources and the cues birds depend upon when choosing stopover habitats. We examined the

effects of varying land-use practices at stopover locations on arctic nesting shorebird populations during northward migration. In 2010-2011, we conducted local and landscape surveys for migrating shorebirds (*Calidris* spp.) in South Dakota to identify habitat preferences. We visited wetlands (n=189) distributed in different land use types on a weekly basis and observed a total of 1901 shorebirds. We calculated habitat preference (P) for wetlands located in four land use types by comparing proportion used (U) with the proportion available (A) on the landscape  $P=(U-A)/A$ . In 2011, we measured invertebrate abundance (food availability) at grassland and agricultural wetlands (n=28) by washing soil core samples through a sieve and counting visible invertebrates. We also deployed video camcorders at wetlands to test for differences in shorebird behavior in different habitat types. We gathered over 600 hours of video that resulted in over 3000 individual observations. Behavioral analysis was focused on foraging and anti-predator behavior. In 2010, 98% of the birds we observed were at wetlands in agricultural fields. We saw a similar pattern in 2011, with 87% seen at wetlands in agricultural fields. Although agriculture occupies a large portion of the landscape, these values are more than double the proportion at which agricultural habitats are available (34%). *Calidris* spp. show a clear preference for wetlands in soybean and other agricultural fields over those in grassland fields. Overall *Calidris* abundance was greater in agricultural wetlands than grassland wetlands. In contradiction to use patterns, invertebrate abundance was higher in grassland wetlands than in agricultural wetlands. Analysis of behavior data is ongoing but early results indicate that shorebirds may be able to compensate for lower food availability in preferred habitats through behavioral modification.

**W16.11 Styring, Alison**, (The Evergreen State College, Olympia, United States); Sheldon, Frederick (Louisiana State University, Baton Rouge, LA, United States); Cannizzaro, Eric (The Evergreen State College, Olympia, WA, United States); Unggang, Joanes (Grand Perfect Sdn Bhd, Bintulu, Malaysia)

**AVIAN DETECTABILITY AND COMMUNITY STRUCTURE IN A BORNEAN RAINFOREST CANOPY: COMPARING SIMULTANEOUS GROUND- AND CANOPY-BASED SURVEYS**

The rainforests of Borneo are home to a remarkable array of plant and animal species. This diverse and charismatic avifauna is still poorly understood, and canopy-dwelling birds are particularly understudied. We conducted simultaneous canopy and ground-based surveys of the avifauna in lowland rainforest sites in Sarawak, East Malaysia (Borneo). Our aims were: (1) to determine how detectable canopy species were from the ground and vice versa, (2) to assess the connectivity of bird communities of the canopy, sub-canopy, and understory, and (3) assess the role of canopy height in bird detectability and community structure. Surveys were conducted in lowland rainforest with canopy heights ranging from 20 to 40 meters. At each survey point, a ground survey was conducted simultaneously with a canopy survey. The canopy was accessed using tree-climbing methods (single rope method). Observers communicated via radio to time the surveys, which consisted of simultaneous 3-minute point counts and 10-minute acoustic recordings. We found significant differences in the birds that were detected from the canopy versus the ground, with more species detected from the canopy. Not only were canopy-dwelling species more frequently detected in canopy surveys, but ground-dwelling and mid-story species were more often detected in canopy surveys compared to ground surveys. These results suggest that canopy surveys are important in gaining a thorough inventory of bird communities in lowland rainforest.

**T2.5 Sumasgutner, Petra**,\* (University of Vienna, Vienna, Austria); Anita, Gamauf (Museum of Natural History, Vienna, Austria); Harald W., Krenn (University of Vienna, Vienna, Austria)

**NEST-SITE SELECTION AND HABITAT USE OF URBAN KESTRELS: ARE BUILDINGS ECOLOGICAL TRAPS?**

Of all raptors the Common Kestrel (*Falco t. tinnunculus* Linnaeus, 1758) is the most abundant aerial predator in Vienna/Austria (415 km<sup>2</sup>) with approximately 350-400 breeding pairs. Its population density is the highest in all European cities and rural areas. Two decisive factors in this respect may be the diversity of structures offered in the city and a positive correlation between number of nesting sites and prey availability. Our research analyzes the influence of demographic and environmental factors on urban breeding Kestrels and raises four main questions. (1) Which nest-site locations and what types of habitats do Kestrels prefer? (2) Are there differences in reproduction rate and breeding biology? (3) How does prey availability influence the ratio of main prey categories? (4) Does food supply influence condition of young and sex ratio of surviving offsprings? In 2010 and 2011, we confirmed the presence of 252 and 297 occupied nesting-sites, respectively. Kestrels in Vienna predominantly bred on buildings (68.5 % in cavities), especially in roof openings. In rare cases window boxes were used (4.0 %). Since the availability of small mammals was insufficient, urban Kestrels enriched their diet with birds (30%), insects (12%) and reptiles (7%), whereas suburban Kestrels were highly dependent on voles (80%). Urban Kestrels switched to prey of similar size but of poorer caloric value, so the cost-benefit ratio defined by nutritional value and hunting effort shifted within the periphery. An additional video-monitoring showed that (1) Kestrels will feed on feral pigeons, (2) the proportion of invertebrate-prey increased greatly in times of food scarcity and (3) the female and her older nestlings actively killed the youngest in times of food scarcity. Since the breeding success in both years decreased with increasing soil sealing factor, and since more females reached the post-fledging period, we conclude that the food supply was insufficient. Most nestlings, especially the younger or the smaller males, died of starvation and were highly infected with ectoparasites. Kestrels seem to choose inner city districts because the diverse building structure provides ample opportunity for breeding. However, since not enough prey is available to feed the young, it is possible that urban Kestrels are stuck in an ecological trap.

**PS2.75 Suomala, Rebecca**, (New Hampshire Audubon, Epsom, United States); Kolia, Jane (New Hampshire Audubon, Concord, NH, United States); Thelen, Brett (Harris Center for Conservation Education, Hancock, United States); Klapper, Ken (n/a, Keene, NH, United States)

**THE USE OF GRAVEL NEST PATCHES ON ROOFTOPS AS NESTING SUBSTRATE FOR COMMON NIGHTHAWKS (CHORDEILES MINOR)**

Data from the Breeding Bird Survey and statewide atlases indicate that Common Nighthawks (*Chordeiles minor*) are declining throughout their range and especially in the Eastern US. In cities and towns throughout the Northeast, they nested on flat, peastone gravel roofs. In recent years, rubber and PVC have largely replaced peastone roofing, and nesting nighthawks have disappeared from many urban areas. Between 2007 and 2009, New Hampshire Audubon and partners installed 44 experimental gravel "nest patches" on flat rooftops as potential nighthawk nesting substrate. Patch design was based on successful nest patches used in Orono, ME in the 1980s (Marzilli 1989). After five years, no NH nest patches have been



utilized by breeding birds but male booming displays were observed over three patches. Two males displayed over patches placed on top of large stone roofing substrate. In Concord, NH, males display almost exclusively over rooftops that are entirely stone. Patches placed on rubber or PVC substrate may be too small to attract birds except when active nesting rooftops have been recently converted from stone to another substrate. Predation was documented on roof-nesting nighthawks and presents a potentially significant issue for nest patches.

**W14.10 Sustaita, Diego.** (University of Connecticut, Storrs, United States); Rubega, Margaret (University of Connecticut, Storrs, United States)

#### INTEGRATING MORPHOLOGY, PERFORMANCE, AND FEEDING ECOLOGY IN LOGGERHEAD SHRIKES

Here we examine the mechanistic linkages between Loggerhead Shrike morphology and feeding ecology, through measurements of functional performance. Differences in the physical and behavioral attributes between arthropod and vertebrate prey are likely to impose conflicting demands on shrike jaws and hooked bills, resulting in predictable biomechanical and performance trade-offs. For instance, capturing and dispatching relatively larger vertebrate prey may select for greater length and curvature of the bill hook, as well as greater bite force capabilities. These features, however, may be at odds with one another, because longer hooks may be more susceptible to fracture under greater loads. We measured bite force and pressure capabilities of wild Loggerhead Shrikes, and gathered feather and prey samples for stable isotope analysis to estimate the proportional composition of arthropod and vertebrate prey in their diets. Our results suggest that shrikes of varying morphologies may achieve functional equivalence in force per unit area by biting less forcefully with a longer, more pointed hook and more forcefully with a shorter, less pointed hook that distributes force over a broader area. Our results demonstrate how apparent morpho-functional trade-offs (e.g., between bill shape and bite force production) may be reconciled by examining other performance metrics (e.g., pressure) that consider their effects collectively. These data, placed in the context of shrike food habits, will help elucidate how geographic variation in morphology is linked to patterns of prey resource use, through measurements of functional performance.

**PS1.83 Sustaita, Zipporah.** (University of Texas Pan American, Pharr, United States); Feria, Teresa; Brush, Timothy (University of Texas Pan American, Edinburg, United States)

#### POSSIBLE CHANGE IN DISTRIBUTION OF ELF OWL, MICRATHENE WHITNEYI

The Elf Owl (*Micrathene whitneyi*) occurs in subtropical and tropical scrub and woodland from the southwestern United States to southern Mexico. Habitat loss and changes in climatic conditions could alter the distribution of this species. This led us to wonder to what extent climatic conditions would cause this species to also modify their distribution due to global warming which is expected to accelerate in the upcoming decades. Therefore, correlations of geographically known distributions (latitude/longitude) with nineteen climatic variables were used in the MaxEntropy program, the A1b IPCC climatic change scenario, and two general circulatory models from two different laboratories (Canadian and Australian), to assess how climate change might influence the distribution of *M. whitneyi* by 2050. After 20 replications of the model we obtained an average map and then did a model evaluation using the area Under the Curve in an ROC plot. Models show an expansion of climatic conditions in the *M. whitneyi*'s current range, throughout the northern United States, however, some areas of the original

distribution could be reduced. Further field work is being done to assess whether the species' distribution and migratory status in the Lower Rio Grande Valley, Texas, has changed.

**T17.2 Suzuki, Yasuko,** (Department of Fisheries and Wildlife, Oregon State University, Corvallis, United States); Roby, Daniel; Dugger, Katie (USGS  $\zeta$  Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis, OR, United States); Gervais, Jennifer; Lyons, Donald (Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR, United States); Suryan, Robert (Department of Fisheries and Wildlife, Oregon State University, Newport, OR, United States); Collis, Ken (Real Time Research, Inc., Bend, OR, United States) **DEMOGRAPHY AND INTER-COLONY MOVEMENTS OF CASPIAN TERNS IN THE PACIFIC COAST REGION OF NORTH AMERICA**

We investigated the demographics and inter-colony movements of Caspian terns (*Hydroprogne caspia*) in the Pacific Coast region of North America based on re-sightings of color-banded individuals breeding at a very large colony in the Columbia River estuary and a much smaller colony on the mid-Columbia River. The colony on East Sand Island in the estuary was of particular interest because it is the largest colony for the species in the world, and recent management actions are designed to reduce colony size in an effort to enhance survival of juvenile salmonids (*Oncorhynchus* spp.) listed under the U.S. Endangered Species Act. Apparent annual survival of adult Caspian terns nesting in the Columbia River estuary and on the mid-Columbia River was 0.95 (SE = 0.01) and 0.94 (SE = 0.02), respectively, and apparent median age at first reproduction was at least 6 years and 5 years post-hatch, respectively. Colony site philopatry of breeding adults at both colonies was high; however, some individuals prospect for breeding colonies over much of the region, from the Salton Sea in southeastern California to the Copper River Delta in south-central Alaska. For some individual terns, dispersal distances between breeding colonies of up to 3,000 km were documented within a single breeding season. The majority of sub-adults visited breeding colonies for several years prior to their first reproductive attempt, suggesting that sub-adults can prospect at multiple colonies prior to nesting. Terns from the large colony in the Columbia River estuary responded quickly to the availability of new colony sites as far as 550 km away and established successful breeding colonies in less than a year. Due to high vagility, delayed onset of reproduction, and high adult annual survival of Caspian terns in this metapopulation, individuals can prospect and select nest sites over an extensive area and establish a high degree of connectivity among colonies throughout the Pacific Coast region. The Caspian tern colony in the Columbia River estuary appears to be an important source colony for a number of smaller, less productive colonies distributed over a vast area with limited and ephemeral nesting opportunities.

**S10.4 Swanson, David,** (University of South Dakota, Vermillion, United States);

#### MECHANISMS AND FITNESS CORRELATES OF SEASONALLY FLEXIBLE METABOLIC PHENOTYPES IN SMALL BIRDS

Annual variation in climate produces distinct seasonal phenotypes in small birds inhabiting strongly seasonal climates. The winter phenotype is characterized by improved cold tolerance and elevated summit metabolic rates ( $M_{sum}$ , maximum cold-induced), the mechanistic underpinnings of which commonly involve flight muscle hypertrophy and

increased capacities to metabolize lipids to support prolonged shivering. However, the suite of biochemical and molecular adjustments contributing to this phenotypic variability are poorly understood. Furthermore, individual variation in these phenotypic traits and their potential fitness consequences remain essentially uninvestigated in birds. Variation in  $M_{sum}$  among individual birds is correlated with individual variation in cold tolerance, suggesting that elevated metabolic rates could have fitness consequences, but few avian studies have addressed whether  $M_{sum}$  is a repeatable trait subject to selection and no studies have explicitly addressed the question of whether high  $M_{sum}$  confers increased overwinter survival or is related to carry-over effects that could influence reproductive fitness. The few avian studies conducted to date suggest that BMR and  $M_{sum}$  are generally repeatable over the short-term (days to weeks), but longer-term repeatability (months to years) is lower, and repeatability often disappears following conditions promoting phenotypically flexible metabolic responses (i.e., between seasons). These results bring up the interesting possibility that the capacity for phenotypic flexibility itself varies among individual birds, and such variation could also have fitness consequences, but studies of individual variation in reaction norm responses to conditions promoting phenotypic flexibility are unstudied in birds. Strategies for addressing these research needs are necessary for expanding our understanding of the importance of seasonal phenotypic flexibility in the annual cycle of birds.

**PS2.241 Szabo, Ildiko**, (Beaty Biodiversity Museum, UBC, Vancouver, Canada); Secrest, Marianne S. (British Columbia Ministry of Forest Lands and Natural Resource Operations, Surrey, BC, Canada)

#### METHOD USED TO FABRICATE NORTHERN SPOTTED OWL (*STRIX OCCIDENTALIS CAURINA*) FEEDING SURROGATE PUPPETS FROM SALVAGED OWLS

Before fabricating a feeding surrogate puppet from a frozen, unprepared northern spotted owl (*Strix occidentalis caurina*), we conducted a fabric-glue matrix experiment to investigate how to reinforce bird skin. We prepared barred owl (*Strix varia*) prototypes to explore different fabrication methods. To test the ability to operate the feeding surrogate prototypes, we conducted mock feeding trials. Disinfectant treatments of Virkon and 70% ethanol were tested on feather capes and a prototype. After testing was complete, we fabricated 2 feeding surrogate puppets from frozen salvaged northern spotted owls. The publication of these fabrication methods may have broader application in aiding researchers to create decoys for trapping or studying bird behaviour. Only salvaged birds were used; no bird was killed for the purposes of conducting these experiments.

**PS2.240 Szabo, Ildiko**, (Beaty Biodiversity Museum, UBC, Vancouver, Canada);

#### FREE DOWNLOADABLE MANUAL ON AVIAN SPECIMEN PREPARATION INCLUDING PICTORIAL INSTRUCTIONS ON HOW TO COLLECT INTERNAL MORPHOLOGICAL DATA AVAILABLE AT: [HTTP://BEATYMUSEUM.UBC.CA/RESEARCH/BIRDS](http://beatymuseum.ubc.ca/research/birds)

This new free downloadable avian specimen preparation manual can be utilized in several ways. Though initially designed to aid novices who have never prepared a bird specimen, people looking for a refresher course on specimen prep, and researchers needing to prepare voucher specimens to complement their DNA studies, it can also be used as a reference guide for collecting internal morphology information. Researchers not intending to collect specimens may encounter birds killed by

natural causes. Photographing and measuring external and internal morphology of these dead bird results in data not previously available. This online reference manual shows how to use gonads to sex a bird, determine if a female has previously laid eggs, categorize fat levels, record gut contents, and estimate the extent of skull pneumatization. Performing a quick necropsy can yield valuable insights on the breeding or migratory condition of a bird. The links portion of the website hosts a collection of videos, websites, and PDF's. Included are PDF's containing data collection and labelling guidelines. The target audience is graduate students working in the field as well as volunteers and staff at parks, colleges, universities, and museums that hold the appropriate permits. This series of 13 PowerPoint presentations is available on the Beaty Biodiversity Museum, University of British Columbia website: <http://beatymuseum.ubc.ca/research/birds>

**W9.2 Szostek, Lesley**, (Institute of Avian Research, Wilhelmshaven, Germany); Meyer, Barbara (Nordrhein-Westphälische Ornithologengesellschaft, Kranenburg-Nütterden, Germany); Sudmann, Stefan (Nordrhein-Westphälische Ornithologengesellschaft, Kranenburg-Nütterden, Canada); Zintl, Heribert (Deutsche Ornithologen Gesellschaft, Langgries, Germany); Becker, Peter (Institute of Avian Research, Wilhelmshaven, Germany)

#### DENSITY DEPENDENT REGULATION IN COMMON TERN (*STERNA HIRUNDO*) COLONIES

Density is known to be an important factor in population size regulation. The specific mechanisms of density effects, i.e. whether they occur at the colony site and in breeding territories or rather in relation to overall colony size and carrying capacity of the environment, are hard to disentangle. Comparing density effects in seven colonies of Common Terns in three different habitat types (marine, natural and artificial limnic), we found colony density playing an important role in determining reproductive output. We attempted to estimate a critical density, above which breeding success was lowered. In all colonies where critical density was reached, a similar decrease in breeding success became apparent with negative impacts even on juvenile survival in subsequent years. This was not related to habitat type or foraging area (water surface area within foraging distance). We did, however, find a significant relationship between the maximum sustainable colony size and available foraging area. Based on detailed long-term datasets of six separate subcolonies, differing in density, at the intensely studied Banter See colony, we were able to show that the density effect at this colony did not originate in factors affecting breeding success at the nesting territories within the colony site (such as intraspecific competition), but rather happened outside the colony site itself, most likely through depletion of food resources. Supported by Deutsche Forschungsgemeinschaft (BE 916/9).

**PS2.147 Tack, Jason**, (Colorado State University, Laporte, United States); Fedy, Brady (Colorado State University & US Geological Survey, Fort Collins, CO, United States)

#### PREDICTIVE NEST MODELS HELP PRIORITIZE HABITAT CONSERVATION FOR GOLDEN EAGLE ACROSS LARGE LANDSCAPES

Unprecedented landscape change in western North America over the past decade has resulted in the loss and fragmentation of habitats for multiple wildlife species. As wildlife populations decline in response to habitat degradation, managers are burdened with the challenges of siting for energy development while maintaining robust wildlife populations. Science-based

tools can assess the impacts of habitat loss and decreased population connectivity; however, research is far outpaced by recent development. Golden eagle (*Aquila chrysaetos*) is an emblematic species of pristine landscapes, and their habitats are a surrogate for the many species of prey they depend upon, including multiple species of mammals and gallinaceous birds. While the true status of golden eagle populations in North America is unclear, generally populations in the U.S. are at best considered stable, with evidence of local declines across their range. A projected increase in wind development projects across the west is particularly concerning for golden eagle populations because wind farms can displace eagles from otherwise suitable habitat, and are a known source of mortality. Without proactive planning tools, there is little recourse beyond mitigation that will help conserve productive landscapes for golden eagle. We collected a wealth of golden eagle nest data from state, federal, consultants and NGOs in Wyoming, to help map territories across the state. Using predictive modeling techniques, we were able to estimate the relative influence environmental and anthropogenic features on the selection of nesting habitat by golden eagle. Incorporating models in a GIS supported a conservation tool that managers use to locate priority habitats at a landscape scale, and make finer scale inference to habitat quality for project-level siting decisions. Using available energy potential data, we identify areas that pose the greatest risks to eagles during a critical life stage.

**FS.4 Taff, Conor,\*** (University of California, Davis, Davis, United States); Dunn, Peter; Whittingham, Linda (University of Wisconsin, Milwaukee, Milwaukee, United States); Freeman-Gallant, Corey (Skidmore College, Saratoga Springs, NY, United States)

#### BREEDING DENSITY AND SPATIAL DISTRIBUTION OF NESTS CONSTRAIN THE STRENGTH OF SEXUAL SELECTION IN A WARBLER.

Many species experience a wide range of breeding densities, yet studies of sexual selection often ignore the fact that mating decisions are made within a spatial context. Indeed, the distribution of neighbors may be critical in facilitating the expression of mating preferences or in weakening sexual selection even when preferences exist. In a six year study of breeding common yellowthroat warblers, we collected data on sexual signals, fitness, and spatial information for 158 male breeding attempts and 369 nests, which produced a total of 526 sampled offspring, 92 of which were extrapair young. We found that males with more close neighbors sired more extrapair young and that sexual selection appeared to be stronger at high densities. At low densities, variation in reproductive success was almost entirely explained by within-pair mating, while at high densities almost half of the variation in total reproductive success was explained by extrapair mating. We suggest that this type of local heterogeneity may be common and has important evolutionary consequences; researchers hoping to understand the evolution of sexual signals must adopt a more nuanced view of the ways that context and ecological factors can influence sexual selection.

**PS1.245 Takats Priestley, Lisa.** (Beaverhill Bird Observatory, Edmonton, Canada);

#### THE ALBERTA NOCTURNAL OWL SURVEY, 10 YEARS, 100 ROUTES, AND COUNTING

In 2012, the Alberta Nocturnal Owl Survey completed ten years of owl monitoring with a record 100 routes being surveyed. Volunteers are sent random routes, survey manuals, and call playback CDs to conduct surveys. There were 190 volunteers

surveying for owls in 2012 across most of forested regions in Alberta, and nine species of owls were detected. Throughout the program Barred, Great Gray, Boreal, Northern Saw-whet, Long-eared, Great Horned, Northern Hawk, Northern Pygmy, and Short-eared Owls have been observed (although the latter three species in low numbers). Barred Owl populations appear to be declining, while all other species of forest owls are stable (although cyclic). Citizen science has been crucial in helping determine owl population changes in non-remote areas. It will be important for long-term programs to be developed in more remote areas where volunteers are not able to survey. As part of a network of agencies from across Canada conducting nocturnal owl surveys in a standardized way, the program collects important long-term information on owl distribution, abundance, and population trends regionally, provincially, and nationally. The volunteer data has also been provided to various agencies to help inform survey designs in remote areas, and help with management considerations. Our 10 year report will be available at [www.beaverhillbirds.com](http://www.beaverhillbirds.com).

**T8.1 Tarr, Nathan,** (Biodiversity and Spatial Information Center, Raleigh, United States); Aycrigg, Jocelyn (National Gap Analysis Program, Moscow, ID, United States); McKerrow, Alexa (USGS Core Science Systems, Raleigh, NC, United States); Rubino, Matthew (Biodiversity and Spatial Information Center, Raleigh, NC, United States); Boykin, Ken (Center for Applied Spatial Ecology, Las Cruces, NM, United States); Lonaker, Jeffrey (National Gap Analysis Program, Moscow, ID, United States)

#### THE GAP ANALYSIS PROGRAM: NATIONAL DATABASES FOR ENHANCING BIRD CONSERVATION

Knowledge of species' geographic locations and ecological characteristics are central to our ability to conserve and manage landscapes for those species. In order to provide for regional and national scale conservation assessments, the USGS Gap Analysis Program (GAP) is creating national databases of range and predicted habitat distribution models within the continental US. Currently, we have completed >650 range maps and habitat distribution models for >400 bird species. Our range maps are 12-digit hydrologic unit maps attributed with species' seasonal use. Our habitat distribution models utilize national data layers including the GAP Land Cover, elevation, and hydrological characteristics and are based on knowledge of species' habitat requirements. All of these data are available for viewing and download through GAP's Species Viewer, an online tool (<http://gapanalysis.usgs.gov/>). These range and model data represent a baseline for national landscape conservation and biodiversity assessment efforts, even for species with limited occurrence data. GAP is also in the process of expanding our national conservation databases to include Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands; developing iterative, hybrid approaches to species distribution modeling by integrating expert opinion and species occurrence records into deductive models; and testing inductive modeling approaches where species occurrence data can support them. We will provide an overview of our modeling approaches, examples of applications of these data, a demonstration of how to access the data, and a status update on GAP.

**PS2.37 Tarvin, Keith,** (Oberlin College, Oberlin, United States); Revells, Cordelia; Beresin, Glennon (Oberlin College, Oberlin, OH, United States); Murphy, Troy (Trinity University, San Antonio, TX, United States)

#### HATCHING ASYNCHRONY OCCURS INDEPENDENT OF THE ONSET OF INCUBATION IN AMERICAN GOLDFINCHES

A widely held paradigm in ornithology assumes that the time span over which eggs within a clutch hatch (a.k.a. “hatching spread”) is determined by the timing of incubation onset relative to the laying of the final egg: Early incubation onset should result in asynchronous hatching, while late incubation onset should lead to synchronous hatching. As few studies have explicitly tested this paradigm, we investigated the hypothesis by comparing hatching spread in American Goldfinches (*Spinus tristis*) to the timing of incubation onset. We monitored nests to ascertain clutch initiation and completion dates, and determined onset of incubation based on differences between nest temperature and ambient temperature. Onset of incubation was categorized as “early” if the final egg experienced at least two fewer nights of incubation than the other eggs in the clutch, and as “late” if incubation began the night before or the night immediately following the laying of the final egg. Clutches with an early onset of incubation tended to hatch asynchronously (over a period of more than 24-hours) as predicted by the hypothesis that hatching asynchrony is determined by incubation onset, but the trend was only marginally significant ( $P = 0.087$ ). Importantly, asynchronous and synchronous hatching occurred with nearly equal frequency in late onset nests, suggesting that factors other than incubation-onset contribute to hatching spread.

**W15.9 Tarwater, Corey E.**, (U.C. Berkeley, Berkeley, United States); Beissinger, Steve (University of California, Berkeley, Berkeley, CA, United States)

#### OPPOSING VIABILITY AND FECUNDITY SELECTION AND THE DRIVERS OF SELECTION ON ONSET OF BREEDING IN A 22-YEAR STUDY OF A TROPICAL PARROT

Environmental conditions may influence the strength, direction, and form of selection, but results can be biased by the fitness metric used and the scale on which selection is examined. Negative directional fecundity selection on onset of breeding is commonly observed, yet, in many species, breeding time is not advancing. This inconsistency may arise, in part, because few studies assess viability selection, nonlinear selection, and selection across multiple scales. We examined fecundity and viability selection on onset of breeding using a 22-year study of two nearby populations of green-rumped parrotlets, *Forpus passerinus*, from Venezuela. We observed opposing viability and fecundity linear selection on onset of breeding. Females that bred earlier in the year had higher fecundity, but had a lower probability of survival. Disruptive fecundity selection was also observed. Correspondingly, two peaks in the onset of breeding were found. Fluctuating annual selection and variation between the two populations was observed, resulting in a nonlinear trend in breeding date across the study. Rainfall had a greater influence on fecundity selection, while breeding density had a greater influence on viability selection. Viability selection was stronger in years of lower breeding density, and fecundity selection was stronger in the lowland population during higher rainfall years. These results highlight the necessity of studying both viability and fecundity selection and nonlinear selection to understand selection on onset of breeding. Furthermore, high variation in selection existed owing to environmental conditions that vary in space and time.

**PS2.57 Tauzer, Lila**, (University of Alaska Fairbanks, Fairbanks, United States); Powell, Abby; Sharbaugh, Susan (University of Alaska Fairbanks, Fairbanks, United States)

#### ECOSYSTEM SHIFT IN AN ALASKAN BOREAL FOREST: IS THERE EVIDENCE OF CHANGE IN AVIAN COMMUNITIES?

Recent changes in plant and avian community composition have been related to accelerated warming at northern latitudes. Despite the underlying assumption that avifauna will be dramatically affected by local habitat change, few change studies have taken an ecosystem approach – primarily due to a lack of comprehensive baseline data for such comparisons. In the poorly understood boreal forest of interior Alaska, we capitalized on available resources to simultaneously assess change in vegetation and birds over the past 35 years. Using archived field data to compare with data collected in 2009-2010, we quantified habitat change for five 10-ha plots representing several boreal habitat types. At this same local scale, we used territory mapping to compare current avian community composition and abundances with historical data. We observed rapid successional changes and associated shifts in avian communities that were approximately tied to the magnitude of change in habitat structure. More specifically, as the landscape became more forested, there was an increase in forest birds and a substantial decrease in wetland and shrub-associated bird species. Townsend’s Warblers (*Setophaga townsendi*) were now found breeding there, while Gray-cheeked Thrushes (*Catharus minimus*) and American Tree Sparrows (*Spizella arborea*) disappeared completely from the study area. Overall, avian species diversity and abundances declined since the 1970s. These findings give insight into avian response patterns in the rapidly changing boreal forest, while highlighting the importance of understanding avian-habitat dynamics. Although often ignored in management plans and predictive models, succession can have a strong influence on avian populations and should not be disregarded.

**T3.1 Taylor, Caz**, (Tulane University, New Orleans, LA, United States);

#### USING NETWORK MODELS TO DESCRIBE THE POPULATION DYNAMICS OF MIGRATORY BIRDS.

We describe a population model for migratory birds composed of a network of breeding and wintering sites to show how habitat loss affects patterns of connectivity and species abundance. When the costs of migration are evenly distributed, habitat loss at a single site can increase the degree of connectivity within the entire network, which then acts to buffer global populations from declines. However, the degree to which populations are buffered depends on where habitat loss occurs within the network: a site that has the potential to receive individuals from multiple populations in the opposite season will lead to smaller declines than a site that is more isolated. In other cases when there are equal costs of migration to two or more sites in the opposite season, habitat loss can result in some populations becoming segregated from the rest of the network. The geographic structure of the network can have a significant influence on relative population sizes of sites in the same season and can also affect the overall degree of mixing in the network, even when sites are of equal intrinsic quality. We discuss the more general use of network models in the study of migratory birds and the challenges and progress in applying such models to real-world species.

**SAT18.2 Taylor, Scott**, (Cornell University, Ithaca, United States); Jeyasingham, Will (Queen's University, Kingston, ON,

Canada); Zavalaga, Carlos (Nagoya University, Nagoya, Japan); Simeone, Alejandro (Universidad Andres Bello, Santiago, Chile); Friesen, Vicki (Queen's University, Kingston, Canada)

#### SPECIALIZATION TO COLD WATER UPWELLINGS FACILITATES GENE FLOW IN SEABIRDS: ADDITIONAL EVIDENCE FROM THE PERUVIAN PELICAN, PELECANUS THAGUS (AVES: PELECANIDAE)

Recent research has shown that tropical seabirds specialized to feed on cold water upwellings exhibit low population differentiation and high gene flow across large geographic distances. This pattern is opposite to the general pattern of differentiation reported for tropical seabirds, and has led to the hypothesis that specialization to cold water upwellings facilitates gene flow between colonies. As an additional test of this hypothesis we characterized population differentiation and gene flow across the range of the Peruvian Pelican, an upwelling specialist endemic to the Humboldt Current, using an 839 base pair segment of the mitochondrial control region and seven microsatellite loci. In support of our hypothesis we report genetic panmixia across the geographic range of this species and high gene flow between colonies. These results are encouraging: the high dispersal propensity of upwelling specialist seabirds may reduce loss of genetic diversity during population declines, and increase the ability of these species to colonize new islands.

**PS2.182 Tegeler, Amy**, (Powdermill Avian Research Center, Carnegie Museum of Natural History, Rector, United States); Lanzone, Michael (Powdermill Avian Research Center, Carnegie Museum of Natural History, Rector, PA, United States)

#### PEAK FLIGHT CALL RATE DURING NOCTURNAL MIGRATION VARIES BETWEEN PASSERINE TYPES

Other studies have found that bird density in the atmosphere during nocturnal migration peaks before midnight, but flight call rate peaks close to dawn. More research is needed to determine if there is a relationship between bird density and flight calling rate. We studied the hourly patterns of nocturnal flight calling between sparrows, warblers, and thrush-like species for 175 nights during fall migration 2004 to 2007 in Rector, PA. We used an automated recording unit that recorded continuously from civil dusk to civil dawn. We recorded 14,074 flight calls, of which 13,914 could be identified as warbler, sparrow, or thrush-like. We recorded significantly more warbler calls ( $n = 6,603$ ) than sparrow ( $n = 2,786$ ), and thrush-like ( $n = 4,525$ ;  $P < 0.001$ ) calls. Overall, most calls were vocalized right before dawn ( $P < 0.001$ ), supporting the results of other research. However, when we looked at calling rates for specific species groups the time of peak call rate was different between the groups. Thrush-like and sparrow species followed similar trends with thrush-like peak calling between 0500 and 0700 hrs ( $n = 2,845$ , 63% of calls) and sparrow peak calling between 0600 and 0700 hrs ( $n = 683$ , 25% of calls). Warblers called more consistently throughout the night with most calls occurring between 1700 and 0600 hrs ( $n = 5,826$ , 89% of calls) with a small peak between 2200 and 0200 hrs ( $n = 2,993$ , 45% of calls). The mean calls per hour were different between species groups ( $P < 0.001$ ). While the timing of peak warbler calling rate shows similar trends to bird density estimates from other studies, it is possible that the calling behavior of thrush-like species and sparrows may partially account for the low correlation between bird density and calling rate that occurs close to dawn. The data suggest that while thrush-like and sparrow species use flight calls during active migration, they may utilize flight calls mostly to locate stopover habitat and form foraging groups. However, since warblers called mostly

during active migration they may use flight calls to form migratory groups and communication migratory information within and among those groups.

**T12.11 Terhune, Theron**, (Tall Timbers, Tallahassee, United States); Roth, Amber (Michigan Technological University, Houghton, MI, United States); Confer, John (Ithaca College, Ithaca, NY, United States); Wood, Petra Bohall (West Virginia University, Morgantown, WV, United States); Smalling, Curtis (Audubon Society of North Carolina, Chapel Hill, NC, United States); Flaspohler, David (Michigan Technological University, Houghton, MI, United States); Buehler, David (University of Tennessee, Knoxville, TN, United States); Streby, Henry (University of Minnesota, St. Paul, MN, United States); Aldinger, Kyle (West Virginia University, Morgantown, WV, United States); Loegering, John (University of Minnesota-Crookston, Crookston, MN, United States); Gratto, Joe; Larkin, Jeffrey (Indiana University of Pennsylvania, Indiana, PA, United States); Percy, Katie (University of Tennessee, Knoxville, TN, United States)

#### GOLDEN-WINGED WARBLER RANGEWIDE FECUNDITY AND NESTING HABITAT MANAGEMENT STRATEGIES

Golden-winged Warbler (*Vermivora chrysoptera*) populations have declined significantly across their breeding range for almost 50 years based on analysis of North American Breeding Bird Survey data. The eastern portion of the breeding population, primarily in the Appalachian Mountains Bird Conservation Region, has declined precipitously and is now largely disjunct from the midwestern (Great Lakes) population. The midwestern population, which comprises over 90% of the total population, is now beginning to decline as well. The Golden-winged Warbler Working Group was formed in 2005 to address the conservation needs of this species. As part of this conservation effort, we conducted a rangewide study on breeding biology in 2008-2010 to document fecundity across a range of habitat conditions and to identify possible management strategies for this species for the breeding grounds. The study occurred on seven sites in Minnesota, Wisconsin, Pennsylvania, New York, West Virginia, Tennessee, and North Carolina. Land use at these sites included wetland shrub forest, aspen (*Populus* spp.) and oak (*Quercus* spp.) regeneration sites, grazed and abandoned pastures, and reclaimed coal strip mines. Study methods involved intensive nest searching and monitoring, followed by habitat characterization at nest sites and within territories. We modeled nest-site selection and daily nest survival in program MARK. Nest success and fecundity varied widely across the breeding range by site, year, and land use. Clutch sizes were typically four or five eggs. Nest predation was the primary limiting factor for fecundity although hybridization with Blue-winged Warblers (*Vermivora cyanoptera*) is a significant factor that reduces overall fecundity of Golden-wingeds across their range. Through this effort, we have developed breeding habitat management guidelines which are being implemented through a rangewide conservation plan.

**F15.12 Terrill, Ryan**, (LSU Museum of Natural Sciences, Baton Rouge, United States);

#### A PHYLOGENETIC CONTEXT FOR MOLT STRATEGIES IN BIRDS

Due to their lightweight nature, feathers break down over time and must be replaced. Because of this, the regular replacement of feathers is a universal phenomenon among birds, and the maintenance of feather function is of profound importance to fitness. Feathers serve many different functions for birds such as

flight, thermoregulation, physical protection, and sexual signalling. Needs for these functions are necessarily variable between and within taxa, as well as within individuals over time. Variability in timing and patterns of scheduled replacement of feathers may indicate differential selection on molt strategies. Variation occurs in all levels of molt, including timing, pattern, and extent of feather replacement. A phylogenetic context for variation and evolution of molt strategies can lay a framework for understanding the factors which may influence the evolution of differing feather replacement strategies. Molt patterns have not been studied in a phylogenetic context. I traced presence or absence of partial molts as well as the pattern of primary flight feather replacement. I found preformative molt to be homologous, and aprealternate molt to be analogous across families. Primary replacement strategy appears to have a complicated history, with simultaneous replacement of primaries is potentially basal to all birds, and step-wise replacement was predicted to have evolved multiple times. The high instance of recent state change in these patterns suggest molt strategies are not heavily influenced by phylogenetic effect and may reflect adaptation to contemporary influential factors.

**PS2.129 Thakur, ML,** (Himachal Pradesh University, Shimla-5 (HP), India, Shimla, India);

#### ECOLOGICAL AND SOCIAL OBSERVATIONS ON INDIAN WHITE-BACKED VULTURE IN HIMACHAL PRADESH, INDIA

Presence of self-sustaining populations of Indian White-backed Vulture (*Gyps bengalensis*) has been recorded in very small patches in Bilaspur, Chamba, Hamirpur and Kangra districts of Himachal Pradesh. During last two years 22 nesting colonies, supporting 105 nests has been reported from different areas. Fledgling success rate increased from 56% in 2009-2010 to around 73% in 2010-2011, indicating a slight increase of 16%. All the nests have been recorded within well-foliaged pine trees (*Pinus roxburghii*) along watercourses in pure chir pine forests, around human settlements, on slanting hilly tract, with the nest placed in a prominent fork (mostly) within the tree canopy. Monkeys have been reported to interfere in normal breeding of the species. Information on accessibility of Diclofenac to the vultures revealed that only 5% of the chemists in the area pointed towards the use of human diclofenac to the cattle. Dead bodies of domestic animals are usually buried in most parts of Himachal Pradesh thereby adversely affecting the food availability to vultures but in Kangra valley the social custom of removing the skin and leaving the carcass open for vulture consumption is being practiced by some migrants from Punjab who unknowingly are supporting a small breeding population of this critically threatened vulture. Frequency of sighting of carcasses in the Kangra valley was normally high as compared to other parts of the state. Continuity of availability of food especially during breeding season has been a matter of concern for these threatened creatures in the State.

**SAT4.4 Thieme, Jennifer,** (The Nature Conservancy, Toledo, United States); Rodewald, Amanda; Gehrt, Stanley (The Ohio State University, Columbus, OH, United States)

#### LINKING GRASSLAND BIRD DENSITY TO PREDATOR ACTIVITY IN URBAN PARKS

Urban green spaces can contribute to grassland habitat conservation, but their proximity to anthropogenic food sources can result in high densities of nest predators. Not only can avian reproductive success decline with rising numbers of predators, but birds also may avoid patches altogether. Such avoidance could result in reduced occupancy rates or densities of birds, thus undermining conservation efforts in urban areas.

From 2010-2011, relationships between avian territory density and activity of predators were examined in 49 2-ha plots in seven urban grassland parks (sites) near Chicago, Illinois. At the plot scale, vegetation characteristics best explained the density of four of the five study species; density of Song Sparrow (*Melospiza melodia*) was best explained by a positive association with activity of snakes. Activity of avian predators was negatively associated with density of each species at the plot scale, and the effect was strong when species were pooled ( $\beta = -5.73$ ,  $p < 0.01$ ). With the exception of Field Sparrow (*Spizella pusilla*), raccoon activity was negatively associated with density of all species at both the plot and site levels; cat activity showed the opposite relationship in all cases, though the relationship was weak. At the site scale, only vegetation characteristics explained density of territories, and no models containing predator variables were competitive for any species. These results provide evidence that grassland and early successional birds not only respond to habitat structure, but also to activity of potential predators at small scales. Thus, in addition to providing suitable habitat, managers need to consider how human activities that promote activity of predators may diminish conservation value of urban parks to birds.

**S1.3 Thogmartin, Wayne,** (United States Geological Survey, La Crosse, United States); McKann, Patrick (United States Geological Survey, La Crosse, WI, United States)

#### EXTINCTION RISK ESTIMATED FOR EVERY SPECIES ADEQUATELY SURVEYED BY THE NORTH AMERICAN BREEDING BIRD SURVEY

The Breeding Bird Survey (BBS) is the most widely used source of information for assessing the status and trend of most landbird species in North America. Information on status and trend is critical in prioritizing research and conservation effort. For example, Partners in Flight uses BBS data to categorize trend, relative regional abundance, and estimated population size to characterize conservation vulnerability for >400 species. However, Partners in Flight ignores variation in trend and fails to fully integrate trend and population size in its risk assessment. Extinction risk is the integration of trend, variability in trend, and population size. We employed autoregressive state-space models to calculate the probability of a species declining in abundance to the point where it is no longer adequately surveyed by the BBS (i.e., quasi-extinction). The generic model for this calculation is written as  $x_t = x_{t-1} + u + wt$ , where  $w_t \sim N(0, \sigma^2)$ , and  $y_t = x_t + vt$ , where  $v_t \sim N(0, \eta^2)$ .  $y_t$  is the logarithm of the observed population size at time  $t$  (as described currently by annual indices of abundance calculated with hierarchical Bayesian over-dispersed count models),  $x_t$  is the unobserved state at time  $t$ ,  $u$  is the growth rate, and  $\sigma^2$  and  $\eta^2$  are the process (environmental stochasticity) and observation error variances, respectively. Confidence intervals are calculated via bootstrapping. These methods artfully combine trend, variability in trend, and population size to provide relative predictions of risk as well as disentangling observation error from environmentally induced stochasticity. We calculated and mapped regional probabilities of quasi-extinction, with bootstrapped confidence intervals, for all species adequately surveyed by the BBS. Our ultimate aim is to incorporate regional estimates of the probability of quasi-extinction into the annual calculations reported by the BBS as a means of delivering objective measures of risk. Such objective measures of risk, described spatially and temporally, will provide a more robust basis for prioritization efforts.

**PS1.264 Thomas, Alaina,** (Kansas State University, Manhattan, United States);

## STATE ACRES FOR WILDLIFE ENHANCEMENT PROGRAM AND GRASSLAND BIRDS: IMPLICATIONS FOR THE ROLE OF AMERICA'S FARMLAND IN CONSERVATION.

Grassland birds are in significant decline throughout much of their range because of ongoing habitat loss and degradation. Much of the historic prairie has been converted to crop production so it is important to understand the role land producers can play in the future of grassland bird conservation. In 1985, the U.S. created the Conservation Reserve Program (CRP) for the prevention of farmland erosion. In 1996, wildlife habitat conservation for upland, lowland and endangered species was encouraged through set-aside programs within the CRP. State Acres for Wildlife Enhancement (SAFE) is a specific type of CRP available for continuous enrollment since 2008. SAFE is intended to restore vital habitat for high priority wildlife throughout the United States. Each state determines priority species and the enrollment requirements for the SAFE program vary regionally. To understand the impacts of the SAFE program enrollments in Kansas, we monitored tracts of land enrolled to estimate abundance, diversity, and relative use of these areas by sensitive species of grassland birds. Our study was conducted in 7 counties in two ecoregions of Kansas, mixed-grass prairie in the Smoky Hills and tallgrass prairie in the Flint Hills. We conducted point-counts in SAFE enrolled fields in each county, which were compared to non-SAFE reference fields. We also compared percent cover of vegetation in enrolled versus non-enrolled fields. Our project results will have an impact on future conservation planning within the SAFE program as it relates to agricultural practices for Kansas and surrounding states.

**T7.3 Thomas, Gavin**, (NA, NA, Canada); Jetz, Walter (Yale University, New Haven, United States); Joy, Jeffery; Mooers, Arne (Simon Fraser University, Burnaby, BC, Canada)

## TESTING COMPLEX MODELS OF TRAIT EVOLUTION ACROSS ALL BIRDS

Ecological processes can generate many different patterns of traits and any observed pattern of traits may also be a result of many different processes. Thus, disentangling which ecological process (e.g. competition) gives rise to observed patterns of traits (e.g. variance in bill morphology) is a complex problem. Here we use the complete tree of birds and novel methods for estimating variable rates of trait evolution to analyze patterns of body size and bill size evolution across the entire class Aves. Specifically, we ask to what extent the rates of diversification and rates of trait evolution are coupled, and what ecological traits explain these rates.

**T7.4 Thomas, Nathan**, (Shippensburg University, Shippensburg, United States); Scharf, Otto (Shippensburg University, Shippensburg, PA, United States); Swanson, David (University of South Dakota, Vermillion, SD, United States)

## METABOLIC RATES OF LEAST AND PECTORAL SANDPIPERS AT A STOPOVER SITE DURING SPRING MIGRATION.

Many birds show temporal variation in metabolic rates that vary with season or other aspects of the annual cycle. For example, shorebird basal metabolic rates (BMR) decline with long-distance migratory journeys but are high during breeding. In general, a dearth of data exists for metabolic rates of shorebirds compared to the relatively large metabolic data set available for passerines. Recent passerine studies suggest that cold-induced summit (Msum) and exercise-induced maximal metabolic rates (MMR) in passerines are not correlated, but clear relationships

have not been elucidated. We collected free-living Least (*Calidris minutilla*) and Pectoral (*Calidris melanotos*) sandpipers during spring migration in southeastern South Dakota and measured MMR (Least Sandpipers only), Msum, and BMR with open-circuit respirometry. Msum was measured in an atmosphere of 79% helium and 21% oxygen with decreasing temperatures and MMR was obtained by using a hop-flutter wheel until visible exhaustion. Msum for both species was 3-5X BMR and MMR for Least Sandpipers was 6X BMR. Scaling relationships for MMR and BMR were similar for Pectoral Sandpipers. Metabolic rates in Least Sandpipers, however, showed variable scaling relationships, with Msum and MMR both showing higher allometric scaling exponents than BMR. The relationships among minimum and maximum metabolic rates for shorebirds were similar to those derived from previous studies on passerines.

## **SAT14.6 Thompson, Sarah**, (University of Minnesota, Saint Paul, United States); Arnold, Todd (University of Minnesota, Saint Paul, MN, United States); Vacek, Sara (U.S. Fish and Wildlife Service, Morris, MN, United States); Granfors, Diane (U.S. Fish and Wildlife Service, Anchorage, AK, United States) RESPONSE OF GRASSLAND SONGBIRDS TO LARGE-SCALE TREE REMOVAL

Grassland birds have declined more than any other North American bird guild. A number of observational studies have noted that grassland songbirds are less abundant on suitable habitat when trees are nearby. Tree removal is being considered as a management tool to improve existing grassland habitat for grassland-obligate songbirds. In order to examine this relationship, we experimentally removed trees from 6 large grassland patches. We hypothesized that grassland birds would be more abundant on treatment sites after tree-removal. We systematically placed twenty point count stations on each of 12 grassland sites (200m spacing). We began conducting surveys in 2005 and removed woody vegetation from 6 sites in the fall after 2005 surveys. We conducted point counts until 2011 for a total of 1876 point counts on 14 sites (due to incorporation of additional control sites). Point counts were 10-minute 100m fixed-radius counts with birds separated into 3 distance-bins and 3 time-intervals based on first detection. We estimated tree and shrub density using the point-quarter method for each count site during each year. We analyzed data using hierarchical models with the 'Unmarked' package in Program R. Tree removal effectively reduced the average density of trees to nearly 0 trees/ha on treated sites, but shrub density was not successfully reduced by the treatment. The most commonly counted bird species were habitat generalists, including red-winged blackbird (4971), common yellowthroat (1917), and song sparrow (1240). Bobolink (n=774), clay-colored sparrow (1363), and sedge wren (578) were the most commonly recorded grassland birds. Data analysis from 2005-2010 showed no significant increase in any target grassland songbird species after the tree-removal treatment and no difference between control and treatment sites. Several working hypotheses may explain this lack of response. Grasslands that undergo tree-removal may take many years to fully recuperate. The continued disturbance of tree removal (repeated prescribed fire and mechanical activity) might further inhibit colonization. Grassland bird populations in the surrounding landscape are depressed, therefore recruitment possibilities are limited. Finally, it is possible that without attention to other habitat features, tree removal on sites will not sufficiently improve habitat for grassland birds.

**PS1.267 Thorngate, Nellie**, (H. T. Harvey & Associates, Los Gatos, United States); Dave, Johnston (H. T. Harvey &

Associates, Los Gatos, CA, United States); Todd, Mabee (ABR, Inc., Forest Grove, OR, United States); Scott, Terrill; Jeff, Smith; Judd, Howell (H. T. Harvey & Associates, Los Gatos, CA, United States)

#### RELATING TURBINE-ASSOCIATED MIGRATORY BIRD FATALITY RATES TO NOCTURNAL MOVEMENT PATTERNS AND LOCAL LANDSCAPE FEATURES AT THE MONTEZUMA HILLS WIND RESOURCE AREA IN CENTRAL COASTAL CALIFORNIA

We investigated the relationship of apparent turbine-related migratory bird fatality rates to nocturnal bird movements and local landscape features during fall migration periods in 2009 and 2010 at the Montezuma Hills Wind Resource Area in Solano County, California. We used daily carcass searches, marine radar, night-vision observations, and spatial analyses to determine how patterns of nocturnal movement and land cover are associated with turbine-associated fatalities of nocturnal migratory birds. The mean nocturnal passage rate was 390 targets/km/hr, a higher rate than reported elsewhere in the US. Only 2-6% of targets recorded by radar passed through the high-risk area at altitudes < 125 m agl. Radar targets that were higher than 125 m agl exhibited directional flight, but those flying below 125 m agl showed no predominant flight direction. Only six nocturnal-migrant bird fatalities were observed during the two 40-day survey periods. Bird fatalities exhibited a clustered distribution across the sites, and were more numerous at turbines southeast of the nearest riparian area. These results suggest that actively migrating birds are not at risk for turbine-associated fatalities in this geographic area, but that birds dropping down into riparian patches or eucalyptus groves amongst the turbine arrays to forage or roost are at high risk for turbine-associated fatalities.

**S6.6 Thorup, Kasper,** (University of Copenhagen, Copenhagen, Denmark);

#### TIMING OF MIGRATION WITHIN AND BETWEEN SEASONS

The timing of migration is expected to be under strong selective pressures but the potential differences within and between seasons are not well studied. We used a long-term series of several songbird species banded and recovered in Denmark to study these differences. In general, we found individuals to time their migration in different years similarly within seasons. Thus, individuals that migrated early in spring in one year would also tend to be early in a later year. Between seasons, the correlation tended to be negative so that early arriving spring birds would depart late in fall. Contrary to expectations, geographical location of breeding or wintering had only a weak effect on migration timing, indicating that the within-species results are not the results of combining several populations. The consistent timing within and between seasons fits well with the expected importance of timing for survival.

**YIA2 Tingley, Morgan,** (Princeton University, Princeton, United States); Beissinger, Steven R. (University of California, Berkeley, Berkeley, CA, United States)

#### GRINNELL'S LEGACY: EFFECTS OF A CENTURY OF CLIMATE CHANGE ON SPECIES OCCURRENCE AND COMMUNITY COMPOSITION IN THE SIERRA NEVADA

Projected effects of climate change on animal distributions primarily focus on consequences of temperature and largely ignore impacts of altered precipitation. While much evidence supports temperature-driven range shifts, there is substantial heterogeneity in species' responses that remains poorly

understood. We resampled breeding ranges of birds across three elevational transects in the Sierra Nevada mountains, USA, that were extensively surveyed in the early 20th century by foundational western ornithologist Joseph Grinnell. Over the past century, rising temperature pushed species upslope while increased precipitation pulled them downslope, resulting in range shifts that were heterogeneous within species and among transects. While 84% of species shifted their elevational distribution, only 51% of shifts to upper or lower range boundaries were upslope. By comparison, 82% of range shifts were in a direction predicted directly from changes in either temperature or precipitation. Only species with small clutch sizes, that defended all-purpose territories, and that were year-round residents were significantly more likely to shift elevational ranges than their ecological counterparts, results that were in opposition to a priori predictions from dispersal-related hypotheses. Heterogeneity in species' movements resulted in broad-scale declines in species richness over time. Our results illustrate the complex interplay between species-specific and region-specific factors that structure patterns of breeding range change over long time periods. Diverging temperature and precipitation regimes projected for the future will create a strong potential for heterogeneous responses of species at range margins – a possibility that would have truly fascinated Joseph Grinnell.

**W11.6 Toews, David,\*** (University of British Columbia, Vancouver, Canada); Mandic, Milica; Richards, Jeffery; Irwin, Darren (University of British Columbia, Vancouver, BC, Canada)

#### INTROGRESSION IN THE YELLOW-RUMPED WARBLER SPECIES COMPLEX: CAN VARIATION IN MIGRATORY BEHAVIOUR EXPLAIN DIFFERENCES IN MITOCHONDRIAL GENOTYPE AND PHENOTYPE IN A CRYPTIC HYBRID ZONE?

The extent to which genetic introgression between divergent lineages provides variation for adaptive evolution is an open question. Hybrid zones have been particularly useful in addressing this, as geographic discordance of genetic and phenotypic clines can be used as evidence of adaptive introgression. Mitochondrial DNA in particular has been known to introgress across taxonomic boundaries, although few studies have tested the various explanations for such patterns. Evidence suggests that mtDNA has introgressed from myrtle warblers (*Setophaga coronata coronata*) into Audubon's warblers (*S. c. auduboni*) through much of their range range. Here we present data from a cryptic contact zone within the range of the Audubon's warbler between this derived and introgressed 'northern' mtDNA lineage (from the myrtle warbler) and a 'southern', putatively ancestral lineage (found in the black-fronted warbler in Mexico). Using stable isotope analysis we show that this transition in mtDNA type is also correlated with a shift in migratory strategy: individuals with the southern mitochondrial type move very little between breeding and wintering grounds, whereas in northern type individuals these areas are disjunct (i.e. resident versus migrant phenotypes, respectively). We also tested whether differences in mitochondrial phenotype might also be correlated with this migratory shift. Given the role that mitochondria play energy production during the metabolically demanding act of migration, we hypothesized that natural selection may have favoured certain mitochondrial variants in migratory individuals. We report a small but significant difference in O<sub>2</sub> consumption rate between mitochondria from with northern-type versus southern-type individuals. This difference was driven primarily by southern mitochondrial types having a higher background



respiration rate, suggesting their mitochondria may be less efficient compared to northern mitochondria, consistent with our hypothesis. Using this integrative approach our evidence suggests a functional basis for mitochondrial introgression in this system and, more generally, we have identified potential novel genetic and physiological adaptations associated with avian migration.

**T2.1 Tomasevic, Jorge A.,\*** (University of Washington, Seattle, United States); Marzluff, John M. (University of Washington, Seattle, WA, United States)

#### ARE HUMANS FACILITATING NATIVE SECONDARY CAVITY NESTING BIRDS IN SUBURBAN AREAS? INSIGHTS FROM THE GREATER SEATTLE AREA.

As urbanization expands, land cover changes and native bird communities are affected. Native secondary cavity-nesting (SCN) birds may be greatly affected as forest cover and snags are lost, while non-native SCN species thrive in human-dominated environments. However, under medium to high environmental stress, facilitation may allow species to persist. Humans directly and indirectly supplement nest sites to SCN species. Our hypothesis was that native SCN species are facilitated by humans' nest provision in the greater Seattle area, potentially allowing their presence in medium to high levels of urbanization. To test this, we found cavity nests between 1998-2010 on 32 1-km<sup>2</sup> sites with different levels of urbanization (0-100% forest cover) and recorded their substrate and fate. We found 344 nests: 185 of seven native and 159 of two non-native SCN species; 196 in natural, and 148 in human-related substrates. Native SCNs nested in natural substrates (n=145) uniformly across the urbanization gradient ( $P=.31$ ); but also used human-related substrates (n=40) affected by forest cover ( $P<.01$ ). Non-native SCNs nested mostly in human-related substrates (156/159), with no effect of forest cover ( $P=.17$ ). Most natural (74.8%) and human-related (94.9%) nests succeeded. Mean nest success was higher in human-related than in natural nests ( $P<.001$ ). Same for native SCN nests ( $P<.001$ ). Native SCN nests were more successful than non-native ones ( $P<.01$ ). Native SCNs nesting in human-related substrates suggests adaptation to human supplements highlighting the potential conservation value of suburban areas.

**PS1.57 Toms, Judith,\*** (Eco-Logic Consulting, Victoria, Canada);

#### INTERSPECIFIC COMPETITION BETWEEN MIGRATORY AMERICAN REDSTARTS (*DENDROICA RUTICILLA*) AND RESIDENT ADELAIDE'S WARBLERS (*D. ADELAIDAE*)

Evolutionary processes increase fitness by reducing overt competition among species through character displacement. However, migrants face a different set of ecological pressures in their breeding and non-breeding habitats, which may result in a compromised set of traits. Therefore, competition may be more easily detected between migrants and residents. I tested the hypothesis that migratory American Redstarts (Redstart) and resident Adelaide's Warbler (Adelaide's) compete for food in southwest Puerto Rico. In other work, I showed that body condition of these species declined during a dry non-breeding season when available arthropod biomass was reduced. This suggests that food may be a limiting resource. Data describing the foraging niches of these species were collected through detailed behavioral observation of marked individuals. Niches were characterized in terms of both foraging location (type of vegetation, relative location within tree canopies and height from ground) and type of attack (substrate and attack method),

and niche overlap was quantified using Bhattacharyya's affinity. The two species had a very high degree of overlap in all metrics, indicating that depletion competition did not occur. To test for interference competition, marked individuals were mapped and kernel density estimators used to estimate home ranges. Interspecific overlap of territories was significantly greater than the intraspecific territory overlap of either species, indicating that interspecific territoriality was not present. Instead, the evidence suggests that Redstarts use temporary competition refuges. I conclude that competition does occur between these species, and is mediated through aggressive confrontations and the behavioral flexibility of Redstarts.

**SAT9.6 Ton, Riccardo,** (University of Montana, Missoula, Canada); Martin, Thomas Eduard (University of Montana, Missoula, United States)

#### A COMPARATIVE FIELD TEST OF THE METABOLIC RATE HYPOTHESIS FOR NESTLING GROWTH RATES AMONG TEMPERATE AND TROPICAL PASSERINES

Growth rates of post-natal offspring vary extensively among species of all taxa. Inter-specific variation in growth and development rates is even greater when compared across geographic regions, especially tropical versus temperate regions. Mechanistic causes of variation in growth rates of offspring are important to understand because potential physiological causes and the resulting growth rates can influence offspring phenotypes and quality. Passeriformes provide strong variation in growth rates within and between temperate and tropical sites. Yet, our understanding of potential intrinsic causes of growth rate variation among species within and among geographic regions remains weak. One general hypothesis has posited that post-embryonic development rates could be strongly determined by intrinsic metabolic rates. Metabolism is the fundamental biological process during development, because it is the rate of energy uptake, transformation, and allocation that drives the speed at which tissues are biosynthesized. High metabolism may allow faster cellular proliferation thus increasing the rate at which organisms grow. However, the ability of differences among species in metabolic rate using standard measures at a standard post-natal stage to explain variation in nestling growth rates has never been tested to our knowledge. Here for the first time we test this hypothesis at two different study sites, located in tropical Malaysia (5° N) and north temperate Arizona (34° N). We recorded oxygen consumption at 37° C at a fixed developmental stage (when feathers of the 8th primary break their sheaths) as a measurement of nestling metabolism in 30 passerine species (17 temperate species, 13 tropical species) with nestling periods ranging from 11 to 21 days. Metabolic rates were strongly related to body mass in typical allometric functions in both sites. After correcting for body mass effects, mass specific metabolic rates of nestlings explained a significant amount of the variation in growth rates among species and across latitudes. This research advances our understanding of the intrinsic influences on rates of nestling development, a character that has long been recognized as a critical life history trait.

**S12.2 Tonra, Christopher,** (Smithsonian Conservation Biology Institute, Washington, United States); Marra, Peter (National Zoological Park, Washington, United States); Willard, David (Field Museum, Chicago, United States); Holberton, Rebecca (University of Maine, Orono, United States)

#### THE NEXUS OF NON-BREEDING, MIGRATORY, AND BREEDING LIFE HISTORY STAGES IN MIGRATORY SONGBIRDS

In spring, migratory birds are at the juxtaposition of three life history stages in which they must complete the non-breeding stage, initiate and complete migration, and initiate breeding. For many species, this transitional period is critical because the timing of arrival at breeding areas can influence reproductive output. We sought to determine a) when physiological preparation for breeding begins, b) if variation in breeding preparation is better explained by endogenous or environmental factors, and c) if breeding preparation can influence migration phenology. We found that male American Redstarts (*Setophaga ruticilla*) wintering in Jamaica show evidence of breeding preparation prior to departure from wintering grounds while females do not. In both these male redstarts and migrating Ovenbirds (*Seiurus aurocapilla*) collected in Chicago, we found that variation in breeding preparation (measured by circulating testosterone, T, and testis size) was better explained by environmental factors (condition, winter habitat wetness measured by stable-carbon isotopes) than endogenous timing (distance to breeding site measured by stable-hydrogen isotopes). Lastly, we demonstrated experimentally that male redstarts who elevate T earlier than competitors are more likely to depart earlier on migration, presumably enabling them to arrive earlier to breed, a strong determinant of reproductive success. These results demonstrate that life history stages greatly overlap for migratory birds and can interact with one another to potentially influence fitness. Our findings have implications for the ability of these species to respond to changing environments.

**S2.4 Tøttrup, Anders P.**, (Center for Macroecology, Evolution and Climate, Department of Biology, University of Copenhagen, Copenhagen, Denmark); Klaassen, Raymond; Strandberg, Roine (Department of Animal Ecology, Lund University, Lund, Sweden); Kristensen, Mikkel Willemoes (Center for Macroecology, Evolution and Climate, Natural History Museum of Denmark, University of Copenhagen, Copenhagen, Sweden); Rahbek, Carsten (Center for Macroecology, Evolution and Climate, Department of Biology, University of Copenhagen, Copenhagen, Canada); Alerstam, Thomas (Department of Animal Ecology, Lund University, Lund, Sweden); Thorup, Kasper (Center for Macroecology, Evolution and Climate, Natural History Museum of Denmark, University of Copenhagen, Copenhagen, Denmark)

#### YEAR-ROUND TRACKING REVEALS DELAYED SPRING ARRIVAL AS A RESULT OF DROUGHT AT AFRICAN STOPOVER SITES IN LONG-DISTANCE MIGRATORY SONGBIRDS

Even though spring temperatures have increased in northern latitudes causing migratory birds to arrive earlier throughout the last four decades, the spring arrival of red-backed shrikes and thrush nightingales in northern Europe was up to two weeks later in 2011 than in 2010. By year-round tracking using light-level loggers (geolocators), we show that this late arrival was caused by an extension of the stopover time in northeast Africa during northward migration and no delay was observed for the final leg of migration including the desert crossing. The later departure from Africa coincides in space and time with the extreme drought on the Horn of Africa likely to have been the ultimate cause of the delayed breeding area arrival time. Interestingly, the annual schedules indicate that only first arrivals were significantly delayed whereas later arriving birds were not unusually late. This strongly indicates that across-season interactions (carry-over effects) may override local cues in determining arrival at the breeding grounds.

**SAT7.4 Townsend, Andrea**, (Department of Wildlife, Fish, & Conservation Biology, University of California, Davis, Davis, United States); Sillett, Scott (Smithsonian Migratory Bird center, Washington, DC, United States); Webster, Mike (Cornell Lab of Ornithology & Department of Neurobiology & Behavior, Ithaca, NY, United States); Cooch, Evan (& Department of Natural Resources, Cornell University, Ithaca, NY, United States); Lany, Nina (3Department of Biological Sciences, Dartmouth College, Hanover, United States); Kaiser, Sara (Cornell Lab of Ornithology & Department of Neurobiology & Behavior, Ithaca, United States); Rodenhouse, Nicholas (4Department of Biological Sciences, Wellesley College, Wellesley, DC, United States); Holmes, Richard (Department of Biological Sciences, Dartmouth College, Hanover, DC, United States)

#### WARM SPRING LINKED TO HIGHER FECUNDITY, LOWER SURVIVAL, AND STABLE POPULATIONS OF BLACK-THROATED BLUE WARBLERS

Warming climate trends have been linked to changes in fecundity—positive and negative—in numerous taxa. However, these fecundity changes do not necessarily predict population changes, which are also affected by adult survival, immigration, and emigration. Here, we examine the effects of spring temperature on lay date, breeding season duration, multiple brooding, annual fecundity, apparent survival, and population dynamics in a Nearctic - Neotropical migratory songbird, the Black-throated Blue Warbler (*Setophaga caerulescens*), at the Hubbard Brook Experimental Forest, New Hampshire, USA, from 1986 to 2010. Warm springs were associated with higher annual fecundity, because mean lay date was earlier and breeding season duration was longer in warmer springs. Individuals that began breeding earlier were more likely to double-brood, and double-brooders fledged more offspring in each season. A time-symmetric mark-recapture approach showed that fecundity in one year led to population growth in the subsequent year, but that warm springs were associated with lower adult survival. One apparent consequence of these opposing effects of temperature on vital rates was that variation in spring temperature had a net neutral effect on population dynamics of this species. These results draw attention to the importance of considering all vital rates when predicting population responses to climate trends, and demonstrate the utility of the time-symmetric approach to distinguishing the relative contribution of recruitment and survival to population dynamics.

**PS1.101 Townsend, Jason**, (Cornell Lab of Ornithology, Davis, United States); Rimmer, Christopher (Vermont Center For Ecostudies, Norwich, VT, United States); Driscoll, Charles (Syracuse University, Syracuse, NY, United States); McFarland, Kent (Vermont Center for Ecostudies, Norwich, VT, United States); Inigo-Elias, Eduardo (Cornell Lab of Ornithology, Ithaca, NY, United States)

#### MERCURY CONCENTRATIONS IN TROPICAL RESIDENT AND MIGRANT SONGBIRDS VARY WITH GEOGRAPHY AND FEEDING GUILD ON HISPANIOLA

Despite growing concerns over mercury (Hg) toxicity to humans and wildlife on a global scale, little is known about Hg bioaccumulation in the New World tropics. In temperate areas, where Hg deposition and bioaccumulation are well-documented, studies have utilized bird species as effective bioindicators to identify Hg hotspots across the landscape. In the present study, we apply this approach to tropical forests of the Caribbean.

Between 2005 and 2011, we monitored Hg bioaccumulation in nine avian species, including eight passerines and one top order predatory accipiter, occupying a geographic range of wet broadleaf sites on the island of Hispaniola. The songbird species included two Nearctic-Neotropical migrants and six residents. Invertivorous songbirds were further differentiated by foraging guild, with six species of ground-foragers and two species of foliage gleaners. Blood Hg concentrations were orders of magnitude greater in central and southern cloud forest sites compared to northern and northeastern rainforest sites, with migratory Bicknell's Thrush (*Catharus bicknelli*) and Ovenbird (*Seiurus aurocapillus*), and resident Red-legged Thrush (*Turdus plumbeus*) showing 2 – 20 X greater blood Hg concentrations in cloud forests. Within cloud forest sites, ground-foraging species had greater Hg concentrations than foliage-gleaning species. Mercury concentrations above levels known to cause adverse effects were more common in resident species than migrants. Sharp-shinned Hawks (*Accipiter striatus*) had the highest blood Hg concentrations among all species, suggesting that Hg biomagnification is occurring in terrestrial forests of Hispaniola.

**T16.4 Tozer, Doug**, (Bird Studies Canada, Port Rowan, Canada); Falconer, Myles; Debbie, Badzinski (Bird Studies Canada, Port Rowan, ON, Canada)

#### COMMON LOON REPRODUCTIVE SUCCESS IN CANADA: THE WEST IS BEST BUT NOT FOR LONG

Reproductive success of Common Loons (*Gavia immer*) is a powerful indicator of aquatic ecosystem health, being particularly sensitive to mercury and acid rain. Therefore, we used citizen-collected reproductive success data from 1992 to 2010 from Bird Studies Canada's Canadian Lakes Loon Survey to test the hypothesis that airborne mercury and acid rain reduce reproductive success of Common Loons in southern Canada. Across an average of ~400 lakes per year, the mean number of six-week-old chicks per pair per year (1) decreased from west-to-east as predicted by mercury- and acid rain-carrying prevailing winds, (2) decreased between 1992 and 2010 as predicted by continuing mercury and acid rain deposition that exceeds critical levels for wildlife, and (3) increased as lake area increased, a surrogate for temperature- and acid-related mercury exposure. The temporal decrease was unexpectedly steeper in the west than in the east, the reasons for which are unclear. Projections suggest that the Canadian breeding population may become a demographic sink within the next 15 years. The results suggest that citizen-collected data are powerful for monitoring ecosystem health over large spatial and temporal scales and support further action to abate emissions of anthropogenic mercury and acid rain.

**PS1.82 Tozer, Doug**, (Bird Studies Canada, Port Rowan, Canada); Falconer, Myles; Badzinski, Debbie (Bird Studies Canada, Port Rowan, ON, Canada)

#### POPULATION TRENDS OF WETLAND BIRDS IN THE GREAT LAKES BASIN: 1995 TO 2011

Using data from Bird Studies Canada's Great Lakes Marsh Monitoring Program (GLMMP), we estimated population trends of American Bittern, American Coot, Common Gallinule, Least Bittern, Pied-billed Grebe, Sora, and Virginia Rail between 1995 and 2011 in the Great Lakes basin using hierarchical modeling. Volunteers visited 1–8 points in emergent wetlands, twice per breeding season during the morning or evening to count birds. Call broadcasts were used to increase detections of secretive species. Most species declined during the period throughout the Great Lakes basin, except American Bittern (stable). Population trends were generally similar over time for each species in each lake basin (i.e., Michigan, Huron, Erie, and Ontario), although

trends were less negative for most species in Lake Ontario. The reasons for this are unclear, but may be related to relatively stable water levels compared to other basins. Bayesian precision analysis suggests that the GLMMP has the ability to detect annual population changes as small as 1.5% in the Great Lakes basin; 3% in the Lake Huron, Erie, and Ontario basins; and 4% in the Lake Michigan basin for nearly all of the species examined. Future models will attempt to adjust trends for differences in detection probability, observer effects, and spatial autocorrelation; and explore whether population trends vary with habitat.

**PS2.185 Trapaga, Ann**, (University of California at Berkeley, Berkeley, United States); Cicero, Carla; Spencer, Carol; McGuire, Jimmy (University of California at Berkeley, Berkeley, United States)

#### THE BIG CHILL: A FRAMEWORK FOR THE CONVERSION OF THE MUSEUM OF VERTEBRATE ZOOLOGY GENETIC RESOURCES COLLECTION FROM ULTRA-COLD TO LIQUID NITROGEN STORAGE

The Museum of Vertebrate Zoology (MVZ) Genetic Resources Collection is one of the largest museum vertebrate tissue collections in the world, with over 100,000 tissues vials representing approximately 95,000 individual specimens, collected since 1965. With NSF funding we are converting our tissue collection from ultra-cold to liquid nitrogen (LN2) storage. We based this conversion on: 1) preventing catastrophic loss and needing to replace the aging bank of ultra-cold freezers that currently house the collection, 2) ensuring long-term viability and maximum research utility of genetic samples, 3) reducing carbon footprint and improving cost efficiencies, and 4) increasing opportunity for growth and storage. We created a new cryogenic laboratory facility, implemented a new tissue barcode labeling system for field and curatorial practices, and integrated the barcoded vials and their location into our Arctos database. This conversion provides a unique opportunity to re-inventory and consolidate the collection, discover and correct tissue issues, and to record both the volume of tissue per specimen and the exact location of each vial. All vials, boxes, rack slots, racks, and freezers are barcoded and exist as hierarchical containers in Arctos. We also examined existing curatorial practices related to data management and handling of tissue specimens for loans and curatorial workflow. The conversion was warranted in terms of cost/benefits, collection preservation, and growth. Such a conversion could be beneficial for many collections but requires dedicated resources and oversight. Challenges that arose during the conversion will also be discussed.

**T12.5 Treen, Gillian**, (University of Saskatchewan, Saskatoon, Canada); Clark, Robert (Environment Canada, Saskatoon, SK, Canada); Johnson, Laurie (University of Saskatchewan, Saskatoon, SK, Canada)

#### REPRODUCTIVE ALLOCATION TRADE-OFFS ARE RELATED TO NEST CHARACTERISTICS IN TREE SWALLOWS (*TACHYICINETA BICOLOR*)

Nest microclimate can affect avian reproductive success via direct effects on nestling fitness and also by influencing costs of incubation and provisioning by parents. We monitored reproductive events and characterized the microclimates in dark-coloured, thin-walled plywood boxes and thick-walled aspen boxes being used by nesting tree swallows (*Tachycineta bicolor*) over a three year period. We cross-fostered three, 2-3 day old nestlings matched for body mass between aspen and plywood boxes matched for hatch date. Average microclimatic

conditions did not differ between plywood and aspen boxes but temperature and relative humidity were less variable in aspen boxes, which were warmer and less humid at night and cooler during the day than were plywood boxes. Clutch initiation dates and amounts of nest materials (vegetation and feathers) did not differ between box types, but birds in aspen boxes tended to lay larger clutches composed of slightly smaller eggs. Parental body mass and provisioning behaviour did not differ between box types, but birds nesting in plywood boxes tended to be older. Nestlings from aspen boxes tended to be lighter and had shorter wings just prior to fledging but nonetheless aspen boxes fledged more nestlings than did plywood boxes. Our results suggest that nest microclimate influences parental investment trade-offs between the numbers and sizes of both eggs and nestlings. Furthermore, while nestling mass at fledging is positively associated with survival probability, preliminary recapture data indicate that return rates are higher for natal and cross-fostered nestlings that fledge from aspen boxes. This implies that potential energetic savings or allocation patterns associated with breeding in the aspen boxes result in higher parental fitness. Experimental manipulations of nest temperatures could be employed to separate microclimate effects on investment from differences related to variation in parental age or quality.

**W17.1 Tremblay, Junior A.**, (Ministère des Ressources naturelles et de la Faune du Québec, Quebec City, Canada); Maisonneuve, Charles (Ministère des Ressources naturelles et de la Faune, Rimouski, PQ, Canada); Katzner, Todd; Miller, Tricia (West Virginia University, Morgantown, WV, United States); Lanzone, Michael (Cellular Tracking Technologies, Somerset, PA, United States); Brandes, David (Lafayette College, Easton, PA, United States)

#### A CASE STUDY OF THE INTERACTION BETWEEN LANDSCAPE CONFIGURATION AND HABITAT USE AT A WIND FACILITY BY GOLDEN EAGLES (AQUILA CHRYSAETOS)

Wind power is expanding all around the world and the province of Québec, Canada, plans to increase its production from about 500 MW today to 2000 MW in 2012 and to 4000 MW in 2015. Some wildlife species are highly vulnerable to blade-strike mortality and golden eagles ( *Aquila chrysaetos* ) are known to be one of those. Not all wind facilities present the same risk of mortality; windmill configuration and site particularities are two major parameters to take into account when evaluating such risks. The present study aims to determine how habitat configuration affects space use of breeding golden eagles, with a particular focus on areas adjacent to wind facilities. We hypothesized that a higher amount of open habitats in the vicinity of wind farms will increase the use by golden eagle of the wind facility. Our study area is located in the Gaspé peninsula of Québec. Golden eagles were tracked with GPS telemetry. Preliminary results show that nests close to areas with high proportion of open habitats had smaller home ranges and individuals were less likely to use open habitats surrounding wind farms. Where availability of open habitats near eagle nests is lower, openings created near and around wind facility offer new hunting areas, increasing the likelihood of use by golden eagles and thus increasing potential risk to birds of blade-strike mortality. Hence, developers aiming to establish wind farm projects in forested mountainous areas, as is the case for many projects in Eastern North America, should consider that creating openings within a forested habitat may increase collision risk for golden eagles. Creating openings by planning forest cuts in the vicinity of nest sites could be experimented to see if this may

shortstop eagle movements and reduce attraction to wind facilities and collision risk.

**T9.4 Tringali, Angela**, (University of Central Florida, Orlando, United States); Bowman, Reed (Archbold Biological Station, Venus, FL, United States)

#### SHARED GENES, SHARED ENVIRONMENTS: USING AN ANIMAL MODEL TO ESTIMATE THE INFLUENCES OF GENETICS AND ENVIRONMENT ON PLUMAGE COLOR IN FLORIDA SCRUB-JAYS

Florida Scrub-Jays disperse short distances and males often inherit all or a portion of their father's territory. Thus, in addition to sharing genes, relatives also share environments. Because of these shared environments, parent-offspring regressions tend to overestimate heritability. Animal models can be used to combine pedigree information and trait measurements to give less biased estimates of heritability. We calculated the heritability of plumage color using both parent-offspring regression and an animal model. Although sire-offspring regressions were significant for mean brightness and UV chroma, heritability was low. Heritability is likely even lower than these estimates. We will use an animal model to refine estimates of heritability and the influences of shared environment on plumage coloration in Florida Scrub-Jays.

**W17.12 Turner, Devin**, (Trent University, Peterborough, Canada); Nol, Erica (Trent University, Peterborough, ON, Canada)

#### NEST-SITE HABITAT AND ITS EFFECTS ON DAILY SURVIVAL RATE OF AMERICAN ROBINS (TURDUS MIGRATORIUS) IN THE SUB-ARCTIC

Species with large geographical ranges can exhibit adaptation to local conditions including variation in habitat use and breeding success. The American Robin (*Turdus migratorius*) is one of the most widespread North American passerines. I studied this species at its northern breeding limit in the sub-Arctic of the Yukon Territory. Compared to populations at more southerly latitudes American Robins should exhibit less variable habitat requirements because of simpler habitat structure. I also predict higher reproductive success because of a positive relationship between latitude and seasonal reproductive success in birds. Vegetative characteristics were measured at 121 nest-sites over 2010 and 2011, and at an equal number of available but unused sites. Vegetation variables collected at nest-sites were also used as covariates in models to predict daily nest survival. American Robins only nested in conifer trees >1.3m, and rarely nested above 2m. This population avoided nesting in areas that were sparsely treed, and on average shrubs and trees were taller at nest-sites than non-use sites. Models predicting nest survival were ranked using AIC; the best two models contained the height of the shrubs around the nest and the size of the nest-tree. These two variables had a positive relationship with daily nest survival. The daily survival rate estimated at this location was 61%, almost double the survival rate of a Delaware (35%) and central Ontario population (32%). This sub-Arctic population of the American Robin use areas with dense vegetation for their nest-sites, and as an indirect result of latitude experience higher annual reproductive success. Consequently, as the tree line advances northward increased woody vegetation in the sub-Arctic may produce higher quality nest-sites for this species.

**SAT3.6 Ulman, Sadie**, (University of Delaware, Newark, Canada); Morton, John (Kenai National Wildlife Refuge, Soldotna, Canada); Williams, Chris (University of Delaware, Newark, Canada)

## STABLE ISOTOPES INFER ORIGINS OF SHOREBIRDS UTILIZING AN ALASKAN ESTUARY DURING MIGRATION

Chickaloon Flats, Kenai National Wildlife Refuge, Alaska, is a 70 km<sup>2</sup> tidal mudflats located along the northern part of the Kenai Peninsula in upper Cook Inlet. It is a smaller protected coastal estuary stopover site along the Pacific Flyway. Almost one third (23 of 73) of shorebird species recorded in Alaska utilize this stopover during spring and/or fall migrations. This study utilized a multi-isotopic approach to estimate probable breeding and/or wintering origins of six species of shorebirds utilizing Chickaloon during spring and fall migration of 2009 and 2010. Hydrogen (dD), Carbon (d13C), and Nitrogen (d15N) were analyzed from feathers and a likelihood-based assignment was used to inform North American (NA) and South American (SA) origins. Only lesser yellowlegs feathers (*Tringa flavipes*) indicated wintering (n=4, coastal SA) and breeding (n=26, central Alaska) ranges. Estimated wintering ranges for least sandpipers (*Calidris minutilla*, n=13) occurred in Southern NA to northern SA, long-billed dowitchers (*Limnodromus scolopaceus*, n=8) occurred in Mexico, and pectoral sandpipers (*Calidris melanotos*, n=11) occurred in northeastern SA. Estimated breeding ranges for greater yellowlegs (*Tringa melanoleuca*, n=67) occurred in southwest Alaska, and short-billed dowitcher (*Limnodromus griseus caurinus*, n=26) occurred in south-central Alaska. The use of stable isotopes to infer molt origins of birds has proven to be a useful and important tool in migration and conservation studies. This study has shown probable origins of long-distance shorebird migrants, some of high conservation concern, utilizing an Alaskan stopover site, and has helped in identifying habitats and previously unknown areas used by Alaskan breeding shorebirds.

**PS2.89 Underwood, Todd**, (Kutztown University, Kutztown, United States); Underwood, Robyn (Kutztown University, Kutztown, PA, United States)

## LARGE NUMBER OF BURDOCK-ENTANGLED SONGBIRDS FROM SOUTHEASTERN MANITOBA LIKELY RELATED TO FORAGING ACTIVITY IN FALL

Burdocks (*Arctium* spp.), exotic plants native to Eurasia, produce their seeds within large burrs that become attached to vertebrates for seed dispersal. Small animals may become entangled in these burrs and die. Through regular searches of parks in Winnipeg, Manitoba from 2000 to 2004, we discovered 29 burdock entangled songbirds and recorded observations of bird activity on burdock plants. We analyzed taxonomic, demographic and seasonal trends among these entanglement data and compared them to observations of bird activity on burdock. Thirteen species of birds were found entangled. Most (62%) were warblers (*Parulidae*), but there were also species from five other families (<15% per family). There was an even (52%) distribution of adult and hatch year (48%) birds and a higher proportion of females (73%) compared to males (27%), although most birds could not be sexed (n = 19). Most entanglements were from fall (86%), but also included a few from spring (7%) and the breeding season (7%). By comparison, we recorded 34 species of birds (n = 178 observations) active on burdock plants. Warblers (38% *Parulidae*) and sparrows (24% *Emberizidae*) were the most active followed by small numbers of birds from eight other families (<9% per family). Most birds perched on burdock stems (79%), although some actively foraged on leaves, stems, or at burrs (21%). Of the seven species that foraged on burdock, 71% were also entanglement victims. Overall, we suggest that fall migrants that forage actively on burdock are most at risk of entanglement.

**PS1.239 Unfried, Thomas**, (University of Washington, Bellingham, United States); Oleyar, Dave (University of Washington, Pullman, WA, United States); Marzluff, John (University of Washington, Seattle, WA, United States)

## INVESTIGATING POTENTIAL SOURCE-SINK DYNAMICS OF SONG SPARROWS IN THE FRAGMENTED URBAN LANDSCAPE AROUND SEATTLE, WA

Urbanization affects the type, amount, arrangement, and disturbance of vegetated land cover that may produce and affect source-sink population dynamics of birds. Detecting source-sink population dynamics can be difficult because it requires simultaneous observation of reproduction, survival, and migration rates in multiple populations. We combined a study of demographic rates with genetic methods that reveal directional migration rates, to investigate possible source-sink population dynamics in Song Sparrows. We monitored 15 study sites in the vicinity of Seattle, WA, from 2000–2008 to generate juvenile and adult survival estimates from mark-recapture analysis and fecundity estimates from territory success and fledgling counts. Additionally, directional gene flow was investigated by genetic assignment methods. The region-wide trend in Song Sparrow relative abundance revealed a population decline of 7.8% annually, and 4 of 15 sampled populations had finite rates of increase ( $\lambda$ , or lambda) significantly less than one. Net immigration estimated from genetic assignments was negatively correlated with  $\lambda$ , evidence that Song Sparrows around Seattle exhibit source-sink population dynamics. Net immigration and  $\lambda$  were not correlated with landscape or local attributes of native vegetation. Genetic methods suggest that gene flow is common throughout the region. Despite the Song Sparrow's short median dispersal distance, they are likely able to disperse and populate suitable habitat as it is available.

**F5.2 Ungvari-Martin, Judit**, (University of Florida, Gainesville, United States); Burleigh, Gordon (University of Florida, Gainesville, FL, United States); Robinson, Scott (Florida Museum of Natural History, Gainesville, FL, United States)

## MOSAIC OF COMMUNITIES: BIRDS IN FORESTS OF WESTERN AMAZONIA

One of the world's most species-rich bird communities can be found in Amazonian forests; often times these forests are characterized by different soil types and the unique composition of plants growing on them provide a range of habitats. We used already published species lists and fieldwork data to estimate species composition of understory birds across two sites in the Peruvian Amazon, including a variety of habitats such as rivers, lakes, white sand forests, flooded forest and clay rich terra firme forests. We predicted that bird communities on relatively unproductive sandier soils would have fewer species, especially ant followers and terrestrial insectivores. We further predicted that white-sand specialists replace closely related species (e.g., congeners or sister species) occurring in richer soil forest. We used phylogenetic methods to create a species level phylogenetic tree for lowland Amazonian birds and compared community structure across the different habitat types in a highly rigorous computational analysis using sequence data available from Genbank. The phylogenetic community structure analysis using PHYLOCOM allowed us to detect clustering over evenness of the species found in the different habitat types. These analyses can aid in generating hypotheses and to make more specific predictions as well.

We also compared capture rates and guild structure of mist-net samples from each site. Preliminary analyses of the samples suggest that, contrary to predictions, ant followers were more

abundant in white sands forest. Richer soils appeared to have better developed mixed-species flocks consisting of sentinels and beaters. These flocks were essentially absent from white sands. Other guilds showed mixed patterns. Surprisingly, mist-net samples show high species diversity on poor white sands forests suggesting that the differences in plant community productivity may not always translate to major differences in bird community structure.

**T4.6 Urban, Elizabeth,\*** (University of Arizona, Tucson, United States); Mannan, R. William (University of Arizona, Tucson, AZ, United States)

#### THE ROLE OF OROPHARYNGEAL PH IN THE PERSISTENCE OF TRICHOMONAS GALLINAE IN COOPER'S HAWKS (ACCIPITER COOPERII)

Trichomoniasis is a disease, caused by the protozoan *Trichomonas gallinae*, which affects avivorous raptor species worldwide. Existing information suggests that the disease is most prevalent in young birds, and differential susceptibility to trichomoniasis among individuals in different age groups was documented in Cooper's hawks (*Accipiter cooperii*) nesting in Tucson, Arizona. In that population, 85% of nestling hawks had *T. gallinae* in their systems, whereas only 1% of breeding age hawks were infected. Trichomonads generally are sensitive to environmental pH and we explored the possibility that differences in oropharyngeal pH may contribute to the differential prevalence of infection between age groups. We measured the pH of the fluid in the oropharynx of a sample of male and female hawks from three age groups (nestlings, fledglings, and breeding age hawks) in Tucson, Arizona in 2010 and 2011. We also clinically tested for the presence of *T. gallinae* in a sub-sample of hawks of each sex from each age group, sub-cultured positive cultures of *T. gallinae* taken from hawks, and inoculated the sub-cultures into mediums manipulated to reach pH levels of 5.5, 6.0, 6.5, 7.0, and 7.5. We sampled 375 hawks and found that pH in the oropharynx of nestlings was 7.3 times less acidic than in either fledglings or breeding hawks. In vitro tests (n=18) showed that *T. gallinae* grew at a higher rate in the pH range found in nestlings (~7.0) than in the other two groups (both ~6.0). The incidence of *T. gallinae* was higher in nestlings (16%) than in either fledglings or breeding hawks (0%). Our findings indicate that pH of the oropharynx becomes more acidic in Cooper's hawks soon after they leave the nest. This change, coupled with the result that *T. gallinae* is not as prolific in more acidic conditions, suggests that the higher levels of acidity in the oropharynx of fledglings and breeding hawks may play a role in the differential prevalence of infection among age groups.

**SAT15.8 Uy, J. Albert C.,** (University of Miami, Coral Gables, United States); Concannon, Moira R. (University of Massachusetts, Amherst, MA, United States); Poelstra, Jelmer (Uppsala University, Uppsala, Sweden); Cooper, Elizabeth A. (University of Miami, Coral Gables, FL, United States); Moyle, Robert (University of Kansas, Lawrence, KS, United States); Filardi, Christopher E. (American Museum of Natural History, New York, NY, United States)

#### THE GENETIC BASIS OF CONVERGENT PLUMAGE COLOR AMONG POPULATIONS OF AN ISLAND FLYCATCHER

Convergence of traits among independent populations provides some of the most compelling evidence of selection in the wild. Little is known, however, about the genetic basis of these convergent traits: Are they mediated by identical or different mutations in the same genes, or unique mutations in different

genes? Here we show that identical plumage color shared by three populations of the *Monarcha castaneiventris* flycatcher in the Solomon Islands is mediated by unique mutations in different genes and maintained by parallel selection. Melanic (entirely black) birds from one small island share an amino acid substitution in the melanocortin-1 receptor (MC1R), whereas identically melanic birds from another small island 100 km away share an amino acid substitution in the Agouti Signaling Protein, the inverse agonist of MC1R. In contrast, all populations of the chestnut-bellied form of *M. castaneiventris* lack the melanic MC1R and ASIP allelic variants. Population genetics analyses of markers not associated with pigmentation implicate parallel selection in the maintenance of the ASIP and MC1R variants despite gene flow between the different color forms. Remarkably, a third island group, over 300 km from the two melanic populations, harbors another melanic population that lacks the melanic MC1R and ASIP allelic variants, indicating a third genetic mechanism mediating convergent melanism. Our results suggest that genetic mechanisms underlying identical traits between populations of a single species can be unique, and these simple genetic changes, in turn, contribute to the diversity of forms that may lead to the origin of new species.

**T3.6 Valdez-Juarez, Simon,** (Simon Fraser University, Burnaby, Canada); Drake, Anna; Green, David (Simon Fraser University, Burnaby, BC, Canada)

#### WINTER HABITAT EFFECTS ON THE INDIVIDUAL CONDITION AND TERRITORIALITY OF YELLOW WARBLERS (SETOPHAGA PETECHIA) IN NATURAL AND AGRICULTURAL HABITATS IN JALISCO, MEXICO

Determining what limits populations of migratory birds requires consideration of events throughout the annual cycle, but relatively few studies have examined the role winter habitat plays on the behavior and physiology of neotropical migrants. We examined differences in the population composition, condition and territoriality of Yellow warblers (*Setophaga petechia*) in natural (riparian forest and mangrove/dry scrub) and agricultural habitats in Jalisco, Mexico. Birds wintering in our study site belong mostly to the western flyway, breeding in western North America. Population composition at six sites was determined by transect surveys, capture rates, and territory mapping in 2011 and 2012. Territory size and fidelity was evaluated using radiotelemetry and visual tracking. Individual condition was assessed between January to March using morphological measures, hematocrit, and blood heterophil/lymphocyte (H:L) ratios. We found a gender bias by habitat: 80% and 74% of individuals found in riparian forest and agricultural habitat respectively were adult males, whereas mangrove/dry scrub habitat had only 53% adult male occupancy. Radiotelemetry conducted in 2012 suggest territories located in agricultural habitat are smaller and occur at higher densities than those in mangrove/dry scrub or riparian habitats where birds hold large territories with less defined boundaries and a greater degree of overlap. Morphometric and blood data from 2011 show that winter habitat influences condition and stress levels in Yellow Warblers. Individuals occupying agricultural habitats were lighter and maintained relatively high H:L ratios (indicative of high stress levels), while individuals occupying mangrove/scrub and riparian habitats were heavier and had low H:L ratios. Variation in behavior and physiology between different wintering habitats could affect migration overwinter and migration survival and breeding success. Our findings will help to determine the influence winter habitat quality in Mexico has on western warbler demography.

**PS1.50 Valencia-Herverth, Jorge**, (Laboratorio de Ecología de Poblaciones, Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Hidalgo, Pachuca, Hidalgo, Mexico); Ortiz-Pulido, Raúl (Laboratorio de Ecología de Poblaciones, Centro de Investigaciones Biológicas, Universidad Autónoma del Estado de Hidalgo, Pachuca, Hidalgo, México, Mexico); Enríquez-Rocha, Paula (2 Departamento de Ecología y Sistemática Terrestre, El Colegio de la Frontera Sur, San Cristóbal de las Casas, Chiapas, México, Mexico)

#### EFFECT OF CLIMATE CHANGE ON NOCTURNAL RAPTORS AT HIDALGO STATE, MEXICO

Knowledge about nocturnal raptor in Mexico is limited. Nowadays the natural history, ecology and distribution of these species are poorly known. This lack of knowledge is reflected in the limited information on the effect that climate change may have on their populations. Our study assessed the effect of climate change in some nocturnal raptor inhabiting Hidalgo State, in central Mexico. Basic information was compiled of bibliographic and databases sources, and field work done by the authors. Using MaxEnt, circulation model HADCM3, scenarios A2 and B2 of climate change, and 19 bioclimatic variables from WorldClim we generated ecological niche models of seven owls species (*Megascops kennicottii*, *M. trichopsis*, *M. guatemalae*, *Glaucidium sanchezi*, *G. brasilianum*, *Ciccaba virgata* and *Aegolius acadicus*) and perform a preliminary approach on the effects of climate change to 2050 and 2080 years. We predicted that some species, as *G. sanchezi*, will have significant reductions in distribution, while others, as *G. brasilianum* and *C. virgata* will increase their distribution. The contrasting answers of the species are explained if we consider species resilience to perturbation and species use of degraded habitat.

**W2.4 Valerie, Steen**, (Colorado State University, Fort Collins, United States); Skagen, Susan (US Geological Survey, Fort Collins, United States); Noon, Barry (Colorado State University, Fort Collins, CO, United States)

#### POTENTIAL EFFECTS OF CLIMATE CHANGE ON WETLAND-ASSOCIATED BIRDS IN THE PRAIRIE POTHOLE REGION, U.S.A.

Freshwater wetlands and wetland-associated birds are considered at particularly high risk for negative climate change effects. The Prairie Pothole Region (PPR) of the north-central U.S. and south-central Canada contains millions of small prairie wetlands that provide critical habitat to many migrating and breeding wetland-associated birds. To look at the potential effects of climate change on these birds we predicted current and future distributions of species common in the PPR using bioclimatic species distribution models (SDMs). We created regional-scale SDMs for the U.S. PPR using breeding bird survey occurrence records for 1971-2000 and wetland, upland, and climate parameters. For each species we predicted current distribution based on climate records for 1981-2000 and projected future distributions to future climate scenarios for 2081-2100. Range reductions were predicted for all species across scenarios. However, individual species projections varied widely and range reductions were as high as 99%. We also created a hypothetical landscape where wetlands were numerous and constant to project future distributions while controlling for patterns of wetland loss in the region. Models indicated that many wetland-associated species would shift to the northeastern portion of the region if wetlands were available. Targeted wetland management, easements, and restoration may ameliorate the future effects of climate and land-use change on wetland birds.

**PS2.97 Van Dellen, Amanda**, (University of Nevada - Reno, Reno, United States); Downs, Cynthia (University of Nevada - Reno, Reno, United States); Sedinger, James (University of Nevada - Reno, Reno, NV, United States)

#### AGE-RELATED IMMUNE FUNCTION IN PACIFIC BLACK BRANT: INDIVIDUAL RESPONSES TO A BACTERIAL KILLING ASSAY

Life history theory posits that because of resource limitation, life histories reflect constraints on resource allocation. Aging may result from the life history optimization of resource partitioning, in which the optimal low level of repair of somatic damage leads to the gradual deterioration of the organism's physiology. The theory assumes that organisms alter their investment in resources between self-maintenance and other various functions like reproduction and growth in a way that maximizes fitness. The optimal strategy, as age increases, is to spend fewer resources on self maintenance. One such self maintenance mechanisms is the immune system. Therefore, according to life history theory we would expect immune function to decrease later in life. Although the deterioration of immune function with age has been documented in humans, fairly little is known about specific variation in immunological capabilities of wild populations. In this study, we assessed the innate immune response of individual Pacific Black Brant (*Branta bernicla nigricans*; hereafter brant) to an in vitro bacterial killing assay (non-pathogenic strain of *E. coli*). We were interested in how age affects immune response in brant, specifically in the differences between the following three age classes: pre-breeders (second-year birds), prime breeders (3-6 year olds), and older breeders (6+ years old). We found no difference in immune response between age classes. Our results suggest a lack of immunosenescence in a wild population of arctic nesting geese.

**PS2.125 van der hoek, yntze**, (CUNY / College of Staten Island, Staten Island, United States); renfrew, rosaling (The Vermont Center for Ecostudies, White River Junction, United States); manne, lisa (CUNY / College of Staten Island, Staten Island, United States)

#### VARIATION IN LONG-TERM THRESHOLD RESPONSES TO HABITAT AVAILABILITY

The minimum amount of habitat needed in a landscape for a species to persist has been a widely recognized conservation target. Several studies have identified habitat thresholds below which the probability of persistence declines rapidly, but as yet little is known of the extent to which thresholds vary spatially and between species. In order to determine variation in threshold responses between species and region, we modeled long-term responses of forest associated breeding birds to habitat availability using repeated state-wide breeding bird atlases of the State of Vermont. We provide estimates of threshold responses for 25 breeding bird species and compare these with previous analyses conducted in the state of New York. Out of all 25 species, less species showed threshold responses to habitat availability in Vermont (11 species) than New York (21 species). For species showing threshold responses in both states, the average of the percentage of forest cover at which thresholds of persistence occurred was significantly lower in Vermont (42.04%, S.E.= 8.32) than in New York (62.97%, S.E.=4.18). Persistence thresholds ranged from 34.25% (Pileated woodpecker) to 95.83% (Winter wren) in New York and from 17.08% (Nashville warbler) to 88.55% (Scarlet Tanager) in Vermont. We showed that variation in habitat requirements for persistence is prevalent between both species and regions, and provide preliminary insights in the variables driving this

variation. This allows us to investigate how results from species-habitat studies can be extrapolated to other areas or species and may inform the establishment of conservation targets based on species-habitat relationships.

**S6.2 van Riper III, Charles**, (USGS/SBSC/ Sonoran Desert Research Station, Tucson, United States); J., Kellermann (University of Arizona, Tucson, AZ, United States); TJ, Fontaine (US Geological survey, Lincoln, NE, United States); S, Skagen (US geological Survey, Fort Collins, CO, United States)  
THE INFLUENCE OF PLANT PHENOLOGICAL PATTERNS ON MIGRATING NEOTROPICAL MIGRANT WARBLERS IN WESTERN NORTH AMERICA

In western North America, migration patterns of neotropical land birds evolved along landscapes at different elevations and within heterogeneous and patchy environments. Western migrant warbler species appear to assess riparian migrant routes and stop over habitats at four major scales; 1) Genetically influenced corridor selection; 2) large-scale landscape features; 3) vegetation patches; and, 4) microhabitat selection within a vegetation patch. Along the lower Colorado River in Mexico, California and Arizona, and the Santa Cruz and San Pedro rivers in Arizona, these four scales are variously influenced by local weather patterns, vegetative species, habitat structure, and plant phenology patterns that appear to provide a cue to food resources. In migrating neotropical migrant warblers that we have examined along the different elevation gradients of the Colorado, Santa Cruz and San Pedro rivers, bird species arrival dates and numbers were variable among years and locations, being largely influenced by plant phenology cycles. Therefore, stopover and bird foraging patterns were greatly influenced by plant species and phenological patterns of the microhabitat within the selected stopover site. Along with large scale landscape features and riparian habitat structure, it appears that vegetation phenology is one of the most important cues for migrating warblers. The flowering of different trees species at various elevations provide a cue for warblers to assess insect prey availability, thus structuring spring warbler migration patterns along southwestern riparian corridors.

**SAT4.5 VanBeek, Kelly**, (University of Illinois, Urbana, United States); Brawn, Jeffrey; Ward, Michael (University of Illinois at Urbana-Champaign, Urbana, IL, United States)  
EFFECTS OF ALTERNATIVE TILLAGE PRACTICES ON BIRD POPULATIONS IN ILLINOIS

Approximately 71% of land cover in the Midwest is in agriculture production, with rowcrops being the most prevalent. Most of these rowcrops have replaced grasslands, resulting in declines of their constituent bird communities. Previous research has shown that tillage regimes can affect the suitability of rowcrop fields as wildlife habitat. Originally created as a soil conservation measure, use of no-till agriculture is increasing in areas of intensive rowcrop production. However, it is not yet clear whether this practice benefits wildlife compared to conventional tillage methods. We compared the nesting success, nest predators, and avian communities in tilled and no-till soybean fields. We found 56 nests in no-till soybean fields but only 4 nests in tilled fields. Nest densities were an order of magnitude greater in no-till fields than tilled fields. Our most common nesting species overall were American Robins (*Turdus migratorius*), Mourning Doves (*Zenaidura macroura*), and Red-winged Blackbirds (*Agelaius phoeniceus*), and all were more common in no-till fields. Of the 56 nests found in no-till, 26.8% fledged at least one chick, 57.1% were depredated, and 16.1% failed due to farming practices. These nest success rates agree

favorably with published accounts of nesting success in Midwestern grasslands. Predators observed on camera included Coyotes (*Canis latrans*) and Thirteen-lined Ground Squirrels (*Spermophilus tridecemlineatus*). We counted 14 bird species on no-till survey transects compared to 11 species on tilled transects. Our results identify an important effect of tillage practices on grassland bird breeding success and habitat use. Nonetheless, the management implications of tillage are not straightforward, and more work is needed to determine the potential of no-till fields as ecological traps.

**F13.3 VanderWerf, Eric**, (Pacific Rim Conservation, Honolulu, United States);  
EVOLUTION OF NEST HEIGHT IN THE ENDANGERED OAHU ELEPAIO IN RESPONSE TO A NON-NATIVE PREDATOR

The majority of bird extinctions since 1800 have occurred on islands, and non-native predators have been the greatest threat to island birds. Island endemics often lack life history traits and behaviors that reduce predation and they can become evolutionarily trapped, but few studies have examined the ability of island species to respond to novel predators. The Oahu Elepaio (*Chasiempis ibidis*) is an endangered monarch flycatcher endemic to the Hawaiian Island of Oahu, and its greatest threat is nest predation by non-native black rats (*Rattus rattus*). I examined whether Oahu Elepaio nest placement has changed at the individual and population levels in response to rat predation by measuring height and success of 293 nests from 1996-2011. Average height of Oahu Elepaio nests increased 50% over this 16-year period, from  $7.9 \pm 1.7$  m to  $12.0 \pm 1.1$  m. There was no net change in height of sequential nests made by individual birds, indicating elepaios have not learned to place nests higher. Nests  $\leq 3$ m high were less successful, and the proportion of low nests declined over time, suggesting nest height has evolved through natural selection by predation. Nest success increased over time, which may increase the probability of long-term persistence of the species. Rat control can facilitate the evolution of increasing nest height by slowing the rate of population decline and allowing sufficient time for this adaptive response to spread through the population.

**PS1.255 VanderWerf, Eric**, (Pacific Rim Conservation, Honolulu, United States);  
ECOLOGEOGRAPHIC PATTERNS OF MORPHOLOGICAL VARIATION IN ELEPAIOS (*CHASIEMPIS* spp.): BERGMANN'S, ALLEN'S, AND GLOGER'S RULES IN A MICROCOSM

Animals often exhibit predictable geographic variation in morphology, and such ecogeographic patterns reflect local adaptation to varying environmental conditions. The most common of these patterns are termed Bergmann's, Allen's, and Gloger's rules. I studied morphological variation in the Hawaii Elepaio (*Chasiempis sandwichensis*) and the Oahu Elepaio (*Chasiempis ibidis*), monarch flycatchers endemic to the Hawaiian Islands. I measured body size and plumage color of 223 live elepaio captured at 36 sites on Hawaii and 132 live elepaio captured at 23 sites on Oahu, and I examined 132 museum specimens from an additional 22 locations on Hawaii. I used multiple regressions to examine relationships of elepaio body size and plumage color to elevation and annual rainfall on each island. Size of Hawaii Elepaio varied among sites and was related to elevation and rainfall. Wing chord, tail length, and body mass had positive relationships with elevation, as predicted by Bergmann's rule. Proportional bill length and proportional tarsus length were inversely related to elevation, as predicted by Allen's rule. Elepaio in areas with higher rainfall were more



heavily pigmented and had fewer and smaller white markings, as predicted by Gloger's rule. Elepaio differed morphologically among sites only a few km apart due to their sedentary behavior and the steep gradients in temperature and elevation and limited climatic variation of the tropical environment of the Hawaiian Islands. Morphological variation in elepaio is smoothly clinal because there are few dispersal barriers and elepaio inhabit areas with a range of climates and vegetation. Morphological and underlying genetic variation is important, and conservation of elepaios with varying phenotypes would preserve evolutionary potential and ability to adapt to climate change.

**PS2.238 vanOordt, Francis**, (California State University Northridge, Reseda, United States); Hertel, Fritz (California State University Northridge, Northridge, United States)

#### WING SHAPE DIFFERENCES AND CHARACTER DISPLACEMENT AMONG PACIFIC BOOBIES

Boobies are primarily plunge divers that rely on flight to locate and capture prey. Six species of boobies inhabit the Pacific: four are more pelagic (Masked, Red-footed, Brown, Nazca) but the Blue-footed Booby (*Sula nebouxi*) and Peruvian Booby (*S. variegata*) inhabit coastal Central and South America. Although these latter two species show a mostly allopatric distribution, they overlap in northern Peru. This zone of overlap could potentially give rise to character displacement in their sympatric range. Therefore, they would be predicted to exploit slightly different niches and foraging strategies in sympatry.

For seabirds, wing size and shape are key components of their functional design and therefore critical in their foraging ecology and breeding success. Wing loading and aspect ratio, indications of wing size and shape, respectively are parameters that can reveal differences in their ecomorphology. These two species were studied in Chile, Peru, and Mexico, and preliminary data suggest evidence of potential character displacement in the region of sympatry. Blue-footed Boobies show a significantly higher aspect ratio than in their northern range (Mexico), which may reflect a more pelagic behavior in sympatry.

Wing loading differs intraspecifically for all species in allopatric localities, but there is significant convergence in the sympatric area for all males and females of both species in Lobos de Tierra Island. Convergence in beak morphology (shape and size) was also found in all species and localities, except for Blue-footed Boobies in Mexico. This may indicate a strong influence of upwelling in Peru and Chile, where all Peruvian and Blue-footed boobies feed mainly of one prey type, whereas Blue-footed boobies in Mexico have a larger wider beak, allowing them capture a broader variety of prey species.

**SAT17.7 VanZandt, Marie**, (University of Hawaii, Hilo, Hilo, United States); Delparte, Donna (University of Hawaii, Hilo, Hilo, HI, United States); Duvall, Fern (Hawaii Division of Forestry and Wildlife, Honolulu, HI, United States); Penniman, Jay (University of Hawaii Pacific Cooperative Studies Unit, Honolulu, HI, United States)

#### THE NESTING HABITAT AND SPATIAL DISTRIBUTION OF LANAI'S ENDANGERED HAWAIIAN PETREL (*PTERODROMA SANDWICHENSIS*).

Spending the majority of their life at sea and appearing over land nocturnally during the breeding season, the endangered Hawaiian Petrel (*Pterodroma sandwichensis*) has a unique set of constraints when determining its spatial distribution. We investigated the nesting habitat selection and at sea distribution of the Hawaiian Petrel in a previously thought extirpated colony, on the island of Lāna'i. By conducting extensive night surveys followed by daylight searches, eighty-eight nesting burrows

were located in the summer of 2011. Binomial logistic regressions, complemented with machine learning techniques (CART), were used to investigate habitat characteristics of Hawaiian Petrel nesting burrows. The probability of nest occurrence was strongly tied to areas dominated by native understory vegetation, open canopies and steeper slopes (> 9 degrees). Utilizing the nest site predictive model and high resolution satellite imagery, in a GIS, the remaining suitable habitat on the island of Lāna'i was quantified (>120 acres). These results will guide habitat restoration efforts; specifically targeted removal of invasive strawberry guava (*Psidium cattleianum*) and predator control at upper elevations. In August 2011, twenty geolocating tags were placed on breeding birds to determine the non-breeding seasonal migration routes. Preliminary data collected from ten of those tags in the Spring of 2012 provides information on these at-sea distributions and patterns.

**PS2.202 Vázquez López, Alma Melisa**, \*U (Museo de Zoología Alfonso L. Herrera, Facultad de Ciencias, UNAM, Mexico City, Mexico); Ramirez Barrera, Sandra Marisol; Hernandez Baños, Blanca Estela (Museo de Zoología Alfonso L. Herrera Facultad de Ciencias UNAM, Mexico City, Mexico)

#### PHYLOGENY AND GENETIC VARIATION ON THE COMPLEX AMAZILIA RUTILA (LESSON, 1842) (AVES: TROCHILIDAE)

In Mesoamerica topographic complexity, climatic variety and different types of vegetation have promoted species diversification. Species with geographically isolated populations can accumulate more genetic differences, due to reduced gene flow. *Amazilia rutila* (Cinnamon Hummingbird) is resident specie on the Pacific (including the Marias Island) and Atlantic Slopes of Mexico and Central America. On base of its fragmented geographic distribution, four subspecies have been reported; however, morphological differences are not clear. On the other hand, *A. rutila* is considered a close relative of *A. yucatanensis* and *A. tzacatl*. The goal of this work was to assess the relationships and genetic variation of *A. rutila* populations and determine the phylogenetic relationships between *A. rutila*, *A. yucatanensis* and *A. tzacatl*, by using mitochondrial molecular markers (ND2 and COI).

We obtained a total of 69 DNA sequences and performed phylogenetic analysis maximum parsimony, maximum likelihood and Bayesian criteria, with combined sequences and separated genes.

The phylogenetic analysis uncovered the presence of five lineages in the *A. rutila* complex: *A. graysonni* (Marias Islands), *A. diluta* (North Pacific), *A. rutila* (Central Pacific), *A. sp.* (Chiapas) and *A. corallirostris* (Yucatan Peninsula-Central American). Population genetics analysis revealed that there is no gene flow between populations. We propose that geographic barriers play an important role in preventing gene flow, thus favoring allopatric speciation. Our analysis showed that *A. yucatanensis* closely related to *A. tzacatl* than to *A. rutila*.

**S1.9 Veloz, Sam**, (PRBO Conservation Science, Petaluma, United States); Dennis, Jongsomjit; Salas, Leo; Elliott, Nathan; Ballard, Grant (PRBO Conservation Science, Petaluma, United States)

#### EXAMINING THE TRADEOFFS BETWEEN USING CITIZEN SCIENCE DATA AND STANDARDIZED OBSERVATIONS FOR MODELING HOW CLIMATE CHANGE WILL AFFECT THE DISTRIBUTION AND ABUNDANCE OF BIRDS AT REGIONAL SCALES

Commonly used methods to estimate the distribution and abundance of birds at regional spatial scales involve developing statistical models of the correlation between observations of birds and a set of environmental variables. When we use these models to estimate responses to future climate change we assume that our set of observations adequately sample the range of suitable conditions within which a species can persist both in current and future time periods. However when we apply these models at regional scales, we seldom have standardized observation data available which adequately sample species' ranges throughout the entire region resulting in biased estimates of species' responses to future conditions. Considerable efforts have been made to amass data from individual standardized sampling programs into centralized databases to facilitate the creation of better models, yet there are still gaps in the coverage from these data. Citizen science bird observations are increasingly becoming available and could be used to improve models when only biased standardized observation data are available. We use examples of our efforts to model the distribution of birds from Mexico through the Pacific Northwest to examine the tradeoffs between using standardized data and citizen science data to project responses to climate change scenarios. In the Pacific Northwest, we were able to acquire close to one million standardized observations from many sources and used the data to create models of the abundance of birds with a sufficient sampling of the available environmental conditions with which to model future responses to climate change. In contrast, we were unable to obtain an adequate sample of standardized observations in the southwest and Mexico and thus used citizen science observations to develop occurrence models for this region. Our models illustrate how results from individual sampling efforts can be applied to much larger regions when data from different sources are made available through a centralized database. We also demonstrate how citizen science can fill in the gaps when standardized data are unavailable and that in many cases models from citizen science data may be superior to models constructed using standardized methods but with poor spatial coverage. Finally we show how the available data can be used to identify priorities for future monitoring efforts by examining where environmental space has been poorly sampled within the region.

**PS1.258 Venkatraman, Madhvi, \*U** (Occidental College, Los Angeles, United States); McCormack, John (Occidental College, Los Angeles, CA, United States)

**DIVERGENCE AMONG CLOUD FOREST ISOLATES OF THE UNICOLORED JAY (APHELOCOMA UNICOLOR) IN THE MIDDLE AMERICAN HIGHLANDS**

We present evidence for genetic and phenotypic divergence among Unicolored Jays (*Aphelocoma unicolor*) from Middle American highland forests. Middle American forests are currently facing high rates of habitat loss despite being considered one of the 25 biological hotspots of the world. The pine-oak forests of Central America are a main component of the Middle American forest ecoregion and are considered an Endemic Bird Area. The Unicolored Jay (*Aphelocoma unicolor*) is an emblematic species of this ecoregion, inhabiting many of the region's disjunct patches of pine-oak habitat. We assessed morphological and plumage color differences among the five allopatric subspecies that stretch south from Veracruz, Mexico to Nicaragua: concolor, oaxacae, guerrerensis, unicolor, and griscomi. We found significant evidence for phenotypic divergence among all five subspecies. Combined with evidence of genetic divergence, our results suggests that at least two, and potentially all five, of the subspecies warrant conservation protection as independently evolving lineages. Given that the

large area covered by the species as a whole has led to its designation as a "species of least concern" by the IUCN, our results would have a significant impact on the conservation status of these birds, and potentially of Middle American pine-oak forests more generally.

**SAT2.5 Vernouillet, Alizée**, (Université de Moncton, Moncton, Canada); Villard, Marc-André (Université de Moncton, Moncton, NB, Canada); Haché, Samuel (University of Alberta, Edmonton, AB, Canada)

**SELECTION HARVESTING NEGATIVELY AFFECTS OVENBIRD SURVIVAL: A 6-YEAR STUDY**

Partial harvest treatments have a significant effect on many species of forest songbirds. However, those effects tend to be moderate and relatively short-lived. In a before-after experiment, our research team found a 40% decline in Ovenbird density in the first year post-harvest. Males occupying treated plots expanded their territories relative to those in controls. In this study, we hypothesized that this phenomenon may incur physiological costs, which would be expressed as lower apparent survival rates. For this purpose, we followed two cohorts (n=141) of male Ovenbirds (*Seiurus aurocapilla*) that we banded in five pairs of 25-ha plots in New Brunswick, Canada, in 2006 and 2007. During the winter of 2006-2007, one site of each pair was treated through selection harvesting (30-40% removal). We estimated annual apparent survival among breeding seasons using program MARK. We found considerable support for a treatment effect on apparent survival ( $\sum w_i = 0.906$ ). Individuals in control plots had higher apparent survival rates ( $\phi = 0.741 \pm 0.063$ ) than those in treated plots ( $\phi = 0.632 \pm 0.086$ ). The best model to explain survival included the additive effects of treatment, age, and year. However, the evidence for age and year effects was weak. In the fifth year post harvest, there were only two males left from the 2006 cohort in treated sites, whereas there were 11 in control sites. These findings are consistent with the hypothesized treatment effect on apparent survival. Even if most missing birds had emigrated, we can still conclude that there was a negative response to the treatment.

**S12.5 Vidal, Rosa Maria**, (Pronatura Sur, San Cristobal de Las Casas, Chiapas, Canada); Macias, Claudia (Pronatura Sur, San Cristobal de Las Casas, Chiapas, Canada); Komar, Oliver (Escuela Agrícola Panamericana/Zamorano University, Tegucigalpa, United States); Castillejos, Efrain (Pronatura Sur, San Cristobal de Las Casas, Chiapas, Mexico); Peak, Rebecca (US Army. Natural and Cultural Resources Management Branch, Fort Hood, Texas, United States); Martinez, Alberto; Hernandez, Eric (Pronatura Sur, San Cristobal de Las Casas, Chiapas, Mexico)

**DESIGNING A NEOTROPICAL LANDSCAPE FOR MIGRANTS AND RESIDENTS: APPLYING RESEARCH RESULTS FOR ON-THE-GROUND CONSERVATION.**

Bird habitats in the Neotropics are facing a rapid change due to the processes of urbanization, population growth, and deforestation. Today's landscapes are composed of a mixture of fragmented patches of vegetation, agricultural lands, and human settlements. In Mexico, only 38 % of the natural vegetation remains, and deforestation is continuing at a rate of 0.4 %. Our challenge is to maintain enough suitable habitat for the largest number of migratory and resident species within this matrix. We discuss the application and integration of research results into the Pine-Oak ecoregional conservation plan, as well as within the Mesoamerican Biological Corridor. We present and

discuss data from comprehensive studies that have been carried out since 1990 on the winter distribution of golden-cheeked warbler (*Setophaga chrysoparia*) in the Neotropics, including results of standardized monitoring for the entire winter range, studies on habitat use, composition of mixed flocks, and GIS analysis. These results have been used at different scales for conservation decision-making, such as ecoregional planning, identification of specific conservation sites, designation of Important Bird Areas, and recommendations for forestry management techniques. A similar approach has been followed for strengthening the Mesoamerican Biological Corridor concept, in which results of bird studies conducted by several authors during the last 20 years continue to be used for improving coffee production plantations, forest restoration, and watershed management. Studies that have greater applicability for these initiatives are those in which specific habitat features are identified and which incorporate human activities that can be adapted to allow those conditions to persist. Basic research continues to be needed, including population studies, foraging and resource use within various habitats, ecology and interactions between resident and migratory birds, as well as regional and latitudinal distribution of species within a landscape matrix. Greater interaction among research institutions, conservation groups, and government agencies is one of the most important steps in integrating scientific research into conservation action.

**PS1.84 Villar, Cynthia**, (Universidade Federal de São Carlos, São Paulo, Brazil); Bryan Jr., Albert; Lance, Stacey (Savannah River Ecology Laboratory, Aiken, United States); Braga, Erika (Universidade Federal de Minas Gerais, Belo Horizonte, Brazil); Congrains, Carlos; Del Lama, Silvia (Universidade Federal de São Carlos, São Carlos, Brazil)

**PREVALENCE AND LINEAGES OF PLASMODIUM AND HAEMOPROTEUS IN WOOD STORK NESTLINGS IN THREE REGIONS OF THE AMERICAN CONTINENT**

The Wood Stork is classified as endangered in US while in other countries its status is undetermined. Haemoparasites are found in many bird species and its occurrence implies in costs on wild bird's populations. Low prevalence of Haemoproteus (1.5%) was detected in the US nestling population. The aim of this study was to verify if Wood Stork nestlings were infected by Plasmodium and Haemoproteus, and to characterize lineages found.

Three Wood Stork nestlings populations were studied: southeastern US (N=90), northern Brazil (N=74) and central-western Brazil (N=125). Molecular diagnosis was based on a screening using Fallon et al (2003) protocol, and a posterior sequencing of a cytochrome b fragment to identify lineages (Hellgren et al, 2004). A phylogenetic tree was built using our data and sequences from the Malawi database (Bensch et al, 2009) for genera identification.

Wood Stork nestlings were positive for Haemoproteus in southeastern US (3) and in northern Brazil (1). Haemoproteus infection in US was confirmed by morphological analysis. Plasmodium was found in Wood Stork nestlings from northern (6) and central-western Brazil (14). Five haplotypes were determined by cytochrome b fragment: one haplotype (H5) joined in the Haemoproteus branch, and four haplotypes (H1 to H4) joined in one of branches of Plasmodium. All four positive individuals infected by the Haemoproteus showed the same sequence (H5). Three Plasmodium lineages (haplotypes 2, 3 and 4) found in the Brazilian center-western region differed each other by one mutation, the other haplotype (H1) of Plasmodium was common among the 17 positive individuals from the center-western and the Brazilian northern. Through the molecular

protocol, we did not find nestlings younger than 15 days old infected by Plasmodium, nor younger than 30 days old infected by Haemoproteus. We also found Haemoproteus in one US subadult and one US adult in a sample of three free-ranging individuals captured in Georgia state.

This is the first time Plasmodium and Haemoproteus were detected in Brazilian Wood Stork populations. The level of Haemoproteus prevalence detected in the US nestlings population (3%) was twice the previously reported by morphological analysis. Our results indicate haemoparasitic infection starts early in development of this species; efforts to determine the prevalence, mainly in populations that exchange individuals with the threatened US population, are recommended to clarify and to evaluate this impact

**W1.4 Villard, Marc-André**, (Université de Moncton, Moncton, Canada);

**CAN FOREST MANAGEMENT INSPIRED FROM NATURAL DISTURBANCE REGIMES CREATE ECOLOGICAL TRAPS? A FIELD EXPERIMENT FEATURING OVENBIRD AND BROWN CREEPER**

The phenomenon whereby individuals show a preference for habitat where their fitness is low is called an ecological trap. Identifying ecological traps implies that we can accurately assess both habitat preference and quality, a challenge in most study systems. This study investigates whether a harvest treatment of moderate intensity can create ecological traps for two focal bird species associated with mature and old forest. The study was conducted over a 6-yr period in northern hardwood forest of northwestern New Brunswick, Canada. Five study plots (25 ha each) were treated through selection harvesting (30-40% removal) in 2006-2007 and each one was paired with a control (uncut) plot. Preference was assessed on the basis of plot saturation rate upon return from spring migration (Ovenbird, *Seiurus aurocapilla*) or cumulative number of active nests (Brown Creeper, *Certhia americana*), whereas habitat quality was determined on the basis of per-capita reproductive success. There was no evidence for a preference for selection cuts relative to control plots in either species. Actually, both species occupied control plots earlier in spring. We also found no treatment effect on per-capita reproductive success in either species. Although the ecological trap concept has received broad attention, convincing empirical cases are still relatively rare. This may either reflect challenges with the empirical assessment of habitat preference/quality, or the ability of most species in most systems to recognize and avoid poor habitat. Alternatively, ecological traps may be more frequent among species associated with naturally-disturbed habitats. We are currently testing this possibility.

**S10.9 Vitousek, Maren**, (University of Colorado, Boulder, Boulder, CO, Canada); Jenkins, Brittany; Hubbard, Joanna; Safran, Rebecca (University of Colorado, Boulder, Boulder, CO, United States)

**EXPLORING THE MECHANISMS LINKING INDIVIDUALLY CONSISTENT DIFFERENCES IN STRESS RESPONSIVENESS WITH REPRODUCTIVE SUCCESS IN BREEDING BARN SWALLOWS, HIRUNDO RUSTICA**

All organisms face trade-offs between investing in reproduction and self-maintenance, but how these decisions are made and physiologically mediated is only beginning to be revealed. Glucocorticoid hormones (primarily corticosterone in birds) may play a central role: an increase in circulating corticosterone promotes processes thought to aid in surviving stressful events, but can simultaneously impair other processes, including

reproduction. Seasonal changes in the corticosterone response to stressors are common, and population comparisons reveal differing patterns within and between the sexes that are consistent with adaptive modulation. However, the functional significance of individual variation in measures of stress physiology, and whether organisms continually modulate the response to stressors based on changes in potential reproductive gain (the 'brood value hypothesis') is not clear. We conducted experiments in free-living breeding barn swallows designed to test whether the corticosterone response to stress – which is highly repeatable within individuals – is associated with specific reproductive behaviors and fitness, or is adaptively modulated based on potential reproductive gain (brood size). The results of these experiments have implications for understanding whether and under what circumstances individual variation in the response to stress influences investment in current reproduction.

**PS1.212 Volker, Cassie, \*U** (Northern Kentucky University, Cincinnati, United States); Walters, Lindsey (Northern Kentucky University, Highland Heights, KY, United States)  
MALE CAROLINA CHICKADEES PROVIDE MORE PARENTAL CARE

In most avian species, both genders contribute extensively to the raising of their offspring, and the Carolina Chickadee (*Parus carolinensis*) is no exception. While only the females incubate the eggs, both sexes provision nestlings and remove fecal sacs from the nest. Minimal research has been done on the parental care behavior of Carolina Chickadees, so we performed an observational study to confirm basic characteristics such as which sex provides more care and how much care parents provide for nestlings of different ages. During this study, we performed daily hour long observations in which we recorded both provisioning visits and fecal sac removals by the parents. We found that provisioning increased over time and that males both provisioned more and removed more fecal sacs than females. Our results are consistent with previous studies and illustrate the importance of male parental care for Carolina Chickadees.

**PS2.45 Wails, Christy,** (The Pennsylvania State University, Berks Campus, Reading, United States); Oswald, Stephen; Arnold, Jennifer (The Pennsylvania State University, Berks Campus, Reading, PA, United States)  
IMPROVING ACCURACY AND EFFICIENCY OF COMMON TERN PRODUCTIVITY ESTIMATES: A TOOL FOR AGING CHICKS IN THE FIELD

Assessing productivity at waterbird breeding colonies provides information about the viability of individual sites and contributes to conservation decisions. However, for species such as the Common Tern (*Sterna hirundo*), that are difficult to age and have age-dependent chick survival, accurately determining productivity is not as simple as just counting eggs and chicks. We describe the development of a comprehensive field guide that provides a simple, yet accurate, way for personnel of varying experience to estimate the age of Common Tern chicks, allowing robust estimation of productivity. We took standardized photographs and measured biometrics of Common Tern chicks at Presqu'île Provincial Park, Ontario, Canada. Morphometric data (mass, wing length, body length, culmen length, and egg tooth presence) of known-age Common Tern chicks were collected in the field from 2008 to 2011. Photographs were analyzed for physical characteristics diagnostic of specific ages. The resulting single-page field guide uses illustrative photographs (including wing development) from six age groupings that encompass distinct developmental stages

of Common Terns. Morphometric data are summarized statistically to illustrate the range of measurements for each group. Tests of the field guide in the field and lab show that it provides a powerful tool for both experienced and untrained personnel to accurately estimate age of Common Tern chicks. This is a major step towards a robust and comprehensive analysis of productivity throughout the Great Lakes region that is urgently required to understand population declines.

**PS1.79 Walker, Jessica,** (University of Waterloo, Kitchener, Canada);

HABITAT SUITABILITY MODELLING FOR THE YELLOW-BREASTED CHAT (*Icteria virens virens*) IN ANDERS FIELD COMPLEX, POINT PEELEE NATIONAL PARK.

The Yellow-breasted Chat (*Icteria virens virens*) meets the criteria for Endangered under the Species at Risk Act of Canada. Populations within Ontario are limited due to the bird's natural range. Point Pelee National Park has been recognized as one of two strongholds in the region. However, populations within the park have been declining drastically over the past 10 years. This decline is suggested to be due to the lack of natural disturbance and land use change that has resulted in a decrease in suitable habitat. The purpose of this research was to examine environmental variables to model suitable habitat for the Yellow-breasted Chat and Willow Flycatcher (*Empidonax traillii*) within the Anders Field Complex in Point Pelee National Park. These results were used to guide management recommendations to improve habitat within the Anders Field Complex. Environmental variables at the nest patch scale, including percent cover and height, were modeled using ArcMap 10 to predict suitable habitat. Results of the models show that there is likely no suitable habitat available for the Yellow-Breasted Chat within the complex (0.04 ha). Some suitable habitat was available for the Willow Flycatcher but seemed limited (4.1 ha). These results show that habitat succession and therefore the loss of suitable habitat, is a likely factor influencing chat populations within the Anders Field Complex. However, management practices within the park should focus on a broad-scale ecological approach that considers novel thinking to restoring ecological integrity, as there are likely factors outside of the park affecting Chat distribution.

**T9.5 Walker, Lauren,** (University of Washington, Seattle, United States); Marzluff, John (University of Washington, Seattle, United States)

RECREATION CHANGES THE USE OF A WILD LANDSCAPE BY CORVIDS: LOCAL EFFECTS AND ECOSYSTEM REPERCUSSIONS

As our urban areas grow in population, the use of nearby natural areas for outdoor recreation has also increased. Although some local effects of human recreation in wilderness areas have been documented, landscape level responses of wildlife species to patterns of human recreation have not been previously evaluated. Members of the avian Family Corvidae (crows, ravens, jays, and magpies) are synanthropes that may be directly affected by human recreation in wildland landscapes. In Mount Rainier National Park, we evaluated the effects of visitor use and the availability of human-subsidized food on the use of landscape features by five corvid species: Steller's jay (*Cyanocitta stelleri*), gray jay (*Perisoreus canadensis*), Clark's nutcracker (*Nucifraga columbiana*), common raven (*Corvus corax*), and American crow (*Corvus brachyrhynchos*). Using data collected from over 1400 point counts across areas varying in type and level of visitor use, we calculated predicted

occupancy and density values while allowing for variation in detection probability. A species-specific suite of vegetative and landscape variables were consistently important in describing occupancy and density patterns for jays, nutcrackers, and ravens (crows were not observed during our surveys). Patterns of human recreation were also significant in explaining the distribution of Steller's jays, nutcrackers, and ravens. Additionally, corvid species used landscape features differently when anthropogenic food subsidies were available, perhaps affecting broadscale ecosystem functions, such as songbird nest predation, nutrient cycling, and seed dispersal.

**W12.8 Wallace, Sarah,\*** (Queen's University, Kingston, Canada); Wolf, Shaye (Center for Biological Diversity, San Francisco, CA, United States); Bradley, Russell (PRBO Conservation Science, Petaluma, United States); Friesen, Vicki (Queen's University, Kingston, ON, Canada)

#### DETERMINING POPULATION GENETIC VARIATION OF CASSIN'S AUKLET: ARE MULTIPLE CONSERVATION UNITS NEEDED?

Describing a species' genetic variation and characterizing gene flow between populations can provide insight into appropriate conservation units. The Cassin's auklet (*Ptychoramphus aleuticus*) breeds in colonies along the Pacific coast of North America. One subspecies, *P.a. australe*, is described from Baja California, Mexico and another, *P.a. aleuticus*, is described from the rest of the range to the Aleutian Islands, Alaska. Many of the colonies throughout its range have been declining in numbers. I used mitochondrial control region and microsatellite variation to characterize genetic variation within populations, determine how the two subspecies compare genetically, and describe the overall population genetic structure and gene flow. Initial analyses indicated that genetic differentiation is present and individuals were mainly clustered by subspecies in the haplotype network and STRUCTURE plot. Further analysis will estimate contemporary gene flow using an isolation with migration model. Determining an appropriate number of management units will aid in conservation of Cassin's auklet, as well as preserving biodiversity in Baja California.

**W11.7 Walsh, Jennifer,** (University of New Hampshire, Durham, United States); Kovach, Adrienne (University of New Hampshire, Durham, United States)

#### INTROGRESSION OF MORPHOLOGICAL TRAITS AND NEUTRAL GENETIC VARIATION IN A HYBRID ZONE BETWEEN SALTMARSH AND NELSON'S SPARROWS

Hybridization is influential in shaping species dynamics and has a number of evolutionary implications. Linking morphological and genetic variation across a hybrid zone is fundamental to hybrid zone research as it can be used to infer selective mechanisms responsible for zone maintenance. To evaluate patterns of introgression of morphological traits and neutral alleles, we applied field and genetic methods in an overlap zone between two endemic marsh birds: the Nelson's (*Ammodramus nelsoni*) and Saltmarsh (*Ammodramus caudatus*) sparrow. We sampled 150 individuals from two marshes in Maine and New Hampshire and characterized them using 12 plumage traits, including plumage color, definition, and bill color. Additional morphometric data were collected, including bill measurements, wing chord, and mass. We genotyped individuals at 12 microsatellite loci and used an allele-frequency based approach to calculate a hybrid index for each individual. We used linear regression models to test for a relationship between morphological data and hybrid index to evaluate patterns of introgression of these traits. Our top models were compared

between males and females to test for sex-biased variation in hybrid plumage characteristics. Preliminary findings indicate that while there is a significant ( $P < 0.01$ ) relationship between plumage score and hybrid index, plumage traits are variable among hybrids. Plumage color and streaking definition correlated most strongly with the hybrid index. We also found more variation in the plumage of male versus female hybrids, which may be indicative of sex-biased selection against hybrids. Our results offer insight into the selective forces shaping the Saltmarsh-Nelson's hybrid zone.

#### **PS1.121 Walsh, Robert,** (UC Davis, Davis, CA, United States); ACCESS TO AQUATIC RESOURCE SUBSIDIES AFFECTS TREE SWALLOW DIET AND BREEDING

The flux of organisms from one habitat to another can link the dynamics of seemingly distinct food webs. In California's riparian areas, emergent aquatic insects such as mayflies and midges represent an abundant aquatic resource subsidy for tree swallows (*Tachycineta bicolor*), an aerial insectivore. We monitored swallows nesting at sites ranging from 0 to 450 meters away from a river to determine whether proximity to water affected swallow diet, behavior, and reproductive success. While aquatic insects were a component of the diet for all birds, stable isotope analysis and fecal dissection revealed that aquatic prey consumption declined with distance from water. Insects of both aquatic and terrestrial origin were most abundant near water, but contrary to expectations, swallows did not show a strong preference for settling in the most prey-rich areas. However, settlement in these areas proved beneficial to birds during short-term and seasonal declines in terrestrial prey availability. There were roles for both insect abundance and early-season nesting success on birds nesting late in the season or attempting second clutches. Emergent aquatic insects are a key food web subsidy for insectivorous songbirds, and their ability to supplement terrestrial prey may help buffer birds against fluctuations in the local prey base and enhance fitness.

#### **PS1.120 Walsh, Robert,** (UC Davis, Davis, CA, United States); A (RELATIVELY) RAPID METHOD FOR COMPOUND SPECIFIC STABLE ISOTOPE ANALYSIS OF FEATHER AMINO ACIDS, AND ITS APPLICATIONS

Studies of the stable isotope ratios of feathers have helped improve our understanding of avian behavior and ecology. Recently, there has been a growing interest in analyzing the isotope ratios of the individual amino acids that comprise feather keratin. This approach is more information-rich and potentially more precise than the analysis of bulk feather material. We have developed a relatively rapid method for analyses of the stable isotopes of carbon and nitrogen contained in feather amino acids. The method involves a sequence of hydrolysis, derivatization, and gas chromatography followed by stable isotope measurements; the entire process takes approximately three hours. We have found that there is considerable variation in the  $\delta^{13}C$  and  $\delta^{15}N$  values of different feather amino acids, spanning as much as 5‰ for carbon and 10‰ for nitrogen. The relative values of different amino acids may allow for the resolution of more sources in foraging models, provide for more accurate determination of trophic level, and elucidate physiological processes during feather growth and molt.

**PS2.72 Walters, Lindsey,** (Northern Kentucky University, Highland Heights, United States); Spicer, Kristoffer; Daulton, Bridgit (Northern Kentucky University, Highland Heights, KY, United States)

## DECLINE IN LOCAL BIRD ABUNDANCE AFTER CONSTRUCTION OF NASCAR SPEEDWAYS

Large sporting venues like NASCAR speedways have the potential to adversely impact local wildlife. The speedways themselves are expansive, covering several square kilometers, and their associated noise, traffic, and pollution could influence birds much farther away. We analyzed data from North American Breeding Bird Survey (BBS) routes located near NASCAR speedways in order to determine whether local bird abundances changed over time after speedway construction. We selected three speedways that were built in the last 20 years and that had active BBS routes nearby: Kentucky Speedway, Kansas Speedway, and Auto Club Speedway. For each speedway, we compared the number of birds observed each year at the BBS route closest to the speedway to the number of birds observed at the next closest active route as a control. For the routes near speedways, there was a significant decrease in total bird abundance after the speedway opened. This decline was not observed at any of the control BBS routes over the same time period. Although other factors could also be influencing bird abundance, these results suggest that further research is warranted into the effects of large, human-made installations like racing venues on local wildlife. This analysis also highlights the usefulness of long-term data sets like the BBS as tools for monitoring avian populations for conservation purposes.

**PS1.37 Warkentin, Ian**, (Memorial University, Corner Brook, Canada); Rae, Lauren (Memorial University, St. John's, NF, Canada); Whitaker, Darroch (Parks Canada, Rocky Harbour, NF, Canada)

## EFFECTS OF BROWSING BY HYPER-ABUNDANT MOOSE ON A FOREST BIRD COMMUNITY

Habitat loss is regarded as a major factor contributing to the decline of songbirds in North America. The boreal forest provides important breeding habitat that allows songbirds to meet specific requirements for vital activities such as foraging and nesting. However on the island of Newfoundland in eastern Canada, over-browsing by introduced moose (*Alces alces*) can alter the pattern of forest regeneration following disturbance, leading to the conversion of densely stocked balsam fir (*Abies balsamea*) forests to habitat dominated by grasses and shrubs. Such impaired forest regeneration is particularly prevalent in Gros Morne National Park (GMNP), where moose greatly exceed typical population densities due to a lack of natural predators and prohibition of hunting. To evaluate the impact of moose-induced habitat change on songbird communities, we conducted point counts ( $n=604$ ) across GMNP during the 2010 breeding season. We compared species abundance and richness across sites having varying degrees of moose disturbance. A similar number of species were observed at severely impaired ( $9.0 \pm 2.4$ , mean  $\pm$  SD) and healthy ( $8.5 \pm 2.2$ ) regenerating sites. While some species showed a strong association with healthy regenerating balsam fir forest (e.g. Magnolia Warbler) others showed an increase in abundance associated with moose-disturbed habitat (e.g. Mourning Warbler).

**PS1.36 Warkentin, Ian**, (Memorial University, Corner Brook, Canada); Espie, Richard (Saskatchewan Environment, Regina, SK, Canada)

## SELECTION PRESSURES ON BODY SIZE BY AGE AND SEX IN MERLINS

We tested whether body size influences breeding performance, survivorship and mate choice in Merlins (*Falco columbarius*). We measured three parameters to assess breeding performance: brood size, chick hatch date, and lifetime reproductive success;

breeding individuals were measured upon capture to assess their physical attributes. Larger yearling females were more successful with respect to brood size and were more likely to survive to adulthood compared to smaller yearling females. Among yearling males, smaller individuals tended to have larger broods, whereas larger birds were more likely to survive to breed again. For adult Merlins, body size had little influence on mortality or any measure of breeding performance. In the analyses of mate choice we found that females had a tendency to choose male partners with similar body size whereas males did not choose the same size female when they switched mates. Our results suggest that size selection in Merlins occurs early in life and that different body size optima exist for male and female in terms of breeding performance and mortality. Moreover, our data for yearling males provides support for the sexual selection hypothesis in that smaller males tended to be superior breeders while larger ones tend to have higher survival; plus females appear to use size when selecting mates.

**PS2.149 Warning, Nathaniel**, (University of Northern Colorado, Fort Collins, United States);

## HABITAT SELECTION AND DISTRIBUTION OF CANYON WRENS IN THE NORTHERN COLORADO FOOTHILLS

Abstract: The canyon wren (*Catherpes mexicanus conspersus*) is considered to be fairly common in suitable habitat within its range, but rarely occurs in high densities. Though it is generally known that canyon wrens are restricted to cliffs, rock faces, and rocky outcrops, studies of detailed habitat requirements are scarce. We conducted 200 surveys in areas with vertical rock and cliff habitat on public lands throughout Larimer County, CO from May-September 2011, identifying and monitoring 20 canyon wren territories. We measured detailed habitat characteristics within each territory including elevation, cliff height, cliff length, cliff orientation, cliff approach, slope, distance to nearest water, relative frequency of crevices and boulders, presence of cliff swallows, and predominant vegetation type. We compared these data with the same parameters from a random sample of 20 surveyed sites absent of canyon wrens. Significant differences were found in crevice frequency between occupied and unoccupied sites, with canyon wrens generally utilizing cliffs that offered high crevice density. Canyon wrens were also found in consistent association with cliff swallows, perhaps an indicator of insect prey density. A lack of significant differences in the remaining habitat parameters along with observations of large sections of unoccupied cliffs suggest that lack of suitable habitat does not limit the canyon wren population in the northern Colorado foothills. Instead, our data suggest that foraging sites, insect availability, and microhabitat features might be most important to canyon wrens when establishing territories. Future research will examine how these factors may determine canyon wren distributions.

**PS1.75 Warren, Meghan B**, (Teton Raptor Center, Wilson, United States); Jellen, Jennifer; Jones, Jason; Smith, Roger (Teton Raptor Center, Wilson, United States)

## A SIMPLE METHOD FOR PREVENTING THE ENTRAPMENT AND DEATH OF CAVITY-NESTING SPECIES IN VAULT TOILETS

Each year thousands of cavity-nesters, animals which prefer dark, narrow spaces for nesting and caching food, become entrapped in vertical open pipes such as ventilation pipes, claim stakes, and chimneys. Vault toilets, the self-contained restrooms found in many of America's wilderness areas, feature such vertical open pipes for ventilation and are a documented danger to owls, bats, and other wildlife. In response to reports of owls

trapped within vault toilets, Teton Raptor Center (TRC), a non-profit raptor education, rehabilitation, and conservation center located in Wilson, Wyoming, initiated a community driven project to install 100 screens on the ventilation pipes of toilets throughout Grand Teton National Park, as well as the Bridger-Teton and Targhee National Forests. These screens, which are designed to prevent non-degradable waste from entering the toilets, also effectively prevent cavity-nesting species from entering and becoming entrapped, without compromising ventilation. Since the completion of this project in 2011, no cases of entrapped wildlife have been reported in the area. We propose to expand this highly effective and community based initiative to public lands throughout America with the help of partner organizations.

**PS1.129 Weber, Wayne C.**, (None, Delta, Canada);

#### 50 YEARS OF CHANGE IN THE AVIFAUNA OF THE VANCOUVER AREA, BRITISH COLUMBIA

The avifauna of the Vancouver area of southwestern British Columbia has been meticulously documented since the early 1960s through the detailed records of scores of observers, as well as through Christmas Bird Counts, Breeding Bird Surveys, and other standardized surveys. Over this period of 50 years, there have been significant numerical changes-- either increases or decreases-- in at least 30% of the regularly occurring bird species. Some of these changes are part of region-wide or continent-wide trends, whereas others are related more to local factors. One of these local factors is the dramatic increase in the population of Greater Vancouver from about 790,000 in 1961 to 2,313,000 in 2011, with the resultant loss of much farmland and old-field habitat. Bird species which have declined greatly or disappeared (\*) in the last 50 years include Gray Partridge (\*), Ring-necked Pheasant, Ruffed Grouse, California Quail (\*), Western Grebe, Marbled Murrelet, Band-tailed Pigeon, Western Screech-Owl, Spotted Owl (\*), Short-eared Owl, Common Nighthawk, Lewis's Woodpecker (\*), Cassin's Vireo, Horned Lark (\*), Crested Myna (\*), Chipping Sparrow, and Western Meadowlark. Species which have increased greatly or established new breeding populations (!) include Canada Goose, Mute Swan (!), Trumpeter Swan, Eurasian Wigeon, Osprey, Bald Eagle, Black Oystercatcher (!), Eurasian Collared-Dove (!), Barred Owl (!), Anna's Hummingbird (!), Northwestern Crow, Purple Martin, European Starling, Fox Sparrow (!), and Brown-headed Cowbird. The causes of these population changes are quite diverse, but it is clear that the avifauna of the Vancouver area is in a very dynamic state.

**SAT12.2 Webster, Michael S.**, (Cornell Lab of Ornithology, Cornell University, Ithaca, United States); Greig, Emma (Cornell University, Ithaca, NY, United States)

#### SPATIAL DECOUPLING OF CULTURAL AND GENETIC TRAITS GENERATES NOVEL PHENOTYPES ACROSS A ZONE OF SECONDARY CONTACT

Sexual signals can be important mechanisms of reproductive isolation between incipient species, but the relative effectiveness and geographic distribution of different signals may vary, particularly when those signals have different modes of transmission from one generation to the next. We assessed divergence of a culturally transmitted signal (song) and conspecific responses to that signal across a zone of secondary contact where plumage characters show asymmetrical introgression between subspecies of the red-backed fairy-wren (*Malurus melanocephalus*). We found that, in contrast to plumage, geographic variation in song correlated well with geographic genetic structure, with some evidence for convergence of song traits near the zone of contact. Playback

experiments revealed that birds responded most strongly to songs from within the same genetic region (i.e. songs acoustically similar to their own population mean) irrespective of plumage type, suggesting that there is stabilizing selection on song despite asymmetrical introgression of plumage characteristics. The decoupling of song and plumage traits in this system has therefore facilitated the generation of a novel phenotype, which likely has complex evolutionary effects.

**PS1.91 Weeber, Russ**, (Canadian Wildlife Service, Environment Canada, Ottawa, Canada); Moore, Dave (Canadian Wildlife Service, Environment Canada, Burlington, ON, Canada); Weseloh, Chip (Canadian Wildlife Service, Environment Canada, Toronto, ON, Canada); Russell, Rich (Canadian Wildlife Service, Environment Canada, Ottawa, ON, Canada)

#### MONITORING COLONIAL WATERBIRDS IN CANADA'S BOREAL FOREST: SURVEY DEVELOPMENT AND PATTERNS OF DISTRIBUTION AND ABUNDANCE.

Our current knowledge of the distribution and abundance of colonial waterbird species in North America's Boreal Forest (BF), a biome ~70% the size of the contiguous U.S.A, is extremely limited and there is no methodology which adequately samples these birds in this habitat. With increased resource extraction and development planned, it is essential to develop effective monitoring schemes. Our objectives were to: (i) test survey methods for estimating colonial waterbird abundance and distributions in the BF and (ii) develop habitat-based models for predicting these metrics. In 2010, we assessed the utility of adopting a standard sampling frame used in waterfowl surveys, using a helicopter to survey all water courses in six, 5 km<sup>2</sup> sample plots, in a grid centred on the eastern half of Lake St. Joseph (LSJ, a large lake near Pickle Lake, Ontario). This method proved ineffective and cost-prohibitive; few target species were observed within plots, while the nests of 726 (n =24 colonies) Common Terns (*Sterna hirundo*, COTEs), 1,672 (n =12) Ring-billed Gulls (*Larus delawarensis*, RBGUs) and 55 (n =6) Herring Gulls (*L. argentatus*, HERGs) were recorded during comprehensive helicopter and boat surveys of eastern LSJ only. In 2011, we used a float plane to survey lakes across five tertiary watersheds in north-western Ontario, based on a stratified (by lake surface area and presence of islands and/or exposed rocks), random sampling design. A large lake, North Caribou Lake (NCL), was also surveyed using float plane, helicopter and boat to compare methodologies. In 2011, we tallied 145 HERGs (n =58 sites), 455 COTEs (n =16) and 376 RBGUs (n =22) on 581 lakes during aerial surveys and an additional 33, 125 and 104 nests (pairs) of those species, respectively, on NCL. A habitat-based survey framework seems promising (e.g. 99% of COTEs were found on 13 lakes, all of which were >500 ha and contained islands or exposed rocks) and preliminary extrapolations suggest there may be a significant number of waterbirds dispersed throughout Ontario's BF, compared to the Great Lakes, where populations are well known. The results of planned refinements to the survey protocol in 2012 (i.e. a focus on large lakes, with other lake sizes and types sampled on transects between focal water bodies), an evaluation of various sampling methodologies and the development and utility of predictive models will be discussed.

**SAT16.8 Wehtje, Walter**, (University of Missouri, Columbia, United States); Kesler, Dylan (University of Missouri, Columbia, MO, United States)

## MIGRATION DIRECTIONALITY OF EUROPEAN STARLINGS (*STURNUS VULGARIS*) IN EUROPE PREDICTS THE SPECIES' NORTH AMERICAN MIGRATION PATTERNS

We used banding data to test the influence of latitude and magnetic declination on migration direction of European Starling (*Sturnus vulgaris*) in Europe and North America. In Europe, starlings migrate in a southwesterly direction, with birds from northern sites orienting more toward the west than those breeding farther south. We identified the direction of migratory travel from 1,836 European birds banded as juveniles and subsequently recovered that year on the wintering grounds. Birds from Great Britain were evaluated separately, as their migration routes are constrained by the North Sea and the Atlantic, but also because the North American population is derived from birds imported from England. We then modeled the effect of latitude and magnetic declination at the natal site on migration direction. We tested the predictive power of the models (latitude, magnetic declination, latitude + magnetic declination, and Great Britain based migration) on migration direction in 171 North American birds. The latitude model best predicted migration orientation in introduced North American migrants, despite the fact that North American breeding sites were further south than most European latitudes. Our results support previous laboratory-based studies showing that starlings use proximate cues associated with latitude to orient during migration, and further suggest that those mechanisms extend to North America. We found no association between North American migration direction and declination, or between orientation of English starlings and North American birds. Furthermore, the southwesterly migration orientation of European Starlings likely facilitated the spread of this species throughout North America.

**PS1.114 Weir, Jason**, (University of Toronto Scarborough, Toronto, Canada); Mursleen, Sara (University of Toronto Scarborough, Toronto, Canada)

## DIVERSITY DEPENDENT CLADOGENESIS AND TRAIT EVOLUTION IN THE ADAPTIVE RADIATION OF THE AUKS (*AVES: ALCIDAE*)

Through the course of an adaptive radiation, the evolutionary speed of cladogenesis and ecologically relevant trait evolution are expected to slow as species diversity increases, niches become occupied and ecological opportunity declines. We develop new likelihood-based models to test diversity-dependent evolution in the auks, one of only a few families of seabirds adapted to underwater "flight", and which exhibit a large variety of bill sizes and shapes. Consistent with the expectations of adaptive radiation, we find both a decline in rates of cladogenesis (a seven-fold decline) and bill shape (a 10-fold decline) evolution as diversity increased. Bill shape diverged into two clades at the basal cladogenesis event with one clade possessing mostly long, narrow bills used to forage primarily on fish, and the other with short thick bills used to forage primarily on plankton. Following this initial divergence in bill shape, size, a known correlate of both prey size and maximum diving depth, diverged rapidly within each of these clades. These results suggest that adaptive radiation in foraging traits underwent initial divergence in bill shape to occupy different food resources, followed by size differentiation to subdivide each niche along the depth axis of the water column.

**F16.2 Weldon, Orion**, (Rutgers University Graduate Program in Ecology & Evolution, North Brunswick, United States); Lockwood, Julie (Rutgers University Graduate Program in

Ecology & Evolution, New Brunswick, NJ, United States); Jensen, Olaf (Rutgers University Institute for Marine and Coastal Sciences, New Brunswick, NJ, United States)

## LANDSCAPE SCALE ANALYSIS OF VEGETATION STRUCTURE PREFERENCE BY EARLY SUCCESSIONAL AND MATURE FOREST BREEDING BIRDS USING LIDAR

Forest breeding birds are a highly threatened group in the Northeast US, with many species such as Golden-winged Warbler (*Vermivora chrysoptera*) and Cerulean Warbler (*Dendroica cerulea*) suffering from habitat loss. Conservation and restoration efforts have been hindered by our poor understanding of the forest structure and composition required by these species. Previously, exploring such relationships at a landscape scale would have required a prohibitively large data collection effort. Here we combine vegetation structure metrics extracted from lidar data that were collected across northern New Jersey and eastern Pennsylvania with abundance data for twelve species from the Breeding Bird Survey. Of these, six species were early successional breeding birds, and six were mature forest breeding birds. We used a bayesian hierarchical model to define relationships between habitat characteristics and abundance. Lidar data allowed us to define forest vegetation structure in much greater detail than would have been possible from the available coarse land-use land-cover maps. Lidar-based habitat descriptions resulted in substantially improved habitat models for several species with respect to structural resolution and spatial extent. These results provide specific guidance on ways that land-owners might manage forest characteristics to benefit threatened forest breeding bird species.

**SAT3.1 Weseloh, D.V. Chip**, (Canadian Wildlife Service - Environment Canada, Toronto, Canada); Moore, Dave (Canadian Wildlife Service, Environment Canada, Burlington, ON, Canada)

## SITE-FIDELITY, ROOSTING AND MIGRATION OF COLOUR-MARKED GREAT EGRETS FROM SOUTHERN ONTARIO

Very little information is available on the ecology of Great Egrets (*Ardea alba*, GREGs) during the breeding and post-breeding seasons at the northern limit of their range in the area of southern Ontario. In Ontario, the GREG has increased from 1 nesting pair (at 1 site) in 1952 to over 300 nesting pairs (at 11 sites) in the 2000s. In this study, our objectives were: 1) To investigate age composition and natal site fidelity of marked GREGs at Nottawasaga Island (NI, the largest breeding colony in Canada), NW of Toronto, 2) To locate nocturnal roost sites of GREGs and investigate their roosting habits and 3) To investigate the post-breeding dispersal, migration and wintering areas of Ontario GREGs through colour-marking of YOY. Since 2001, we have colour-banded and/or wing-tagged over 1400 GREGs at 4 Great Lakes sites, located and monitored 30 post-breeding roost sites and searched the NI breeding colony for marked birds. Our re-sighting rate for annual cohorts of colour-marked GREGs at NI ranged from 9.1% - 24.5% of birds marked. In 2011, we identified 59 marked egrets at NI during April to July; all had been marked at NI. The age structure was: 2 years old = 10.2%, 3 yrs = 22.0%, 4 yrs = 23.7%, 5 yrs = 20.3%, 6 yrs = 13.6%, 7 yrs = 5.1%, 8 yrs = 3.4% and 10 yrs = 1.7%; birds aged 1 or 9 years old were not observed during this period. In 2010, we located 30 post-breeding roosting sites in southern Ontario, upstate New York, Michigan and Ohio. They ranged in peak size from 1 to 384 individuals. The 384 individuals (at "Luther Marsh") is the largest known GREG roost in Canada. The modal nearest neighbour distance among GREG roost sites was 8 km (median = 24 km, range = 1-160



km). Egrets usually roosted in trees or shrubs in or near standing water but were also found roosting on mudflats or directly in shallow water. Occasionally, at a given site, GREGs would move from roosting in water/mudflats to roosting in trees at the same wetland. This may have been in response to changing water levels. During the winter period (December – February) encounters with marked birds came mostly from coastal areas from North Carolina to Georgia; lesser umbers were reported from south Florida and the Caribbean islands. Breeding colonies and large roosting sites of GREGs should be designated for protection/IBA

status; egrets using small roosts may have the flexibility to switch to other nearby roost sites, if necessary.

**F12.5 Wethington, Susan,** (Hummingbird Monitoring Network, Patagonia, United States); Beck, Pieter (Woods Hole Research Center, Falmouth, MA, United States); Powers, Don (George Fox University, Newberg, OR, United States); Schondube, Jorge (CIEco, UNAM, Morelia, Michoacán, Mexico); Goetz, Scott (Woods Hole Research Center, Falmouth, MA, United States); Graham, Catherine (The Research Foundation of State University of New York, Stony Brook, NY, United States)

#### DELAYED TIMING OF MOLT AND CHANGES IN MIGRATION STOPOVER SITES: POSSIBLE RESPONSES BY BROAD-TAILED HUMMINGBIRDS (*SELASPHORUS PLATYCERCUS*) TO EXTREME COLD TEMPERATURES ON THEIR WINTERING GROUNDS

Climate change is commonly predicted to increase the frequency and occurrences of extreme climatic events. Evidence suggests that birds are sensitive to these extreme events but additional studies are needed to determine how species will respond to particular climatic anomalies. Hummingbirds are uniquely suited to monitor climate and environmental change impacts on birds because they have high physiological demands and are subsequently dependent on the abundance and phenology of nectar producing plants, much of which is controlled by climate conditions. In February 2011, extreme cold weather extended far south into Mexico reaching over-wintering sites of Broad-tailed Hummingbirds, a 3 gram species that breed at high elevations in the western USA. During their 2011 spring migration through Arizona and into Colorado, Broad-tailed Hummingbirds occurred in record numbers at low and mid elevation monitoring sites maintained by the Hummingbird Monitoring Network (HMN) with most birds in the early stages of wing molt, which usually is completed on the wintering grounds. To determine the response of Broad-tailed Hummingbirds to environmental conditions, and their cold temperature tolerance in particular we construct a Scholander curve (metabolic rate vs. temperature under BMR conditions) for the species during winter and summer conditions from laboratory measurements. We also use gut physiology measurements that provide information about how effectively this species can process nectar and obtain energy under different temperature and food quality regimes. Using gridded time series of meteorological data (from The National Centers for Environmental Prediction's (NCEP's) Climate Forecast System Version 2) in conjunction with this physiological data, we identified the temperature conditions under which Broad-tailed Hummingbirds will likely be stressed. We then identified those years during the past decade that meet these climatic conditions and use HMN monitoring data to determine if the percentage of Broad-tailed Hummingbirds still in molt is higher than expected and whether the timing and location of their migration also differs during these years. The results of this study provide insight into physiological and

behavioral responses of a hummingbird species to extreme climatic events.

**T17.9 Wheeler, Hazel,** (Trent University, Peterborough, Canada); Joe, Nocera (Trent University & OMNR, Peterborough, ON, Canada)

#### MOVEMENT PATTERNS OF BREEDING CHIMNEY SWIFTS IN RELATION TO LANDSCAPE FEATURES AND SOCIAL ATTRACTION

Declines in abundance and quality of food resources (flying insects) are strongly linked to population declines in Chimney Swifts (*Chaetura pelagica*). Recovery of this aerially-foraging insectivore requires a greater understanding of how swifts use their habitat, especially while foraging during times of high metabolic demand, such as the nesting period. It is commonly hypothesized that Chimney Swifts require breeding habitat near water to facilitate foraging opportunities; if this is the case, then they should spend more time foraging towards water than away from it. Chimney Swifts are also a highly social species, and their daily movements may be dictated by attraction to conspecifics. To test the hypotheses that Chimney Swifts orient towards water and/or conspecifics, we used radio telemetry to track breeding Chimney Swifts ( $n = 12$  over two years) and located birds in the four cardinal directions every 20 seconds within the antenna detection range. The direction of the closest water body to the nest was not a significant determinant of mean seasonal preferred direction for any bird (circular-circular regression,  $p = 0.31$ ). Daily patterns of mean preferred direction were correlated in two pairs of neighbouring sites, each site separated by 110 m from the closest neighbour (circular  $r = 0.67$ ,  $p < 0.01$ ; circular  $r = 0.48$ ,  $p = 0.01$ ), though correlations between other pairs of birds nesting in close proximity (90 – 160 m) were insignificant ( $p > 0.05$ ). These results suggest that sociality between birds may affect foraging patterns, but further examination and experimentation is needed. Importantly, our results suggest the requirement to be close to water is a misconception, at least in our study region of southern Ontario; foraging patterns are not dictated by major waterbodies in the landscape.

**W11.1 Wheeler, Maria,** (Duquesne University, Pittsburgh, United States); Katzner, Todd (West Virginia University, Morgantown, WV, United States); Porter, Brady (Duquesne University, Pittsburgh, PA, United States)

#### ASSESSING THE GENETIC DIVERSITY AND DISTINCTNESS OF EASTERN NORTH AMERICAN GOLDEN EAGLES: LONG TERM CONSERVATION IMPACTS OF EXOTIC INTRODUCTIONS ON A SMALL NATIVE POPULATION

Eastern North America is home to a small but geographically distinct population of Golden Eagles (*Aquila chrysaetos canadensis*). Because they are isolated from their western counterparts, these eastern birds are currently of particular interest due to the development of wind energy and its potential impacts on this small ( $n = 1000 - 3000$  individuals) population. However, this eastern population was augmented by multiple independent translocations of at least 190 exotic western US eagles between 1981 and 2006. Thus, the modern eastern population may be descended from a “diluted gene pool,” just altered enough to hide any genetic population structure that otherwise should have existed. We are evaluating the level of genetic distinction of eastern Golden Eagle populations both pre- and post-reintroduction, relying on both museum specimens (historic) and blood and feather samples from modern birds as sources of genetic material. To accomplish our goal, we

sequenced the mitochondrial cyt b gene for an indication of phylogeny and amplified ten microsatellite loci for fine-tuned population analysis. Our data indicate that the modern populations of eastern and western Golden Eagles are not currently distinct from one another and furthermore, preliminary data suggests there is minimal uniqueness with North American golden eagles from other populations within the Holarctic range of this species. Average cyt b sequence divergence between North American populations is 0.303%, with 0.314% sequence divergence across all specimens. Bayesian analysis of microsatellite data revealed no definitive clustering of populations and  $F_{st}$  values (indicators of genetic differentiation) were low. Results of this study have the potential to impact not only the management of Golden Eagles in the eastern US but also conservation planning for other species for which exotic introductions are planned to augment populations.

**PS2.160 White, Gretchen**, (Purdue University, West Lafayette, United States); Zollner, Patrick (Purdue University, West Lafayette, IN, United States); Horn, David (Millikin University, Decatur, IL, United States); Dunning, John (Purdue University, West Lafayette, IN, United States); Rompre, Ghislain (The Scotts Company, Marysville, OH, United States)

#### SEASONAL VARIATION IN AVIAN HABITAT SELECTION BASED ON CHARACTERISTICS AT MULTIPLE SPATIAL SCALES

Previous studies have shown that birds select habitat based on characteristics at multiple spatial scales. Therefore, presence or absence of a species at a site might be dependant on characteristics at a fine scale, but also characteristics at a larger landscape scale as well. Birds' habitat selection criteria may also vary seasonally. This study is designed to test if the spatial scale at which land cover and land use characteristics that influence bird presence at a site changes across seasons. We plan to use data from a multi-year, nationwide study, PROJECT WILDBIRD®. This industry-funded study utilized knowledgeable volunteers to monitor bird species visiting bird feeders in backyards across the continental United States and Canada. We propose to test the influence of landscape characteristics at multiple spatial scales on the occupancy of several common songbird species in human altered landscapes, i.e. residential backyards. Each backyard survey site will provide up to thirty-two presence or absence observations per season for up to eight seasons total. We will incorporate those encounter histories in occupancy modeling analyses including habitat covariates across a range of spatial scales and use AIC to determine which spatial scales best model site occupancy for each species. Results will be compared by season to determine if the critical scale of habitat characteristics influencing species presence or absence changed seasonally as a function of species life history characteristic. In this poster we illustrate our approach using our analyses of two closely related species with dissimilar life histories, American Goldfinch (*Spinus tristis*) and Pine Siskin (*Spinus pinus*). Preliminary results show this method is promising to uncover differences in seasonal habitat selection. In light of growing human populations and increasing influence of human development, these results have the potential to highlight the importance of understanding changes in seasonal habitat preference in the context of urban planning when avian biodiversity is a priority. These models which we are developing have the potential to provide important insights as we contemplate the impact of future human avian interactions.

**PS1.195 Whitfield, Mary**, (Southern Sierra Research Station, Weldon, United States); Rowe, Sean (Audubon California, Weldon, CA, United States)

#### BIRD MORTALITIES IN OPEN-TOP PIPES

Hollow metal and plastic (PVC) pipes and posts are found throughout the world and serve a variety of purposes. Wildlife (birds, reptiles, small mammals) mortalities, including species of conservation concern, were documented in mine claim marker posts (Brattstrom 1995, Lahontan and Red Rock Audubon Societies 2009) which resulted in the passing of a law in Nevada that called for the removal of all PVC mine claim markers across the state (American Bird Conservancy 2011). However, wildlife mortalities in pipes (death pipes) are not limited to uncapped mine claim marker posts. In 2009, we found a fallen irrigation stand pipe which contained the remains of over 200 dead birds. Since then we have documented a large number of open-topped pipes with dead birds. At least 45 species of birds along with several other vertebrate species have been found dead in pipes. We will give examples of numerous uses of open-top pipes and will present information on solutions to prevent this problem.

**PS2.248 Whitney, Suzanne**, (Texas State University, Austin, United States); Murphy, Thomas (South Carolina Department of Natural Resources (retired), Green Pond, South Carolina, Canada)

#### A COMPARISON OF NESTING SUCCESS AND CHICK PRODUCTIVITY BETWEEN DEVELOPED AND RURAL BALD EAGLE NESTS IN SOUTH CAROLINA (1977-2007)

The rebound in bald eagle (*Haliaeetus leucocephalus*) abundance is a rare example of species recovery leading to delisting under the Endangered Species Act (ESA). Bald eagle numbers were reduced by a variety of anthropogenic factors, but after protection under the ESA and the banning of DDT, they made a strong recovery and were delisted in 2007. Though bald eagles have historically nested in more remote areas, as their populations have increased, so have human populations, especially near waterways. This has led to an increase in nesting territories located near anthropogenic disturbance. If the presence of human activity affects bald eagle reproduction, continued recovery may be impacted. We explored whether the variation in productivity among South Carolina bald eagle nests could be explained by their exposure to human activity and development. All known nests in the state were classified as developed or rural for each year the nest was occupied between 1977 and 2007 (2954 "nest/years"). Historical productivity data were used to determine if the number of nests that either produced chicks or had a particular reproductive output (0, 1, 2, or 3 chicks) were different at developed nests than would be expected based on productivity data across all nests. From 2005 – 2007, developed nests were further classified according to the proximity, intensity, and duration of various types of anthropogenic disturbances. Logistic regressions were used to compare these factors to the probability of nesting success. Rates of nesting success were independent of development status ( $\chi^2 = 0.418$ ,  $df = 1$ ,  $p = 0.517$ ). The proportion of successful nests was similar between rural (0.74) and developed sites (0.76). Mean productivity for rural and developed nests were 1.22 and 1.21 chicks, respectively. The proportions of nests producing each number of chicks were not significantly different between the two categories ( $\chi^2 = 2.880$ ,  $df = 4$ ,  $p = 0.422$ ). Among developed sites, no specific type of disturbance or development was a useful predictor of nesting success. Anthropogenic disturbance does not appear to influence nesting success or chick output per nest for the bald eagles of South Carolina. However, these data were collected while bald eagles

were still protected under the ESA; continued productivity studies might identify different types or intensities of human activity that do influence nesting success and/or productivity.

**T5.6 Wiebe, Karen,** (University of Saskatchewan, Saskatoon, Canada); Slagsvold, Tore (University of Oslo, Oslo, Norway)  
**YOUNG TITMICE ACQUIRE PREY PREFERENCES AND FORAGING BEHAVIOURS THROUGH SOCIAL LEARNING**

Fledgling birds face a difficult challenge of becoming efficient foragers as their dependence on food provided by parents decreases. There have been few studies in the wild on how young birds come to adopt prey preferences and foraging techniques, i.e., the foraging niche. We studied the degree to which foraging niches are innate versus learned by experimentally cross-fostering two closely related passerines with different foraging behaviours: Great Tits *Parus major* and Blue Tits *Cyanistes caeruleus*. The physically smaller Blue Tits naturally forage higher in the canopy and more on branch tips compared to Great Tits, and they select more green larvae and smaller prey. We observed the foraging behaviour of the cross-fostered offspring compared to controls in the fall and spring after they became independent from parents. Consistent with the hypothesis that social learning plays a role in the development of foraging behaviours, cross-fostered offspring foraged at locations in the tree canopy characteristic of their foster species. The effect of learning was more pronounced for Great Tits than for Blue Tits. By video-taping the prey items which cross-fostered birds brought to their own offspring later in life, we found that the size of prey had also shifted in the direction of the foster species. Surprisingly, the adopted foraging niches were maintained as the young aged, suggesting that social learning of foraging techniques occurs during a short time window early in life and is persistent.

**W3.3 Wiens, J. David,** (USGS Forest and Rangeland Ecosystem Science Center, Corvallis, United States); Anthony, Robert G. (Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR, United States); Forsman, Eric D. (USDA Forest Service, Corvallis, OR, United States)  
**COMPETITIVE INTERACTIONS AND RESOURCE PARTITIONING BETWEEN NORTHERN SPOTTED OWLS AND BARRED OWLS**

Competition with invasive barred owls (*Strix varia*) is an increasingly relevant factor to consider in managing threatened northern spotted owl (*Strix occidentalis caurina*) populations and their habitats. We used radiotelemetry data from 29 spotted owls and 28 barred owls to investigate space-use, habitat selection, and dietary overlap between the two species in western Oregon, USA. Individual spotted and barred owls in adjacent territories often had overlapping home ranges, but interspecific space sharing was largely restricted to broader foraging areas with minimal spatial overlap among core-use areas. The two predators displayed broadly similar patterns of habitat selection, as both species spent a disproportionate amount of time foraging in patches of old (>120 yrs old) conifer forest or in riparian areas with large hardwood trees. Diets of both species were dominated by nocturnal mammals, but barred owls captured many terrestrial, aquatic, and diurnal prey species that were rare or absent from diets of spotted owls. Mean niche overlap calculated for spatially associated pairs of spotted owls and barred owls showed that the two species were most similar in their use of forest conditions (81%) followed by diets (43%) and then spatial distributions (18%). In addition to overlap in resource use, we also found evidence that spotted owls avoided

core-use areas of barred owls while foraging. Preliminary results from our study suggest that increasing populations of invasive barred owls may affect the viability of spotted owls both directly (via territorial exclusion from shared resources) and indirectly (via joint exploitation of high-biomass prey).

**W16.7 Wiest, Whitney,\*** (University of Delaware, Newark, United States); Shriver, Greg (University of Delaware, Newark, DE, United States)

**THE EFFECTS OF SURVEY EFFORT, TIME, AND FREQUENCY ON OCCUPANCY, ABUNDANCE, AND DETECTION PROBABILITY ESTIMATES FOR SALT MARSH BIRDS**

Knowing when and how often to survey can provide valuable information in monitoring program design. We examined the effects of survey timing and frequency on occupancy, abundance, and detection probability estimates of four salt marsh obligate birds. We conducted 240 surveys at 30 points in Delaware during the 2008 and 2009 breeding seasons. We tested three different three-survey visit scenarios: an early scenario, an early-middle-late scenario, and a late scenario. We found occupancy estimates for Clapper rail and Willet were highest in the early scenario, Saltmarsh sparrow occupancy was highest during the early-middle-late scenario, and Seaside sparrow estimates remained relatively constant. Clapper rail abundance estimates were constant across scenarios, Willet abundance decreased with later scenarios, and sparrow abundances increased with later scenarios. Results for two through eight visits indicated that species occupancy and abundance estimates increased as survey effort increased, but detection probabilities for occupancy and abundance estimates decreased from two to eight visits with the exception of the detection probability of Saltmarsh sparrow occupancy. We recommend conducting three surveys early in the breeding season to avoid juvenile detections and declines in overall detection estimates. Generally, standard error estimates were lowest during the early scenario and more surveys often led to a decrease in detection probability. This research supports the North American Secretive Marshbird Monitoring Protocol's recommendations for seasonal timing of surveys and provides insight regarding changes in occupancy, abundance, and detection probability estimates for varying levels of survey frequency.

**PS2.162 Wildrick, Rachel,** (University of Colorado, Boulder, United States); Safran, Rebecca (University of Colorado at Boulder, Boulder, United States)

**ECOLOGICAL AND SOCIAL PREDICTORS OF AGE-RELATED REPRODUCTIVE PERFORMANCE IN BARN SWALLOWS, HIRUNDO RUSTICA**

Among vertebrates, age-related patterns of allocation towards parental care and self-preservation lead to a well-understood trade-off in evolutionary theory, in which young individuals typically reproduce less successfully than old individuals. There is an increasing focus on ecological features which associate with age-related reproductive success, such as pair-bond maintenance, breeding experience, and site fidelity. However, for systems in which females exert choice, male reproductive success is a function not only these ecological factors but also due to sexual signal traits, which also change with age. Age-related changes in morphology – and thus age-related changes in attractiveness – are rarely studied along with ecological mechanisms. Two features of barn swallow (*Hirundo rustica*) morphology change with age: tail streamer length and ventral plumage color. However, these changes have not been examined

in relation to other features which might co-vary with age-related increases in reproductive performance. Accordingly, our study addresses within-individual changes, such as changes in breeding partner, nesting site, and morphology, as a function of genetic measures of reproductive performance in the barn swallow. These results will yield information about how aging impacts known sexual ornaments and genetic reproductive performance, the interplay between individual morphological change and ecological and social changes, and aid further integration of age-related factors into sexual selection experiments and theory.

**W14.1 Wiley, Anne**, (National Museum of Natural History, Smithsonian Institution, Washington, United States); Ostrom, Peggy (Michigan State University, East Lansing, United States); James, Helen (National Museum of Natural History, Smithsonian Institution, Washington, DC, United States); Welch, Andreanna (University at Buffalo, Buffalo, NY, United States); Fleischer, Robert (Smithsonian Conservation Biology Institute, Washington, DC, United States); Gandhi, Hasand (Michigan State University, East Lansing, MI, United States); Stafford, Thomas (Stafford Research, Inc., Lafayette, CO, United States)

#### A MILLENNIAL-SCALE RECORD OF FORAGING ECOLOGY IN THE ENDANGERED HAWAIIAN PETREL: ISOTOPIC EVIDENCE OF RECENT HUMAN IMPACT TO PELAGIC FOOD WEBS

Understanding the magnitude of anthropogenic impact to birds and their ecosystems can be challenging, given the relatively short time scale covered by most ornithological studies (years to decades) as compared with the length of human influence on many avian habitats (centuries to millennia). Here, we explore potential human impact to a pelagic seabird, the Hawaiian Petrel (*Pterodroma sandwichensis*), by studying its foraging ecology over the past ca. 4,000 years. We base our interpretations on stable carbon and nitrogen isotope values ( $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ ), which reflect Hawaiian Petrel foraging location and trophic level. By generating isotope data from nearly 200 modern and ancient, radiocarbon-dated bones, we develop isotopic chronologies that extend to a pre-human baseline: a period before human colonization of Hawaiian Island breeding grounds or direct human exploitation of marine feeding habitat. Isotopic segregation among petrels from different islands suggests that island populations have differed in their foraging locations for at least that past 2,000 years. Temporally, the most pervasive trend we observe is a 1.4 to 2.6 ‰ decline in  $\delta^{15}\text{N}$  values for birds breeding on the islands of Hawaii, Maui, and Lanai. This species-wide shift likely occurred within the past 100-200 years and stands in contrast to temporally consistent  $\delta^{13}\text{C}$  values and  $\delta^{15}\text{N}$  values prior to 300 BP. Recently declining  $\delta^{15}\text{N}$  most likely reflects a fishery-induced change in trophic level, which could have consequences for reproductive success and foraging efficiency in this endangered species. Given the large range and high mobility of Hawaiian Petrels, their shifting foraging habits could reflect widespread alterations in pelagic food webs of the NE Pacific Ocean.

**PS2.233 Wilkins, Matthew**, (University of Colorado at Boulder, Boulder, United States); Merz, Martin; Safran, Rebecca (University of Colorado at Boulder, Boulder, CO, United States)

#### AN EXPERIMENTAL TEST OF THE ROLE OF TRILL RATE IN SEXUAL SIGNALING AND SONG EVOLUTION IN THE BARN SWALLOW (*HIRUNDO RUSTICA*)

Rapidly repeated acoustic elements (trills) are commonly used in animal communication for a variety of functions. Because they are hard to produce rapidly, trills have been hypothesized to honestly signal an individual's ability to procure and defend critical resources, and may be subject to strong sexual selection. In light of recent studies highlighting the importance of acoustic divergence in speciation, divergence in trill rate may function as an early form of reproductive isolation if they are involved in species recognition. Among four sampled populations of the six described barn swallow (*Hirundo rustica*) subspecies, trill rate and length are the most strikingly divergent characters. We conducted playback experiments that manipulated trill rate in order to examine relationships between this song trait, male-male aggression, and reproductive success in the North American barn swallow (*H. r. erythrogaster*). Our results show that focal males exhibited different strategies in responding to a "normal" versus a "fast"-trilling simulated intruder. Furthermore, the difference in males' latency to sing and vocalize in response to the two treatments predicted the number of young fledged from his nest. These findings suggest that trill characteristics have an important role in mediating male-male aggressive interactions and that the dynamics of signal production and attendance have evolutionary implications. By matching variation in signal characteristics, corresponding behavioral responses, and reproductive success with broad patterns of geographic variation, this study aims to improve our understanding of song evolution across multiple scales.

**SAT14.2 Will, Tom**, (U.S. Fish and Wildlife Service, Bloomington, United States); Rosenberg, Kenneth (Cornell Lab of Ornithology, Ithaca, NY, United States)

#### REDIRECTING CONSERVATION: GOLDEN-WINGED AND BLUE-WINGED WARBLERS, SPECIES BLINDERS, AND CONCEPT TETANUS

Blue-winged Warbler (*Vermivora cyanoptera*) hybridizes with and tends to geographically replace its sister species, Golden-winged Warbler (*V. chrysoptera*)—a species that has declined precipitously and is listed as threatened in Canada and petitioned for listing in the U.S. As a result, Blue-wings have been identified as a major threat to Golden-wings, have incited labeling as "evil Blue-wings" on popular listservs, and have sparked Golden-wing isolation conservation strategies. In the last decade, investment in Golden-wing research has totaled easily over three million dollars, while research on Blue-wings has virtually ceased. The fact that both remain the only two species in the genus (*V. bachmanii* has gone extinct) argues that they be treated as an evolutionary complex. We briefly review and update the research practiced more than 50 years ago that highlights attributes of an evolutionarily active sibling species complex unequalled in North America: complex territorial, physical interaction, and song behavior; complex phenotypic and genotypic recognition signals; complex and puzzling hybridization genetics; geographic climate response patterns unmatched by any other species; and fascinating or unknown non-breeding season behavior. More importantly, we use *Vermivora* research and management history to illustrate the importance of redefining conservation in the face of radical uncertainty both as a process for facilitating evolution rather than preserving rarity and as a tool for adaptive learning about how to share space and resources with co-evolvers rather than as an excuse for investing in obfuscating conceptual dead-ends.

**T2.6 Williams, Casey**, (New Mexico State University, Las Cruces, United States); Good, Jennifer; DiAndrea, Victor; Desmond, Martha (New Mexico State University, Las Cruces, NM, United States)

## REPRODUCTIVE SUCCESS OF THE WESTERN BURROWING OWL (*ATHENE CUNICULARIA HYPUGAEA*) IN AGRICULTURAL AND URBAN HABITATS OF DONA ANA COUNTY, NEW MEXICO

The Western Burrowing Owl (*Athene cunicularia hypugaea*) is native to grasslands of western North America. Habitat loss and degradation across the Great Plains is hypothesized to have caused observed population increases in urban and agricultural habitats in the south. We examined factors influencing productivity ( $n = 52$ ) in urbanized landscapes of Dona Ana County, NM during 2010 and 2011. We hypothesized that Burrowing Owl nest survival and success will be influenced by local and landscape variables surrounding the nest. We developed 15 a priori models and used Akaike Information Criterion to examine variables influencing reproduction. Based on previous research, we chose to examine the following variables: year, owl density, nearest neighbor fledging success, the interaction of owl density and nearest neighbor fledging success, percent green space, and the number of habitat patches surrounding nests. We predicted that nest survival and success will be positively influenced by Burrowing Owl density and percent green space. Nearest neighbor fledging success alone was the top model, however, four of the 15 models were competing, indicating that no one model accounted for the majority of the variation. Nearest neighbor fledging success and Burrowing Owl density were clearly the most important variables, both negatively influencing fledging success with cumulative model weights of 0.71 and 0.55 respectively. This suggests that successful nests had a lower owl density and neighboring nests tended to do poorly suggesting competition for resources prior to the onset of the monsoon season was the main factor limiting productivity.

**F1.5 Williams, Kate**, (Biodiversity Research Institute, Gorham, United States); Adams, Evan (Biodiversity Research Institute, Gorham, ME, United States); Chilson, Phillip; Kuster, Charles (University of Oklahoma, Norman, United States); Lambert, Robert; Yates, David (Biodiversity Research Institute, Gorham, United States)

## COMPARISON OF BANDING, ACOUSTIC, AND NEXRAD RADAR DATA FOR STUDYING PASSERINE MIGRATION IN UPSTATE NEW YORK: A COMPLEMENTARY APPROACH

Animal migration, particularly over water, can be a difficult phenomenon to study. Commonly used research methods each have detection biases and other biases when used to indicate animal abundance and species diversity. We used a suite of complementary techniques to examine avian migration in the fall of 2011 at island sites in upstate New York; these methods included bird banding, diurnal point counts, passive acoustic nocturnal migration monitoring, and analysis of Next Generation Radar (NEXRAD) data. The Grindstone Island banding station in the St. Lawrence River had a total of 2,096 individual captures, including 71 species, and a capture rate of 75 birds per hundred net hours (Sept.-Oct. 2011). Visual surveys encountered another 2,185 individuals. The banding station had high warbler abundance and diversity, including twenty-two species and six of the top ten most common species for the station. Acoustic monitoring devices for nocturnal bird migration were placed on both Grindstone and Carleton Islands in the St. Lawrence and were operated during the same time period in 2011. We used two Song Meter acoustic recording setups (Wildlife Acoustics, Inc.) and analyzed data using Program RAVEN (Cornell University, Ithaca, NY); 6,765 distinct flight calls were detected at two locations, from a variety of species. NEXRAD data are

publicly available, and we developed tools in MATLAB and GRASS to process radar data, weather data, and the vector images for the focal islands in batch scripts. We conducted arrival and exodus analyses for five islands in the eastern Great Lakes region; created probability distribution maps to examine regional patterns over the time periods of interest; and examined migration patterns detected via radar in relation to weather patterns and acoustic and banding data. We particularly focus on comparison of results between banding, acoustic and radar data, such as whether larger migratory exodus from island sites as viewed via radar corresponds temporally with days of high banding numbers or high numbers of recorded nocturnal flight calls, and whether the more common species captured during banding are likewise strongly represented in the acoustic monitoring. The project was continued in the spring of 2012.

**S10.1 Williams, Tony**, (Simon Fraser University, Burnaby, Canada);

## INTEGRATING AVIAN PHYSIOLOGY AND ECOLOGY: INTRODUCTION TO THE SYMPOSIUM

How does individual variation in physiology relate to individual variation in 'performance' and, ultimately, to individual variation in fitness? Heritable, individual (phenotypic) variation is often referred to as the raw material of evolution. Most researchers collect data on physiological traits (e.g. a muscle enzyme, a fuel metabolite, a reproductive hormone) in individual birds but commonly only analyze differences in mean values between different states (e.g. non-breeding versus breeding, or wintering versus migration) – ignoring the individual, phenotypic variation itself. So, on average, migrating birds might have higher expression or activity of muscle enzyme X compared with non-migrating birds. Or, on average, breeding birds might have higher levels of reproductive hormone Y than non-breeding birds. However, does individual variation in the same trait(s) explain individual variation in performance and fitness among migrating birds or among breeding birds? For example, are migrating individuals with relatively higher expression or activity of muscle enzyme X more efficient (fitter?) migrants? Or do individuals with higher plasma levels of reproductive hormone Y have higher fecundity or reproductive success among breeding birds? How do we identify the physiological (or morphological, behavioral) components of phenotype that determine individual quality and individual variation in fitness? Do behavioral syndromes ('personalities') or developmental constraints (ontogenetic carry-over effects) provide integrated approaches to capturing individual quality? I will explore and provide examples of some of these ideas, and discuss concepts of repeatability, phenotypic plasticity, repeated measures designs and reaction norms, which can facilitate further integration of avian physiology with evolutionary biology and ecology.

**SAT5.5 Williams-Sieg, Kelly**, (Ohio University, Chillicothe, United States); Miles, Donald (Ohio University, Athens, OH, United States)

## HABITAT DISTURBANCE AND THE ROLE OF BEHAVIORAL PLASTICITY IN MEDIATING LIFE HISTORY TRADE-OFFS

Many factors are impacting forest ecosystems including climate change, forest management practices, and other anthropogenic influences. Habitat alteration could increase structural heterogeneity which may provide increased opportunities for foraging or nesting; however, this may render some patches within a habitat unsuitable. Spatial variation in patch suitability may induce multidimensional trade-offs, altering energy allocation among behaviors involved in reproduction, parental

care and self maintenance, which ultimately affects fitness. Behavioral plasticity may ameliorate these trade-offs in energy allocation. However, the ability of behavior to overcome spatial variation in habitat quality may be limited by constraints in time and energy budgets as well as trade-offs with other correlated behaviors. We examined behavioral variation in Hooded Warblers (*Setophaga citrina*) across contexts (e.g., foraging, territory defense, mating, parental care) and situations (three different environmental conditions: unaltered, burned and thinned forest stands) to determine whether behavioral plasticity is influenced by habitat structure and disturbance. We predicted higher plasticity in the thinned stand because it is more heterogeneous. We estimated mating success, nest survival, and fledgling and adult survival to evaluate the link between behavioral plasticity and components of fitness. Contrary to our prediction, individuals in the thinned stand exhibited less plasticity in foraging than those in the unaltered stand. However, consistent with our prediction, individuals that successfully fledged young exhibited greater plasticity in foraging behaviors than those with failed nests. Foraging repertoires differed across stands and we found significant differences in transition probabilities across contexts. For example, individuals in the thinned unit were more likely to switch to non-feeding behaviors (e.g., singing, territory defense and vigilance) after short or long flights than those in the undisturbed stand. Moreover, individuals in the thinned unit were much more likely to attack prey using aerial maneuvers suggesting that aerial attacks may be modulating time budget trade-offs and variation in habitat structure. Results from this study provide insight into behavioral plasticity, the role of plasticity in responding to disturbance, and suggests that behavioral plasticity is adaptive.

**T13.7 Williford, Damon**, (Caesar Kleberg Wildlife Research Institute; Texas A&M University; Kingsville, Kingsville, United States); DeYoung, Randy; Brennan, Leonard; Hernandez, Fidel (Caesar Kleberg Wildlife Research Institute; Texas A&M University; Kingsville, Kingsville, TX, United States); Honeycutt, Rodney (Natural Science Division, Pepperdine University, Malibu, CA, United States)

#### SPECIES RELATIONSHIPS AND PHYLOGEOGRAPHY OF THE BOBWHITES

The bobwhites (*Colinus*) are a widely distributed genus of New World quails that consists of four allopatric species distributed from eastern North America to northern South America. The four species exhibit substantial intraspecific variation. Approximately 56 subspecies are currently recognized among the bobwhites, largely on the basis of geographic distribution and male plumage coloration, however, relationships within and among species have not yet been studied in detail. We used mitochondrial DNA sequences to investigate relationships among the bobwhite species and assess the geographic distribution of genetic variation within each species. Phylogenetic analysis revealed that *Colinus* is composed of two deeply divergent lineages, one composed of Northern (*C. virginianus*) and Yucatán Bobwhites (*C. nigrogularis*) and another clade of Spot-bellied (*C. leucopogon*) and Crested Bobwhites (*C. cristatus*). The Northern Bobwhite displayed little phylogeographic structure and poorly differentiated subspecies. The Yucatán Bobwhite and the Spot-bellied-Crested Bobwhite complex exhibited stronger phylogeographic structure partially concordant with subspecies taxonomy. The weak phylogeographic structure and lack of genetically distinct subspecies in the Northern Bobwhite implies short periods of isolation among subspecies as well as recent expansion northward out of Mexico. The stronger phylogeographic structure observed in the Yucatán Bobwhite and the Spot-

bellied-Crested Bobwhite complex are probably the result of geological events and climate-driven changes in the availability of suitable habitat during the Late Quaternary. Further investigation is warranted to clarify the phylogenetic relationships of *Colinus* and intraspecific relationships among the subspecies of each species.

**PS1.218 Williford, Damon**, (Caesar Kleberg Wildlife Research Institute; Texas A&M University; Kingsville, Kingsville, United States); DeYoung, Randy; Brennan, Leonard; Hernandez, Fidel (Caesar Kleberg Wildlife Research Institute-Texas A&M University-Kingsville, Kingsville, TX, United States); Honeycutt, Rodney (Natural Science Division, Pepperdine University, Kingsville, TX, United States)

#### PHYLOGEOGRAPHY OF THE SCALED QUAIL

The scaled quail (*Callipepla squamata*) is distributed over much of the Chihuahuan Desert in the United States and central Mexico. Four subspecies have been described based on slight variations in coloration and body size. We conducted a range-wide phylogeographic analysis of the scaled quail based on the mitochondrial control region (D-loop). Our objectives were to: 1) determine the overall genetic diversity, 2) examine the phylogeographic structure of the scaled quail, and 3) determine the genetic distinctiveness of its 4 subspecies. We obtained D-loop sequences from 190 hunter-harvested wings and 38 museum specimens. Haplotype diversity ( $H_d = 0.386$ ) and nucleotide diversity ( $\pi = 0.002$ ) were relatively low. We found 16 D-loop haplotypes, 5 of which were shared by 2 or more subspecies. Haplotype A (carried by 178 individuals) was the most widespread haplotype and occurred in nearly every population. Analysis of molecular variance revealed that most of the genetic variation of the scaled quail occurred within populations rather than among subspecies. The low levels of genetic diversity probably reflect a historically restricted distribution within the Chihuahuan Desert, and wide geographic distribution of some haplotypes implies expansion from a single refugium. Our data indicate that the scaled quail subspecies probably do not represent historically independent units.

**W9.1 Wilson, Scott**, (Environment Canada, Saskatoon, Canada); Anderson, Eric (Simon Fraser University, Burnaby, BC, Canada); Wilson, Amy; Arcese, Peter (University of British Columbia, Vancouver, BC, Canada); Bertram, Doug (Environment Canada, Sydney, BC, Canada)

#### DECLINES OR REDISTRIBUTION? POPULATION TRENDS OF WESTERN GREBES WINTERING ALONG THE PACIFIC COAST

Several waterbird species along the North American Pacific Coast are declining, with Western Grebes (*Aechmophorus occidentalis*) in the Salish Sea displaying one of the steepest declines. The majority of the continental population overwintered in this region in the 1970s and 1980s but numbers have plummeted to a fraction of their former abundance over the past two decades. The Salish Sea is only one portion of the potential wintering range for the species and the relative roles of a demographic decline versus a distribution shift in contributing to the observed pattern is unclear. In this study, we used a hierarchical Bayesian approach with 41 years of Audubon Christmas Bird Count data from across the species range to assess continental population change and regional trends for Western Grebes from 1970 to 2010. During this period, the entire North American wintering population decreased by approximately 46%, likely representing a true demographic decline due to threats on the breeding and wintering grounds. Our analyses also confirmed the steep decline for Western

Grebes in the Salish Sea with an 8.34%/yr decrease corresponding to a 97% decline over the past 41 years. In contrast, abundance along coastal southern California and interior regions of California and Nevada increased by 4-5%/yr over the same period. Opposing patterns between northern and southern regions of the wintering range, combined with a known lack of migratory connectivity for the species, suggests that a southward shift of the wintering range may also be contributing to the near extirpation of the species from the Salish Sea. The increased abundance of grebes in southern California coincided with the rapid increase of the Pacific Sardine stock in the California Current and a decline in the availability of several important Pacific Herring stocks in British Columbia and Washington. Thus, a possible mechanism is that Western Grebes display facultative migration with periodic shifts in their wintering range in relation to a change in the abundance of key forage fish. This hypothesis needs further study but suggests that true declines and movement both need to be considered when interpreting non-breeding season trends for species that are capable of tracking resources over broad areas.

**S4.10 Wimmer, Jason**, (Queensland University of Technology, Brisbane, Australia); Williamson, Ian (Queensland University of Technology, Brisbane, Australia)

#### ANALYSING ACOUSTIC SENSOR DATA & METHODS TO TAME THE DATA DELUGE.

Acoustic sensors provide an effective means to monitor biodiversity at large spatial and temporal scales. They can passively and continuously collect acoustic data over large spatial and temporal scales; however this data must be analysed to detect the presence of vocal species. Analysis of acoustic sensor data involves identifying the unique vocal characteristics of each species in recordings, which may contain high levels of noise and interference from the natural environment. Analysis can be performed manually, in a semi-automated fashion utilising software to scan for vocalisations identified by a human user, or automatically using software to identify individual species. Manual processing by experienced users can produce accurate results, but the time and effort required to process even small volumes of data make it prohibitive. Continuous, 24 hour per day acoustic sensor deployments are restricted practically only by storage capacity, and storage capacity continues to increase in size and decrease in price. The volume of data that we are now able to collect far outweighs our present ability to process it manually or even automatically. This presentation examines a number of techniques and tools from our ongoing research on analysing large volumes of acoustic sensor data to estimate biodiversity. These range from data sampling approaches to automated species identification and 'acoustic richness' indices.

**W4.1 Winger, Benjamin**, (University of Chicago, Chicago, United States); Bates, John (Field Museum of Natural History, Chicago, IL, United States)

#### A GENOMIC APPROACH TO UNDERSTANDING ALLOPATRIC SPECIATION IN MONTANE BIRDS

When two sister populations are isolated from each other by a geographic barrier, it is intuitive to hypothesize that increased time in isolation and decreased gene flow between the populations will lead to greater genetic and phenotypic differentiation. However, the degree of concordance between genetic and phenotypic differentiation observed among bird populations is often variable, and it remains unclear what length of time in isolation and threshold of gene flow leads to allopatric speciation. Consequently, the factors that have led to the differential diversification of bird species in allopatry are poorly

known. Andean cloud forest bird species whose ranges span the arid Marañon River valley in Peru represent a natural experiment with which to empirically test hypotheses on speciation in birds. To test hypotheses on the processes that lead to differential speciation in allopatry among Andean taxa, we have taken both a traditional approach using mitochondrial sequence data, and a next-generation sequencing approach to gather large-scale genomic data. Illumina sequence data from 36 million short-read sequences has enabled among-population Single Nucleotide Polymorphism (SNP) discovery, which will help determine the role that periodic gene flow between populations has had in shaping observed patterns of phenotypic differentiation.

**SAT15.3 Winker, Kevin**, (University of Alaska Museum, Fairbanks, United States); McCracken, Kevin (Institute of Arctic Biology, Fairbanks, AK, United States); Peters, Jeffrey (Wright State University, Dayton, OH, United States)

#### HETEROPATRIC SPECIATION IN A DUCK

Heteropatric differentiation is a mode of speciation with gene flow in which divergence occurs between lineages that are in sympatry and allopatry at different times during cyclic movements. Empirical evidence suggests that heteropatric differentiation may prove to be common among seasonally migratory organisms. We examine genetic differentiation between the sedentary Aleutian population of Green-winged Teal (*Anas crecca nimia*) and its close migratory relative, nominate *Anas c. crecca*, which leapfrogs *nimia* during its seasonal migrations. Sequence data from mtDNA and eight nuclear introns show that this divergence was initiated much more recently than the deeper, intercontinental *crecca-carolinensis* split. Despite considerable spatial overlap during spring and autumn migration, two of the key predictions of heteropatric differentiation are supported between these populations: genetic differentiation and low gene flow. (Winker and Peters contributed equally to this work.)

**S1.11 Winkler, David**, (Cornell University, Ithaca, United States); Rakhimberdiev, Eldar (Cornell University, Ithaca, NY, United States); Stager, Maria; Cooper, Caren (Cornell University, Ithaca, United States); Ardia, Daniel (Franklin & Marshall College, Lancaster, United States)

#### PATTERNS IN THE SURVIVAL AND DEMOGRAPHY OF TACHYCINETA SWALLOWS ACROSS THE WESTERN HEMISPHERE

Over the past ten years, an increasing number of studies have been initiated across the Americas on the breeding biology of Tachycineta swallows as part of the Golondrinas de las Americas project. Some of these studies are long-term (>10 years) and others have only two or three year's data to date. We experimented with several methods to get estimates for adult survival from sites where the data by themselves are not sufficient for analysis with traditional mark-recapture methods. These survival data can be combined with data on breeding biology and reproductive success to yield estimates of the demographic status of populations across the Western Hemisphere. These estimates, though far from perfect, also will bear directly on the results of several recently completed comparative studies of latitudinal variation in parental investment and offspring growth and survival, and thus they may be relevant to evaluating potential costs of reproduction.

**PS2.114 Withrow, Jack**, (University of Alaska Museum, Fairbanks, United States); Sealy, Spencer (University of

Manitoba, Manitoba, MB, Canada); Winker, Kevin (University of Alaska Museum, Fairbanks, AK, United States)

#### HETEROPATRIC SPECIATION IN THE HAIDA GWAI OWL, *AEGOLIUS ACADICUS BROOKSI*.

The Northern Saw-whet Owl (*Aegolius acadicus*) occurs across much of North America but exhibits morphological differentiation in only one population: on the Queen Charlotte Islands (Haida Gwaii), British Columbia. We studied the genetic differentiation of this population (*A. a. brooksi*) from mainland populations. Mitochondrial genes cytochrome *b* (*cyt b*) and NADH dehydrogenase subunit 2 (ND2) were sequenced for 24 *brooksi* and 21 and 19 *acadicus*, respectively. Amplified fragment length polymorphisms (AFLPs) were generated for 23 *brooksi* and 22 *acadicus* to assess nuclear genomic divergence. *Cyt b* exhibited one fixed difference between subspecies, had very few haplotypes, and  $F_{ST} = 0.96$ . ND2 had more haplotypes and an  $F_{ST} = 0.67$  between subspecies. AFLPs showed lower levels of divergence ( $F_{ST} = 0.074$ ) between subspecies. A Bayesian clustering algorithm determined that two populations were likely present but also showed evidence of gene flow. Together, these genetic differences suggest that *A. a. brooksi* is a product of the last glacial maximum and that it has not yet achieved full speciation. Heteropatric differentiation may be the driving force behind its divergence since the last glacial maximum.

**F12.6 Wolf, Blair**, (University of New Mexico, Albuquerque, United States);

#### HEAT WAVES - CHALLENGES FOR DESERT BIRD COMMUNITIES

For the avifaunas of hot subtropical deserts, among the most important, but understudied, direct effects of climate change may involve catastrophic mortality events associated with extreme heat waves and droughts. A number of large-scale die-offs during extremely hot weather have been documented in the past, and general circulation models predict increases in the intensity, frequency and duration of heat waves. Here, we identify the physiological mechanisms underlying avian mortality associated with heat stress and the lack of water, and develop a model that predicts rates of evaporative water loss and survival times during very hot weather as functions of body mass and dehydration tolerance. Applying our model to current and projected maximum air temperatures for two localities in hot subtropical deserts, we find that the increase in maximum air temperatures predicted for the 2080s will increase rates of evaporative water loss by more than 50-80% in very small birds, reducing survival times by 30-40%. The existing literature suggests that many species will simply be unable to up-regulate EWL to maintain body temperatures below critical lethal limits given the predicted increases in heat stress. Current and historical accounts document catastrophic mortality caused by hyperthermia or through dehydration. Increasing global temperatures, combined with more intense and frequent heat waves, will result in more frequent die-offs among desert birds, potentially depopulating regional communities.

**PS2.189 Woltmann, Stefan**, (Louisiana State University AgCenter, Baton Rouge, United States); Taylor, Sabrina S.; Stouffer, Philip C (Louisiana State University AgCenter, Baton Rouge, LA, United States); Woodrey, Mark S. (Coastal Research and Extension Center, Biloxi, MS, United States)

#### SEASONAL MOVEMENTS OF SEASIDE SPARROWS (*AMMODRAMUS MARITIMUS*) ALONG THE GULF COAST?

The Seaside Sparrow (*Ammodramus maritimus*) is of conservation interest throughout its range along the northern Gulf of Mexico. Large-scale problems include habitat loss and sea-level rise, and three of the four named subspecies in the region (*A. m. peninsulae*, *juncicola*, and *sennetti*) occupy small geographic ranges, making them vulnerable to more local disturbances (hurricanes, oil spills, etc.). All Gulf Coast populations are generally considered non-migratory. We determined the sex of birds captured during the non-breeding period using a standard and verified PCR approach. We found samples from Mississippi and eastern Louisiana (*ssp. fisheri*) to be considerably male-biased. In contrast, samples from Wakulla Co., FL (*ssp. juncicola*) and Cameron Co., TX (*ssp. sennetti*) during the same time period showed no male bias. Samples collected in Mississippi in July and early August also showed no male bias. These observations support the long-held contention that the narrowly-distributed subspecies are sedentary, but suggest that there may be sex-biased migration or differential winter habitat selection by *A.m. fisheri*, the most widespread Gulf subspecies.

**W11.8 Wommack, Elizabeth**, (U. C. Berkeley, Museum of Vertebrate Zoology, Berkeley, United States); Bowie, Rauri (U. C. Berkeley, Museum of Vertebrate Zoology, Berkeley, United States); Dawson, Russell; Shrimpton, J. Mark (University of Northern British Columbia, Prince George, BC, Canada)

#### MOLECULAR ANALYSIS OF A POPULATION DECLINE IN A LONG-STANDING BREEDING POPULATION OF AMERICAN KESTRELS IN SASKATCHEWAN, CANADA

The American Kestrel *Falco sparverius* has often been counted as one of North America's most common species of raptor. However, recent demographic data has begun to reveal a decrease in the number of individuals at both migration and nesting sites, sparking a concern that the North American subspecies *F. s. sparverius* may be on the brink of a decline. In this study we examined whether a demographic decrease seen in a long-term breeding population of American Kestrels in the boreal forests of Saskatchewan could be attributed to a population bottleneck. A bottleneck occurs when a population experiences a decrease in the number of individuals contributing to the breeding population that is of a sufficient duration to leave a genetic signature. Demographic data collected at the nest box program in Saskatchewan has shown a significant decline in occupancy rates over the past twenty years. However, it was not known if the reduction in the number of breeding pairs was a result of a decrease in the number of individuals within the population, or if instead the population had begun to shift their breeding and migratory behavior and as a result was nesting in a different location. In this study we used microsatellite data collected from breeding adults ( $N = 205$ ) trapped in 2007 and 2008, to confirm the presence of a decline in genetic diversity for the population, supporting the idea that the American Kestrel is declining in numbers for nesting sites in the eastern and northern sections of Canada and the United States. Comparison of the genetic and demographic data suggests that the Saskatchewan breeding population has experienced a population bottleneck, and that there has been a decline in the number of breeding individuals within this northern population of the American Kestrel.

**S6.11 Wood, Eric**, (University of Wisconsin-Madison, Madison, United States); Pidgeon, Anna (University of Wisconsin-Madison, Madison, WI, United States)



## VARIATIONS IN CLIMATE AFFECT ECOSYSTEM SERVICES PROVIDED BY BIRDS DURING SPRING MIGRATION

Variations in climate have resulted in less predictable phenological events (e.g., tree flowering and insect emergence). It is not clear how this affects migratory songbirds and their valuable ecosystem services (e.g., depredation of herbivorous Lepidoptera larvae) during spring migration. In a Midwest oak savanna we explored this during spring and early summer, 2009 and 2010. We recorded tree flowering and leaf-out phenology, monitored migratory songbird arrival and use of trees, and conducted a branch enclosure experiment. In 2009, the dominant tree at our study site, black oak (*Quercus velutina*), flowered and leafed-out in early to mid-May and migratory songbirds heavily used the black oak trees during this time. Black oak branches, from which birds were excluded, had significantly higher insect richness, higher Lepidoptera abundance, and higher leaf damage than control branches. The average daily low temperature was approximately ten degrees warmer in March and April of 2010 and, as a result, black oak tree flowering and leaf-out was on average three weeks earlier than in 2009. Migratory songbirds were nearly absent from the study area in 2010 presumably because peak food availability and accessibility (e.g., flowering) had concluded by the time birds arrived in mid-May. Because of this, there were no significant differences in insect richness, Lepidoptera abundance, or leaf damage between bird-excluded and control branches of black oak trees. Our results suggest large variations in climate interfere with the phenological synchrony of migratory songbirds and their food resources, which in turn alters habitat use and ecosystem services of birds.

**PS2.193 Wood, Eric**, (University of Wisconsin-Madison, Madison, United States); Pidgeon, Anna (University of Wisconsin-Madison, Madison, WI, United States); Radeloff, Volker (University of Wisconsin - Madison, Madison, WI, United States); Flather, Curtis (Canada)

### PATTERNS OF AVIAN COMMUNITY RESPONSE AT THE BOUNDARY OF PROTECTED AREAS: IS THE CONSERVATION BENEFIT BEING ERODED?

Biodiversity conservation is generally seen as a responsibility of publicly owned protected areas. Protected areas also provide amenities that make development in their vicinity attractive and, consequently, such pressures are strong along protected area boundaries. Despite a common perception that protected areas are critical for sustaining biodiversity, there has been little formal assessment of the relative contribution to conservation of public and private land. We explored patterns of avian species richness and abundance, calculated from Breeding Bird Survey data (BBS), in relation to land use and housing density inside, at the boundary, and outside of protected areas in 11 Bird Conservation Regions (BCR) of the United States. Human-associated land uses (e.g. agriculture) and housing density were greater at the boundary and outside of protected areas. In contrast, 'natural' land cover types (e.g. forest) were more widespread within protected areas. As a result, selected avian guild richness and abundance were higher in protected areas. For example, in the Appalachian BCR, richness and abundance of forest breeding species and Neotropical migrants were significantly greater within protected areas than outside their boundaries. On the other hand, there were strong negative associations between bird metrics and human-associated land uses and housing density. These results suggest that human-associated ecosystem stresses negatively impact avian richness and abundance. Protected areas appear to provide a safe-haven for biodiversity on an increasingly human-modified landscape. However, increases in human-associated ecosystem stresses on

the boundary of protected areas likely will result in increased differences between protected and private land bird communities.

**S6.12 Wood, Eric**, (University of Wisconsin-Madison, NA, United States); Kellermann, Jherime (USA-National Phenology Network, Tucson, United States)

### FRONTIERS IN AVIAN PHENOLOGICAL MONITORING AND RESEARCH: TRENDS, ADVANCES, AND NEXT STEPS

Phenological events have long been admired and studied. Polynesians used the reoccurrence of migrating Pacific Golden-Plovers (*Pluvialis fulva*) to discover remote islands, naturalists such as Aldo Leopold remarked at the phenology of plants and animals as the 'arteries of the land', and current research is aimed at better understanding how a rapidly changing climate may decouple synchronous phenological relationships between bird species and their resources throughout the avian life cycle. Faced with a diversity of pressures including climate change, altered disturbance regimes, invasive species, and anthropogenic land use, practitioners are challenged with understanding phenological events in order to prioritize management and conservation. In this talk, we will review status and trends (e.g. monitoring), comment on advances (e.g. USA-National Phenology Network), suggest some key challenges (e.g. population connectivity, fitness assessment), and lay a broad road map for possible next steps (e.g. remote sensing applications) in avian phenological monitoring and research with the intent to facilitate an open discussion.

**S9.6 Woodworth, Bradley K.**, (Acadia University, Wolfville, Canada); Francis, Charles (Canadian Wildlife Service, Environment Canada, Ottawa, ON, Canada); Taylor, Philip D. (Acadia University, Wolfville, NS, Canada)

### MIGRATION STRATEGIES OF INDIVIDUAL SONGBIRDS AT A MAJOR ECOLOGICAL BARRIER AND THEIR RELATIONSHIP TO WEATHER

At many ecological barriers, migratory songbirds must choose to cross the barrier directly or detour around it. In southwest Nova Scotia, radar has shown that fall migrants frequently cross the Gulf of Maine, but orientation studies (and a single band return) suggest that some individuals decide to travel northwest around the Gulf. Prior to or as an alternative to initiating migratory flight across or around such a barrier, migrants may make one or a series of local- to landscape-scale flights. Such 'stopover flights' may occur if conditions at the current site are unsuitable for refueling or if weather conditions are unsuitable for extended migratory flight. To understand these migration strategies, we studied the departure decisions and movement behaviors of individual songbirds during fall migration using an automated digital telemetry array spanning from southwest Nova Scotia to southern Maine. Of 92 individuals detected departing from stopover sites in southwest Nova Scotia, 45% made one or more stopover flights prior to continuing migration or moving out of detection range, and of 47 migratory departures detected, 57% were oriented in a southwesterly direction and 43% were oriented in a northwesterly direction. Fifteen individuals were re-detected 4 h to 15 days later over the Bay of Fundy and/or on the coast of Maine. Migratory flights in both directions were more likely to be initiated with tailwind assistance and under high atmospheric pressure. Stopover flights were also initiated under high atmospheric pressure but often without tailwind assistance and in more variable weather conditions than migratory flights. Our results show variable strategies by which migrants negotiate a major

ecological barrier and the influence of weather on these decisions.

**SAT11.1 Wright, Natalie,\*** (University of New Mexico, Albuquerque, United States); Kratter, Andrew; Steadman, David (University of Florida, Gainesville, FL, United States); Witt, Christopher (University of New Mexico, Albuquerque, NM, United States)

#### ECOLOGICAL DETERMINANTS OF FLIGHT MUSCLE SIZE ACROSS BIRDS

Surprisingly little work has been done on flight muscle size in birds, considering that the ability to fly is integral to most aspects of avian ecology, life history, morphology, and physiology. Here we use flight muscle mass data collected from 7,000 museum specimens of over 1400 species to begin to explain flight muscle sizes across avian lineages. Flight muscle mass (pectoralis major and supracoracoideus) scales isometrically with body mass across birds and exhibits phylogenetic conservatism. After controlling for body mass, ecological and life history variables seem to explain much of the variation in flight muscle size within lineages. Birds that spend time foraging on the ground and require explosive flight to escape predators have large flight muscles for their body size, whereas ground-foraging birds that tend to respond to predation threat by running or remaining still in vegetation have small flight muscles. Mode of flight explains substantial interspecific variation, with smaller flight muscles associated with soaring and some of the largest associated with hovering.

**T6.6 Wright, Stephanie,\*** (The Ohio State University, Columbus, United States); Nelson, Douglas (The Ohio State University, Columbus, OH, United States)

#### SONG LEARNING PREFERENCES DIFFER BETWEEN TWO CLOSELY RELATED CHICKADEE SPECIES

Song learning research has shown that several songbird species have an innate, "template-based" preference to learn their own species' song. When two closely-related songbird species have overlapping species distributions, this species-specific predisposition in song learning may have an impact on a young bird's ability to develop into a reproductively-viable individual and could influence the propensity for hybridization between the two species. Black-capped (BCCH) and Carolina (CACH) chickadees are two closely-related songbirds that hybridize where their ranges overlap. Both BCCH and CACH can learn perfect versions of the other species' song in the laboratory, but these experiments exposed nestlings only to songs of one of the chickadee species; a preference to learn conspecific song when exposed to both species' songs has remained untested. In summer 2011 we hand-raised 16 BCCH and CACH nestlings (8 of each species) until fledging and then tested them for their ability to recognize and discriminate between BCCH and CACH song by calculating begging call rate given in response to song playback, a metric that has previously been shown to correlate with learning preferences in other songbird species. Prior to any tutoring, neither BCCH or CACH showed any preference to beg more in response to either chickadee species' song or showed an ability to discriminate between the two species' songs. After 10 days of tutoring with both BCCH and CACH song types, only BCCH fledglings showed a trend to respond more to conspecific song than heterospecific song (Wilcoxon Signed Ranks Test,  $p=0.068$ ) and only BCCH fledglings showed any ability to discriminate between BCCH and CACH song after tutoring (WSRT,  $p=0.068$ ). Current vocalizations of the birds reflect the data above: CACH sing both BCCH and CACH song types, while BCCH only sing conspecific song. These data indicate

that the auditory template of CACH may recognize both CACH and BCCH song early in life and that these same birds go on to sing both species' songs. Further, BCCH appear to be able to discriminate between conspecific and heterospecific chickadee songs after tutoring, which correlates with a bias to sing conspecific song. These results may be able to explain the pattern of song learning seen in the chickadee hybrid zone and are the first indication that selective pressures on innate learning preferences may differ for closely related species.

**T17.10 Wu, Joanna,** (University of Hawaii at Hilo, Hilo, United States); Delparte, Donna; Hart, Patrick (University of Hawaii at Hilo, Hilo, United States)

#### NATIVE AND NON-NATIVE FRUGIVORE MOVEMENT PATTERNS AND IMPLICATIONS FOR SEED DISPERSAL IN HAWAII

The thrush, 'Ōma'o (*Myadestes obscurus*), is the last remaining native frugivore in Hawai'i, and disperses seeds in a landscape naturally fragmented by lava flows. Now an introduced opportunist, the Japanese White-eye (*Zosterops japonicus*), has become the most common bird in Hawai'i. The Japanese White-eye consumes and disperses some seeds, and its abundance makes it a potentially significant part of the ecosystem. However, little is known about the movement and seed dispersal patterns of the native versus introduced frugivore. We used radio-telemetry to study movements, tracking 9 'Ōma'o and 9 Japanese White-eyes. Bird location points are calculated from the two observers' GPS locations and bearings using triangulation. The average 50% kernel home range size of 'Ōma'o is 2.13 ha in the breeding season, and 3.14 ha in the non-breeding season. During the time of gut passage, approximately 30 minutes, 'Ōma'o move an average of 133 m, with a large variation in distances traveled. 'Ōma'o primarily spend time in a core area, but make trips to the surrounding lava matrix and neighboring forest islands and thus may be dispersing seeds to those areas. Preliminary data from the breeding season suggest that Japanese White-eyes exhibit similar or smaller movements, though ongoing tracking will provide concrete results. Fecal sample analysis and previous studies suggest that Japanese White-eyes consume more insects than 'Ōma'o, so Japanese White-eyes would not make good substitutes for the thrushes' seed dispersal services where native frugivores have been extirpated (on all the other Hawaiian Islands). This study is the first to track movements of the Japanese White-eye in Hawai'i.

**SAT8.1 Wunderle, Joseph,** (Intl. Inst. of Tropical Forestry, USDA Forest Service, Luquillo, United States); Currie, Dave; White, Jennifer D. (Intl. Inst. of Tropical Forestry & PR Conservation Found., Luquillo, PR, United States); Powell, Adele (University of Exeter, Cornwall, United Kingdom); Ewert, David N. (The Nature Conservancy, Lansing, MI, United States); Lebow, Patricia K. (Forest Products Lab., USDA Forest Service, Madison, WI, United States)

#### SEX AND AGE DIFFERENCES IN SITE FIDELITY, FOOD RESOURCE TRACKING, AND RESPONSE OF BODY CONDITION TO RAINFALL IN WINTERING KIRTLAND'S WARBLERS (*SETOPHAGA KIRTLANDII*) IN THE BAHAMAS MAY HAVE DROUGHT YEAR CONSEQUENCES THAT CARRY OVER TO THE BREEDING GROUNDS.

We predicted that differences in site fidelity, movements, and population density would correspond with variation in food abundance in wintering Kirtland's Warblers, on Eleuthera,

Bahamas. In addition, site fidelity and resource tracking were expected to vary by sex and age due to competition and experience, contributing to differences in body condition. We found that the warbler's food resources (fruit and arthropods) typically declined during a winter, but not always consistently due to yearly variation both within and between study sites. Despite variation in food availability, the proportions of fruit and arthropods in the warbler's diet, determined by fecal samples, varied little within the winter or with sex or age class. As predicted, site fidelity within and between winters varied between the sex (males > females) and age classes (adults > juveniles). However, 53% of the variation in overwinter site fidelity was explained by age class and ripe fruit abundance. Individuals that shifted study sites moved to sites with higher ripe fruit abundance. This resource tracking resulted in late winter warbler densities that were positively correlated with ripe fruit and ground arthropod biomass. Both fruit abundance and late winter body condition were positively affected by rainfall in the prior month. Late winter body condition differed by sex and age corresponding with sex and age differences in site fidelity. These sex and age differences in wintering Kirtland's Warblers are indicative of intraspecific competition, which in drought years may have consequences that carry over to the breeding grounds.

**F5.3 Wyman, Katherine,** (University of Minnesota, Saint Paul, United States); Cuthbert, Francesca; Wires, Linda (University of Minnesota, Saint Paul, MN, United States)

#### NOW YOU SEE THEM, NOW YOU DON'T: SITE OCCUPANCY DYNAMICS OF GREAT LAKES COLONIAL WATERBIRDS

Conservation of colonial waterbirds should rely on knowledge of colony site use dynamics, because the best strategies to protect or manage waterbird populations differ depending on the rate of colony site turnover. Earlier studies have suggested relationships between single predictors and site use probability, but few have considered multiple predictors simultaneously. Multivariate analyses are critical to a full understanding of waterbird colony dynamics because individual aspects of the environment are not experienced in isolation, and because the estimated relationship between predictor and response can change in the presence of other predictors. We used a hierarchical model of site occupancy and colony detection to determine how multiple characteristics of the physical and social environment influence probability of site colonization by new species and re-use of sites by previously-nesting species. We applied our model to decadal census data on colonies of ten species of waterbirds (gulls, terns, cormorants, and herons) breeding in the U.S. Great Lakes; most of these species are regional conservation or management priorities. Using a Bayesian analytical approach, we generated posterior densities for model parameters via Markov chain Monte Carlo simulation. The ten species varied considerably in their responses to the presence of co-nesters, human development, and site location with respect to the mainland. Sites with large waterbird colonies and those not susceptible to flooding were most likely to be reoccupied in the following census period, suggesting that sites with these characteristics should be priorities for land protection. However, given that no two species responded in the same way to all modeled variables, the most effective conservation strategy will use knowledge about species-level variation to tailor conservation and management to species of interest.

**PS2.40 Wynia, Amy,** (Arkansas State University, State University, United States); Bednarz, James (Arkansas State

University, State University, United States); Benson, Thomas (Illinois Natural History Survey, Champaign, IL, United States)  
**COMPARISON OF NEST-SITE VEGETATION CHARACTERISTICS AMONG THREE UNDERSTORY-DWELLING PASSERINES: SWAINSON'S WARBLERS, NORTHERN CARDINALS, AND INDIGO BUNTINGS**

Passerines select specific habitat characteristics for the placement of their nests to minimize the probability of predation, avoid competition with ecologically similar species, provide safety from adverse environmental conditions, and for other adaptive ecological reasons. The need to minimize competition should be most critical among species nesting in similar ecological circumstances, such as in understory shrub habitat. However, if avoidance of predation is a primary driving selective factor, we would predict similar nest placement (e.g., nesting in thick cover) among all species using a certain micro-habitat. Here, we compare vegetation characteristics for Swainson's Warblers (*Limnothlypis swainsonii*), Northern Cardinals (*Cardinalis cardinalis*), and Indigo Buntings (*Passerina cyanea*) nesting in Saint Francis National Forest in eastern Arkansas. Generally, we found that these species are nesting in areas with similar vegetation characteristics. For example, mean percent shrub cover 0-2.5 m for Swainson's Warblers, Northern Cardinals, and Indigo Buntings was 46.49%, 32.07%, and 43.03%, respectively. However, mean total number of understory stems was 6.57/m<sup>2</sup>, 2.29/m<sup>2</sup>, and 3.92/m<sup>2</sup>, respectively, which were significantly different among species. Although Swainson's Warbler nest sites had more total stems, these were mostly cane stems (*Arundinaria gigantea*), (3.49/m<sup>2</sup>), compared to Northern Cardinals (0.14/m<sup>2</sup>), and Indigo Buntings (2.00/m<sup>2</sup>). Many shrubs and vines have a higher density of leaves than cane, thus the cover of shrubs, used by cardinals and buntings for nesting, was similar to that of Swainson's Warblers, which primarily used cane. These vegetative similarities indicate that predation may be a stronger driving force than interspecific competition, which perhaps may explain why these passerines build nests in habitats with similar micro-habitat characteristics.

**PS1.139 Yanco, Scott,** (ClearPath Environmental, Denver, United States); Linkhart, Brian (Colorado College, Colorado Springs, CO, United States)

#### HOME-RANGE AND HABITAT USE BY FLAMMULATED OWLS (*OTUS FLAMMEOLUS*) FOLLOWING A LARGE-SCALE FOREST FIRE IN CENTRAL COLORADO

The Flammulated Owl (*Otus flammeolus*) is a sensitive forest raptor often associated with larger, older stands of mixed conifers and ponderosa pine (*Pinus ponderosa*). In order to determine home-range and habitat use patterns of this species in a post-fire environment, we used radio-telemetry to track the movements of breeding male Flammulated Owls in the burn scar of the Hayman Fire, which burned the largest area in Colorado history (55,846 hectares) in 2002. Radio tracking occurred between 5 and 8 years post-fire. Here we present habitat selection preferences of these males at two spatial scales: 1) home-range; and, 2) microhabitats within the home-range, specifically day-roosting and foraging locations. Home-ranges were located in unburned or low-intensity burned "islands" within the larger burn matrix (approximately 50% of which was stand replacing). Trees used for both roosting and foraging were generally larger than unused but available trees. The selection for larger trees is consistent with the results of similar studies of the species conducted in unburned environments. Anthropogenic fire suppression has led to larger, more catastrophic fires across western North America with greater

proportions of high-intensity burned areas than was historically normal. Understanding how Flammulated Owls recolonize and use habitats in significantly disturbed environments has important conservation implications for the species and provides insight into the impacts of a revised fire regime on avian communities.

**PS1.144 Yantachka, Jennifer**, (State University of New York College of Environmental Science and Forestry, Syracuse, United States); Beier, Colin (State University of New York College of Environmental Science and Forestry, Syracuse, NY, United States)

#### RELATIONSHIPS AMONG ADIRONDACK SONGBIRD COMMUNITIES, CALCIUM AVAILABILITY, AND ACIDIC DEPOSITION

The depletion of soil calcium, an important macronutrient, by acidic deposition has been linked to changes in plant and invertebrate communities, as well as to reproductive declines in some avian species. To investigate the effects of calcium depletion on overall avian abundance and diversity, we sampled bird communities at 13 sites representing a soil calcium gradient of upland northern hardwood forests in the Adirondack Mountains, New York. There was no relationship between species diversity and soil calcium concentration or acidic deposition levels. However, flycatchers, corvids, and nuthatches appear to preferentially establish breeding territories at higher calcium sites with lower acidic deposition inputs, indicating that some species may be more sensitive to calcium availability and acidic deposition than others. We also found evidence that overall avian abundance may respond positively to mineral soil calcium availability. We will discuss how avian communities at low-calcium sites may differ from communities at high-calcium sites. Our results provide guidance for conservation efforts in the Adirondack Mountains by demonstrating that highly buffered sites may act as neoreugia for biodiversity by retaining potential for long-term acidification resistance and recovery.

**T5.5 Yao, Mu-Chun**, (National Taiwan University, Taipei, Taiwan); Lin, Ruey-Shing (Endemic Species Research Institute, Nantou, TW, Taiwan); Lee, Pei-Fen (National Taiwan University, Taipei, TW, Taiwan)

#### USE OF MAMMALIAN DUNG AND ITS POTENTIAL FUNCTIONS IN NESTING FAIRY PITTA (PITTA NYMPHA)

Nesting success will affect the individual fitness directly in birds. Nests are the place where birds reproduce; the contents in nests are directly correlated to safety of nests and then influence reproductive success of individuals. It's rare that birds place or utilize animal dung in nests; however, existence of mammalian dung was discovered in nests of Fairy Pitta (*Pitta nympha*, family Passeriformes). In order to understand the generality of this behavior, we used video recording, photograph taking and regular nest checking to understand the use of mammalian dung and mammalian dung-like substance (MDS) in Fairy Pitta nests at the Linnei township of Yunlin county from May to July in 2009 and 2010. We recorded the type of MDS, the occurred period, location of placement, the quantity and the quality of it. Within 78 Fairy Pitta nests, which including 84 nest periods, 74.4% of nests were observed with MDS placing behavior. The type of MDS can be divided into three categories: mammalian dung, soil and others, with mammalian dung occurring most frequently (63%). The mammalian dung was determined as the dung of Formosan macaque (*Macaca cyclopis*) and Masked Palm Civet (*Paguma larvata*). Period of MDS occurrence is most frequent in laying, early-nestling and late-nestling stage (88.2%,

91.7%, and 100%), and the location of placement in nest is mostly at the area which is five centimeters inside the entrance of the nests (59.4%), but it also have about 28% occurred at the area five centimeters outside the entrance of the nests. We proposed anti-predation hypothesis and egg-incubation hypothesis, and we used artificial nests for hypothesis testing, with dung of Formosan macaque as the representation of MDS. The anti-predation hypothesis proposed MDS could avoid nests from predation, and then increased the survival rates of the nests; the egg-incubation hypothesis proposed MDS could maintain or increase the temperature of the nests. The results of the daily survival rates of eggs in artificial nests supported anti-predation hypothesis, which means the nests added the dung of Formosan macaque have significantly higher daily survival rates than those without the dung ( $P < 0.001$ ). However, the egg-incubation hypothesis did not support by our results. Accordingly, most of breeding Fairy Pittas do place mammalian dung and mammalian dung-like substance (MDS) inside their nests and the function of the behavior is relevant to anti-predation.

**W7.3 Yezerinac, Stephen**, (Mount Allison University, Sackville, Canada); Lanctot, Richard (USFWS, Anchorage, United States); Brown, Stephen (Manomet Center for Conservation Sciences, Manomet, United States); Casler, Bruce (USFWS, Cold Bay, United States); Fifield, Dave (Memorial University, St. John's, Canada); Gates, River; Hill, Brooke (USFWS, Anchorage, United States); Kendall, Steve (USFWS, Fairbanks, United States); Liebezeit, Joe (Wildlife Conservation Society, Portland, United States); McKinnon, Laura (Trent University, adfsa, Canada); Nol, Erica (afdsf, afd, Canada); Zack, Steve (Wildlife Conservation Society, afd, Canada)

#### CONNECTING DUNLIN BREEDING SITES WITH MIGRATORY STOPOVER AND WINTERING LOCATIONS USING LIGHT-LEVEL GEOLOCATION

Knowledge of the geographic links between migratory populations at different stages of their annual cycle is essential for effective wildlife monitoring and conservation. We identified migratory routes and stopover areas for the three subspecies of Dunlin, *Calidris alpina arctica*, *pacifica* and *hudsonia* that breed in North America. In 2010, between 22 and 51 Dunlin at each of seven breeding populations (total of 268) were equipped with light-level loggers. In 2011 we recovered 97 loggers: 54 from three populations of *pacifica*, 26 from three populations of *arctica*, and 17 from one population of *hudsonia*. On average, these logged 333 days, though the range was large 6-394 days. We found that all *arctica* migrated to Asia, all *pacifica* went to the west coast of North America, and all *hudsonia* wintered along the east coast or Gulf coast of North America. We use these data to examine the distributions and the connectivity of separate breeding populations throughout their annual cycle, and relate differences in migration routes, timing and stopover duration to individual attributes such as sex, condition, and breeding initiation and success.

**PS2.70 Yoo, Jenny**, (University of Manitoba, Winnipeg, Canada); Koper, Nicola (University of Manitoba, Winnipeg, MB, Canada)

#### EFFECTS OF SHALLOW GAS WELL DEVELOPMENT AND ROADS ON GRASSLAND SONGBIRD NEST PRODUCTIVITY

Over the past 40 years, grassland songbird populations have experienced dramatic declines due to habitat loss and fragmentation from land conversion and development. However,

very few studies have evaluated the effects of energy infrastructure on songbird species, even with increasing energy development across the prairie. Our study sites consisted of twelve 260ha pastures in mixed-grass habitat of southern Alberta, which were divided into three levels of gas well density; 4 control sites (0 gas wells), 4 sites with moderate well densities (8-15 wells), and 4 sites with high well densities (20-30 wells). We used the rope – drag method to find songbird nests, which were monitored every 2-4 days to study the effects of gas well distance and density on songbird productivity. We also used video-camera recordings to document nest predators and predation events, supplemented with sand track stations to account for relative predator activity. To analyze nest productivity data we used the logistic exposure method. One grassland songbird species, chestnut-collared longspur (CCLO), had higher nest failures in pastures of high gas well density in comparison to lower density pastures, but there was no effect of distance to gas wells on nesting success. However, infrastructure development was found to have no significant effect on other grassland songbird species, particularly savannah sparrows. Between May and July 2012, we will evaluate whether the effects of well density on CCLO nesting success were driven by changes in effects of well density on parental disturbance, predator communities, or provisioning rates. Understanding the impacts of infrastructure in mixed-grass prairie ecosystem will help energy companies improve mitigation methods to conserve grassland songbird species and habitat.

**T7.6 Zanette, Liana**, (University of Western Ontario, NA, Canada); **Hobson, Keith** (Environment Canada, Saskatoon, SK, Canada); **Clinchy, Michael** (University of Victoria, Victoria, BC, Canada); **Travers, Marc** (Canada); **Williams, Tony** (Simon Fraser University, Burnaby, BC, Canada)

#### FOOD USE BY SONGBIRDS IS AFFECTED BY THE EXPERIENCE OF NEST PREDATION: IMPLICATIONS FOR INDIRECT PREDATOR EFFECTS ON CLUTCH SIZE

Indirect predator effects on prey demography include any effect not attributable to direct killing and can be mediated by perceived predation risk. Though perceived predation risk clearly affects foraging, few studies have yet demonstrated that it can chronically alter food intake to an extent that affects demography. Recent studies have used stable isotopes to gauge such chronic effects. We previously reported an indirect predator effect on the size of subsequent clutches laid by song sparrows (*Melospiza melodia*). Females that experienced frequent experimental nest predation laid smaller clutches and were in poorer physiological condition compared to females not subject to nest predation. Every female was provided with unlimited supplemental food with an unmistakable  $^{13}\text{C}$  signature. Here we report that frequent nest predation females had lower blood  $\delta^{13}\text{C}$  values, demonstrating that the experience of nest predation caused them to eat less supplemental food. Females that ate less food gained less fat and were in poorer physiological condition, consistent with the effect on food use contributing to the indirect predator effect on clutch size. Tissue  $\delta^{15}\text{N}$  values confirmed that clutch size was not constrained by endogenous resources. Finally, we report that the process of egg production evidently affects egg  $\delta^{13}\text{C}$  values, and this may mask the source of nutrients to eggs. Our results indicate that perceived predation risk may impose food limitation on prey even where food is unlimited and such predator-induced food limitation ought to be added to direct killing when considering the total effect of predators on prey numbers.

**F14.8 Zarones, Lainie**, (Oklahoma Biological Survey, Norman, United States); **Sussman, Adrienne** (University of Washington,

Seattle, United States); **Morton, John** (USFWS, Soldotna, AK, United States); **Plentovich, Sheldon** (USFWS, Honolulu, HI, United States); **Faegre, Sarah** (University of Washington, Seattle, WA, United States); **Aguon, Celestino** (4Division of Aquatic and Wildlife Resources, Mangilao, United States); **Amar, Arjun** (Percy FitzPatrick Institute, Cape Town, South Africa); **Ha, Renee** (University of Washington, Seattle, United States)

#### POPULATION STATUS AND NESTING SUCCESS OF THE CRITICALLY ENDANGERED AGA OR MARIANA CROW (*CORVUS KUBARYI*) ON ROTA, MARIANA ISLANDS, MICRONESIA

The Aga or Mariana Crow (*Corvus kubaryi*) is a critically endangered species found only on the island of Rota, Northern Mariana Islands. It was extirpated from the neighboring island of Guam by the introduced brown tree snake (*Boiga irregularis*) and the Rota population has been in decline since at least 1987. We identified only 60 pairs present on the entire island in 2007, a decline of nearly 50% of pairs in 9 years. Losses have not been uniform across the island, with more pairs lost in areas with greater levels of human disturbance. We found and monitored 204 Aga nests during the 1996–2009 breeding seasons. Aga initiate clutches nearly year-round (August–April). The overall rate of nest success was 30% (Mayfield estimation,  $n = 204$ ). Mean clutch size was 2.6 ( $n = 82$ ), mean number of nestlings in hatched nests was 1.4 ( $n = 106$ ), and mean number of fledglings in nests that fledged was 1.3 ( $n = 68$ ). Nest success was significantly lower in 2005–2009 than in 1996 and 1998. However, there was not a consistent pattern of declining nest success over time. Nest success, like territorial pair losses, varied across the island, although it did not appear linked to human disturbance. Nests initiated in October, November, and February had significantly higher success rates, whereas those initiated in August, September, and March had the lowest rates. Predation appears to be the primary cause of nest failure. However, with a breeding season of up to nine months, combined with a proclivity to renest after failure, nest failure does not appear to be the most important factor in the population decline. Instead, juvenile and adult mortality may be the primary cause. Feral cats are known to be a cause of mortality in both adults and juveniles. Predation of adults and nests by introduced predators such as cats, combined with possible inbreeding depression and habitat disturbance appear to be pushing the Aga to extinction.

**PS1.175 Zelt, Jessica**, (US Geological Survey/ Patuxent Wildlife Research Center, Beltsville, United States); **Courter, Jason** (Clemson University, Clemson, United States); **Arab, Ali** (Georgetown University, Washington, United States); **Johnson, Ron** (Clemson University, Clemson, United States); **Droege, Sam** (USGS/Patuxent Wildlife Research Center, Beltsville, United States)

#### ILLUMINATING SHIFTING MIGRATORY BIRD PATTERNS USING A LEGACY CITIZEN SCIENCE PROJECT

Over the past four years, the North American Bird Phenology Program (NABPP) has revived a legacy dataset of first arrival dates, maximum abundance, and departure dates of migratory birds across the North America. This historic program, active between 1880 and 1970, was coordinated by the Department of the Interior and sponsored by the American Ornithologists' Union. With a growing network of over 2,500 volunteers worldwide, records are being transcribed online and made freely accessible to the public, researchers and policy makers. The

NABPP was established in response to questions about changes in climate around the globe and the need to understand the wide-scale effects on bird migration arrival dates. With this collection, we have established a historical baseline of bird arrival dates to compare with recently collected data-sets. Understanding long-term changes in spring migration arrival dates in birds can provide an important indicator of reproductive success and therefore population stability. Here, we present two case studies illustrating how data from the North American Bird Phenology Program have been used to model historical Ruby-throated Hummingbird (*Archilochus colubris*) and Purple Martin (*Progne subis*) arrival dates in eastern North America.

**PS1.181 Zenal, Theodore,\*** (University of Southern Mississippi, Hattiesburg, United States); Moore, Frank (University of Southern Mississippi, Hattiesburg, MS, United States); Ward, Michael (University of Illinois, Urbana-Champaign, Urbana, IL, United States); Diehl, Robb (U.S. Geological Survey, Bozeman, MT, United States); Deppe, Jill (Eastern Illinois University, Charleston, IL, United States)  
**STOPOVER OF RUBY-THROATED HUMMINGBIRDS: SEX-DEPENDENT AUTUMN MIGRATION ON THE GULF COAST**

This study examines the stopover biology of male and female Ruby-throated Hummingbirds (*Archilochus colubris*) from arrival to departure during autumn migration along the northern coast of the Gulf of Mexico. Sex-dependent migration is expected because of sexually dimorphic characteristics in wing morphology and body size. Information on arrival condition, phenology, fuel deposition rates (FDR), stopover duration, departure direction and time of departure was obtained through banding data, passive integrated transponder tags, and radio telemetry. While there is some evidence of sex-dependent migration, such as differences in arrival timing, arrival condition, and FDR, these results were not consistent between years. In 2010, females arrived significantly earlier yet there was no difference in 2011. In 2011, males arrived in significantly better condition while females had significantly higher FDR rates, yet there were no differences detected in 2010. Radio telemetry provided uniquely accurate information on the timing and direction of departure for Ruby-throated Hummingbirds. Most individuals departed around civil twilight in a southerly direction over the Gulf of Mexico, consistent with nocturnal migrants through this area and inconsistent with the prevailing view that Ruby-throated Hummingbirds are diurnal circum-Gulf migrants in autumn. All radio tracked birds carried fuel loads estimated to allow for successful trans-gulf flight. Possibly any consequences of sex-dependent differences are minimized when birds confront an ecological barrier. Furthermore, this study provides information on the poorly understood migration of Ruby-throated Hummingbirds, which is surprising given that this is the only breeding hummingbird in Eastern North America.

**PS1.234 Zhang, Yufeng,\*** (University of South Dakota, Vermillion, United States); Swanson, David (University of South Dakota, Vermillion, SD, United States)  
**METABOLIC RATES IN SWALLOWS: DO ENERGETICALLY EXPENSIVE LIFESTYLES AFFECT METABOLIC CAPACITIES IN BIRDS?**

Because both summit ( $M_{sum}$  = maximum thermoregulatory metabolic rate) and maximum (MMR = maximum exercise metabolic rate) metabolic rates are functions of skeletal muscle metabolism, correlations between these measures of maximal metabolic output could occur, but this has been little studied in

birds. Moreover, because energetically expensive lifestyles are often correlated with high metabolic rates, cross-training effects of a high-energy lifestyle (i.e., high exercise) on thermogenesis, and vice versa, may exist. We tested this cross-training hypothesis with swallows, a family with an energetically expensive aerial insectivore lifestyle. We measured basal and summit metabolic rates in three species of temperate-zone breeding swallows and combined these data with literature data to address the hypothesis that swallows have higher BMR and  $M_{sum}$  than non-aerial insectivore birds. BMR for temperate-zone swallows was higher than for tropical swallows, similar to results for other bird taxa. In addition, our preliminary data suggest that BMR in swallows shows a tendency to be higher than BMR for other birds. In contrast,  $M_{sum}$  values in the six species of swallows that we measured were consistent with  $M_{sum}$  values for other swallow species, including tropical species, and the  $M_{sum}$ -body mass regression for swallows was almost coincident with the  $M_{sum}$ -body mass regression for other birds. These data tentatively suggest that swallow  $M_{sum}$  is similar to that for other birds, so cross-training effects of an energetically expensive lifestyle on thermogenesis are not apparent.

**W8.6 Zink, Robert,** (Bell Museum, St Paul, United States);  
**INFERRING THE LOCATION OF GLACIAL REFUGIA USING NICHE MODELING AND PHYLOGEOGRAPHY**

It is standard practice to infer that an extant species containing distinct phylogroups must have evolved in the same or larger number of glacial refugia. Phylogroups whose origin predates the Last Glacial Maximum (LGM) are assumed to have remained isolated during the succeeding glacial and interglacial periods. Sometimes it is apparent where glacial refugia were located, whereas in other cases their locations are vague at best. Niche models can also be used to predict where species occurred at the LGM and at the Last Interglacial (LIG). I maintain that one cannot infer the locations of LGM refugia from either extant phylogeographic patterns or niche models alone. I believe that the two sources of information have to be used in a process of reciprocal illumination to build believable historical hypotheses. I constructed niche models for six species of obligate forest birds that have been subjects of phylogeographic studies: Black-capped Chickadee (1 phylogroup), White-breasted Nuthatch (4), Downy Woodpecker (1), Hairy Woodpecker (7), Brown Creeper (6) and Barred Owl (1 or 2). Their LGM distributions are very similar, indicating convergence in Grinnelian niche dimensions. However, there is little or no concordance in the number of extant phylogroups. I suggest that only a comparative phylogeographic and niche modeling approach can reveal the locations of glacial refugia.

**S6.10 Zuckerberg, Benjamin,** (University of Wisconsin-Madison, Madison, United States); Gavin, Jones (University of Wisconsin-Madison, Madison, United States); David, Bonter (Cornell Lab of Ornithology, Ithaca, Canada)  
**THE EARLY BIRD GETS EARLIER: ANALYZING SHIFTS IN THE MIGRATION PHENOLOGY OF SPRING MIGRANTS USING CITIZEN SCIENCE**

The timing of many springtime events throughout the world are shifting due to climate change, and this global-scale phenomenon is also happening throughout the Midwestern United States. Studies have suggested that the spring arrival dates of many migrants have been getting earlier since the late 1930's, but many of these results rely on observations from single banding stations. Using data from Project Feederwatch, a continental-scale citizen science program focused on wintering birds, we quantified the timing of spring arrival for a number of

early spring migrants to hundreds of feeder stations over a twenty-year period (1990-2010). Earlier arrivals were observed among six species, including a ~13 day shift since 1990 for the spring migratory arrival of American Robins (*Turdus migratorius*), the iconic harbinger of spring. By using data from a broad-scale winter-long survey of birds, we were able to quantify different spatiotemporal aspects of migration fronts by quantifying first and median arrival dates. We found annual variation in minimum winter temperature was significantly related to first arrival date, but not a strong predictor of median arrival dates for several bird species. This finding suggests that subgroups of early arriving individuals in populations of short-distance temperate zone migrants may be responding to different climatic cues or have higher plasticity in migration onset than later-arriving individuals. Our results show a more pronounced acceleration in spring arrival over the past two decades than similar studies. If the trend continues, we can predict that by the year 2030 many short-distance migrants will arrive at their breeding grounds nearly a month earlier than they did 40 years before. The burgeoning interest in citizen science over recent decades has allowed for the analyses of phenological events at unprecedented scales. The continued contribution of volunteers in programs, such as Project FeederWatch and eBird, will help scientists better document and predict phenological responses of bird populations to a changing climate.