

COS · AOU · SCO
2010
S A N D I E G O



ABSTRACT BOOK

WELCOME TO SAN DIEGO!

On behalf of the many people who have been working for over a year and a half to put this meeting together, we cordially welcome members and guests of the Cooper Ornithological Society, the American Ornithologists' Union, and the Society of Canadian Ornithologists to the COS/AOU/SCO 2010 Joint Meeting. The 2010 meeting in San Diego marks the 80th annual meeting of the Cooper Society, the 128th stated meeting of the American Ornithologists' Union, and the 28th annual meeting of the Society of Canadian Ornithologists/Société des Ornithologistes du Canada.

Our goal in planning this meeting has been to provide an intellectually stimulating atmosphere for the exchange of scientific ideas concerning avian research and conservation in a relaxing environment. We hope that you will have the opportunity to take advantage of our local culture and cuisine, and also to experience the wide biological diversity in our county that stretches from the coast through the mountains to the desert and beyond. Please don't hesitate to contact one of us if any questions arise. And be sure to check the meeting web site daily for program updates, such as cancelled papers: www.birdmeetings.org/cosaousco2010/. Thanks for coming, and enjoy your time in San Diego!

—COS/AOU/SCO 2010 Local Committee

The COS/AOU/SCO 2010 Joint Meeting could not have happened without the help and support of the United States Geological Society, the University of California-Riverside, and San Diego State University. Thank you!



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PERSONALITIES OF GREAT TITS IN THE WILD

Consistent individual variation in exploratory behavior of Great tits (*Parus major*) has been demonstrated in laboratory setting. No study, however, has investigated this behavior in the wild. We studied individual variation in the exploratory behavior of the cavity-nesting Great Tit in the field using two novel techniques: 1) we habituated birds to a cube-shaped maze at the entrance of their nestbox and observed their response to changes in the configuration of the maze; 2) we placed a novel nestbox next to the birds' existing nestbox to observe their exploratory behavior. We found extensive variation in the response of birds to both treatments. Birds showed some consistency in their responses to the maze configurations. However, individual responses to the maze configurations were independent of the responses to the novel nestbox. Our results indicate that consistency in exploratory behavior might be less pronounced in a natural setting and that birds may behave consistently in one context without showing consistent inter-individual differences between contexts. We suggest caution should be taken when extrapolating consistency of exploratory behavior demonstrated in laboratory to the natural environment.

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MASS CHANGES IN RELATION TO HABITAT AT AN URBAN STOPOVER

Understanding how migrants utilize urban stopover habitats is critical for determining their suitability. I examined changes in condition at an urban stopover site in southeast Tennessee. Overall, migrants lost mass over the course of the day; however they lost more mass in wooded habitat versus overgrown field. In addition, birds with higher condition index values were captured more in woods. Examining patterns more closely, Magnolia Warblers using woods were significantly heavier, had significantly longer wings, had significantly more fat, and lost more mass than those caught in the field. Over the course of fall migration, there was a steady increase in the proportion of Magnolia Warblers caught in woods. While male Magnolia Warblers are typically larger and arrive later in the fall, these trends held regardless of sex. Thus, there seems to be a genuine preference for woods by heavier migrants, and suggests that food is not the primary resource woods provide. These data reinforce the need for maintaining a variety of stopover habitats, even in an urban setting.

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CHARACTERIZATION OF MICROSATELLITE MARKERS FOR THE ENDANGERED THICK-BILLED PARROT (RHYNCHOPSITTA PACHYRHYNCHA) FOR POPULATION GENETIC STUDIES.

The thick-billed parrot (*Rhynchopsitta pachyrhyncha*) is a parrot species endemic to the high-altitude pine forests of the southwestern United States and northern Mexico. Its population has been reduced due to habitat degradation and fragmentation and it is classified as endangered with only four known breeding colonies. To aid in conservation of this species, we have developed microsatellite loci as markers of population structure and genetic diversity. Here we describe the development of 8 microsatellite markers from a genomic library of thick-billed parrot DNA and identification of 7 markers developed for other species that have cross amplified thick-billed parrot DNA. We have genotyped 28 individuals (wild and captive) with these 15 loci. Preliminary data show one

to six alleles in this sample, with a range of 1.00 to 19.00 and 1.00 to 9.76, of observed and expected heterozygosity, respectively. These loci will be used to genotype the captive and wild populations of the thick-billed parrot to evaluate population substructure, genetic variation, and relatedness.

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LATITUDINAL DIFFERENCES IN SICKNESS BEHAVIORS AND FEVER: MOVING FROM GEOGRAPHICAL PATTERNS TO PHYSIOLOGICAL MECHANISMS

While immune responses vary widely among species and populations, the physiological mechanisms underlying these differences remain unknown. Uncovering such mechanisms is crucial to determining how selection acts to shape variation in immune function. Free-living song sparrows (*Melospiza melodia*) along the western coast of North America exhibit differences in sickness behaviors (lethargy, in particular) and fever that vary inversely with latitude. Here, we brought sparrows from southern California and Washington into captivity to determine 1) if these differences persist in a common environment and 2) if so, what physiological signals underlie such differences. Consistent with field studies, Washington birds exhibited shorter bouts of fever and lethargy in response to lipopolysaccharide (LPS), a non-pathogenic antigen that mimics bacterial infection. Moreover, Washington birds exhibited lower circulating levels of Interleukin-6 and corticosterone, two molecules involved in immune system signaling. These results suggest that differences in immune responses among wild song sparrows cannot be explained by current environmental conditions alone and may reflect evolutionary changes. Moreover, they show that differences in immune signaling molecules likely play a crucial role in shaping variation in immune function.

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WESTERN YELLOW-BILLED CUCKOO SURVEYS ALONG THE MIDDLE RIO GRANDE, NEW MEXICO

Various avian studies have been conducted by the Bureau of Reclamation along the Middle Rio Grande during the past 15 years. Between 1997 and the present, due to the presence of an apparently substantial population of Western Yellow-billed Cuckoos (*Coccyzus americanus occidentalis* – cuckoo) within the basin, an increasing level of attention has been given to the species. Casual detection data gathered during Southwestern Willow Flycatcher surveys between 1997 and 2005 documented numerous resident cuckoos annually. In 2006, formal protocol surveys, based on methods developed in conjunction with the Arizona Game and Fish Department and U.S. Geological Survey, were first conducted for the cuckoo. Additionally, a GIS-based "territory" delineation methodology was developed to quantify cuckoo detections within each survey site. During this first year, 32 river miles were surveyed between the Bosque del Apache NWR and Elephant Butte Reservoir and 44 cuckoo "territories" were documented. During each of the next three years, the area surveyed and number of cuckoos located increased to a high of 107 "territories" documented in 109 survey sites (89 river miles) during the summer of 2009.

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RESPONSE OF THE LEAST BELL'S VIREO (VIREO BELLII PUSILLUS) TO WILDFIRE IN SOUTHERN CALIFORNIA

Wildfires are a major disturbance to vegetation communities, altering habitats critical to endangered species. We analyzed the response of the endangered migratory Least Bell's Vireo to the October 2007 wildfires at Marine Corps Base Camp Pendleton, San Diego County, California. We surveyed vireos from 2007-2009 and compared the abundance of vireos pre-fire and post-fire within five burned sites and five unburned reference sites. Vireo numbers declined 21-52% within the first year post-fire in four of five burned sites,

and remained constant at one site. In contrast, vireo numbers increased 5-50% at all five reference sites during the same time period. During the second year post-fire, vireo numbers in burned sites increased from the first year post-fire by 67- 200%, exceeding pre-fire numbers within two of the five sites. This annual increase was greater than that at reference sites which averaged 24%. The high breeding site fidelity of vireos and a preference for early successional habitats combined with the capacity for riparian vegetation to resprout and recover quickly suggests that the effects of wildfires on vireo populations may be short-lived.

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LONG-TERM VARIABILITY IN OCEANOGRAPHY OF THE GULF OF CALIFORNIA AND CALIFORNIA CURRENT: DYNAMIC ECOSYSTEM CHANGES

Phenomena such as El Niño, and the Decadal Variation of the North Pacific affect both the California Current and the Gulf of California. Anything that changes the conditions of the Pacific Ocean in turn affects the circulation in the gulf. During El Niño the warm and oligotrophic Equatorial Surface Water (ESW) has a much stronger invasion into the gulf than during years without El Niño. ENSO events change the phytoplankton community structure, and this has a profound effect in the food web. El Niño periods are generally marked by greater abundance of diatom and silicoflagellate species whose distribution is limited to tropical and subtropical waters. In February 1992, an El Niño year, anchovies spawned only in the big islands region. Dramatic interdecadal changes of fish biomass have been read in the paleo-ecological records of the laminated sediments of Guaymas Basin. Time series of scale-deposition rates show a negative association between the presence of sardines and anchovies, with anchovies dominating throughout the nineteenth century, and with only two important peaks of sardine scale deposition – one in the twentieth century and one at the end of the eighteenth century. This suggests an overall coherent pattern in changing ecosystem structure that operates over a period of about 120-140 years.

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A MOLECULAR PHYLOGENY OF THE VARIABLE KINGFISHER (*CEYX LEPIDUS*) REVEALS A NOVEL PHILIPPINES LINEAGE

The Variable Kingfisher (*Ceyx lepidus*) is a widespread species of lowland forest that occurs in the Philippines, the Moluccas, New Guinea, and the Solomon Islands. As its English name implies, it is phenotypically variable with highly disparate plumage patterns and differences in bill morphology across its range. We tested for the monophyly of *C. lepidus* and examined relationships among the subspecies using molecular phylogenetic techniques. We sampled all 14 described subspecies, including samples from 18 islands across its entire range. We used maximum likelihood and Bayesian methods to reconstruct a molecular phylogeny based on DNA sequence data from two mitochondrial protein-coding genes and two nuclear introns. We found support for the monophyly of all subspecies, however we failed to recover the monophyly of *C. lepidus* at the species level. *C. lepidus* is paraphyletic with respect to *C. argentata* and *C. cyanopecta*, which has biogeographical implications of a Philippines origin. We explore species limits and patterns of evolution of bill morphology in this group.

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LONG-TERM VARIABILITY IN NESTING AND REPRODUCTION OF THE BROWN PELICAN IN THE GULF OF CALIFORNIA: INFLUENCE OF ENSO.

ENSO's general effects on ecological dynamics of marine systems date to pre-historical times. ENSO's influence on breeding population size and reproductive performance in the California Brown Pelican meta-population is highly variable from year-to-year (as also potentially influenced by windy and cold periods during the breeding season, human disturbances, contaminants, habitat degradation, etc.). Yet, oceanographic features and

feeding conditions associated with ENSO drive most variability in nesting effort and productivity. The total meta-population is estimated at about 71,000 \pm 2,600 breeding pairs (Mean \pm SD) in optimal, non-ENSO years; the total numbers within this meta-population was estimated at 196,000 \pm 7,200 individuals (including sub-adults and non-breeders). Based on detailed data from several important breeding colonies in the Midriff Region of the Gulf, annual numbers of breeding pairs and their productivity might drop to near zero during years of ENSO-effect. A life-table model incorporating ENSO's varying effects on survival and reproduction indicates that within current demographic characteristics, increased frequencies and/or intensities of ENSOs expected effects might be unpredictable, but likely to cause population declines and/or range shifts.

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CONTRIBUTIONS TO POPULATION GROWTH IN SONG SPARROWS

We tested hypotheses about factors affecting population growth (r) in an island song sparrow (*Melospiza melodia*) population from 1960-2009 using structural equation models. Vital rates accounted for 96% of variation in r , with adult and juvenile survival exerting ~3 times more influence on r than immigration or reproduction. In 36 of 38 years without crashes, the influence of juvenile survival on r increased by 24%, but the influence of adult survival declined by 60%, indicating that juvenile survival was the main vital rate limiting r . We next estimated the total effect of intrinsic (density) and extrinsic (spring temperature, winter severity, brood parasitism) factors on vital rates and r . Spring temperature strongly influenced lay date, and brood parasitism influenced nest success, neither factor had large effects on r because the direct effect of reproduction on r was small. In contrast, density had a large effect on r because it influenced fledging, immigration and juvenile survival. Our results show that a full understanding of the contribution of vital rates to variation in r is often essential to predict population growth, answer long-standing questions about the impacts of intrinsic and extrinsic factors on population size, and design effective plans for conserving declining species.

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EFFECTS OF FOREST FRAGMENTATION ON THE PREVALENCE OF BLOOD PARASITES IN BIRDS OF COSTA RICA

Using the birds of Costa Rica, we determine how forest fragmentation, landscape mosaics, and the life history characteristics of avian hosts can affect the prevalence of haemosporidian blood parasites. Birds were sampled from 2004-2010 at Las Cruces Biological Station in southern Costa Rica. Habitats include coffee plantations, riparian zones, undisturbed contiguous forest and disturbed forest fragments. Target species include 4 species of manakins, 2 thrush species and the silver-throated tanager. We have collected over 1200 blood samples from these birds. Some of these species are sedentary and others are highly vagile. Preliminary data show prevalences range from 0-55% for Plasmodium and Haemoproteus species. Some of the parasite lineages and their evolutionary relationships are described here for the first time. Interestingly, we find a paucity of parasites in recaptured birds. This study is unique in that avian blood parasites are studied in a single tropical habitat over multiple seasons.

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THE RELATIONSHIP BETWEEN EGG SIZE, YOLK SIZE, AND EGG TEMPERATURE IN TREE SWALLOWS, TACHYCINETA BICOLOR
Variation in the size and quality of eggs can have important long-term consequences. However, egg size per se is only a coarse predictor of the quality of an egg, as yolk and albumen levels in an egg can vary. Using a non-invasive technique, we measured yolk mass of tree swallows. We first tested for what

factors explained variation in yolk mass. Earlier-laying females laid small eggs with large yolks, relative to later-laying females, which laid large eggs with small yolks. There was a weak effect of laying order on yolk mass but not on egg mass; eggs laid early in the sequence tended to have larger yolks. We then tested for a relationship between yolk mass and egg temperature. Early-breeding females maintained higher egg temperatures even though ambient temperatures were colder. When controlling for timing of breeding, females incubating eggs with large yolks maintained higher egg temperatures, while larger egg mass was associated with lower egg temperatures. These results suggest that early-breeding tree swallows are better able to secure resources to produce high quality eggs and still maintain high quality developmental conditions.

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ESTRILDINAE FINCHES (AVES, PASSERIFORMES) FROM AFRICA, SOUTH ASIA AND AUSTRALIA: A MOLECULAR PHYLOGEOGRAPHIC STUDY

Email: arnaiz@med.ucm.es Estrildid finches are distributed throughout Africa, South Asia, Australia and Indian and Pacific Ocean islands. Specific phylogenetic questions have been clarified in this study by analyses of 64 species of estrildids through cytochrome b DNA sequencing and Bayesian Inference. Our results support that estrildids are a monophyletic group with polytomies that may have started evolving by Middle Miocene Epoch (about 16.5 million years ago). This date is coincidental with the Fringillinae finches' radiation starting time and also with the biggest Himalayan and Tibetan Plateau uplift. The most basal estrildid clade comprises African, Indian and Australian birds, suggesting that the whole estrildids radiation might have originated around India. It is shown that: 1) Gouldian Finch (*Chloebia / Erythrura gouldiae*) is definitively included within genus *Erythrura*, 2) the oldest Estrildinae evolutive radiation group seems to be the African silverbill (*Lonchura cantans*), together with Indian silverbill (*Lonchura malabarica*), and the phenetically distinct Diamond Firetail (*Stagonopleura guttata*) from Australia, 3) the Java sparrow (*Padda / Lonchura oryzivora*) is a *Lonchura* species, 4) African munias ("Spermestes") form a distinct phylogenetic cluster (within genus *Lonchura*) with respect to Asian and Australian munias.

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MITOCHONDRIAL DNA PHYLOGENETIC DEFINITION OF A GROUP OF 'ARID-ZONE' CARDELINI FINCHES

Email: arnaiz@med.ucm.es Birds included within the Carduelini tribe (genera *Rhodopechys*, *Carpodacus* and *Leucosticte*) apparently belong to the same radiation according to molecular phylogenetic analyses. Our phylogenetic analyses based on nucleotide sequences of the cytochrome b gene (*cyt-b*) indicate that some of these birds (*Rhodopechys mongolica*, *R. githaginea* and *Carpodacus nipalensis*) do not cluster together with their respective phenetically defined allies. This new group of birds thrives in both hot and cold arid zones and are phenetically distinct, probably because of their adaptation to different extreme environments. Both maximum likelihood and Bayesian inference methods support the existence of this new evolutionary basal group among finches which might have originated about 14 MYA. A redefinition of genus *Carpodacus* is needed: one American, and one different Eurasian evolutionary group at least. Also, a new definition of genus *Rhodopechys* is found: *Rhodopechys obsoleta* is a greenfinch ancestor, while *R. githaginea* and *mongolica*, along with *Carpodacus nipalensis*, *Leucosticte arctoa*, and *L. tephrocotis*, at least, are the "Arid Zone" group of finches defined in this work. The possibility of existence of more phylogenetic splits within genus *Carpodacus* is put forward.

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INFLUENCE OF MALLARD BODY CONDITION ON THE SPREAD OF LOW PATHOGENIC AVIAN INFLUENZA

Migrating waterfowl are implicated in the global spread of avian influenza. Recent findings suggest that some duck species, specifically mallards (*Anas platyrhynchos*), serve as competent reservoir hosts without exhibiting morbidity or mortality. However, experimental studies do not typically represent the natural variation in energetic condition observed in birds during migration. We examined how natural variation in body condition affects immune status, susceptibility, and viral shedding in mallards infected with low pathogenic avian influenza (LPAI). Body conditions were manipulated via food restriction in wild-caught juvenile mallards (n=30) and hatchery juvenile mallards (n=10) to simulate varying body conditions encountered during migration. When groups reached desired mass, all birds were inoculated with LPAI H5N2 virus. Oropharyngeal and cloacal swabs were collected 14 days post-infection to monitor concentration and duration of viral shedding. Swab samples were tested using RT-PCR and plaque assays to confirm LPAI infection and determine viral titer concentrations, respectively. Virus shedding was compared between the different food treatments. We predict that viral concentration and duration will be negatively correlated with body condition. Research findings are under analysis.

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THE EFFECTS OF SURROUNDING LAND COVER ON THE ABUNDANCE OF SHRUBLAND BIRDS IN POWERLINE RIGHTS-OF-WAY

Several studies have shown that declining shrubland bird species are abundant in powerline rights-of-way in the northeastern United States, but most of these investigations were conducted in heavily forested regions. We examined the effect of surrounding land cover on the abundance of shrubland species along powerlines in both developed and more heavily forested landscapes in Connecticut. Point counts were conducted on plots within corridors; the areas of agricultural and developed land surrounding the plots were determined from 2002 land cover maps. Poisson regression and stepAIC were used to generate models describing the abundance of six shrubland specialists. Indigo Bunting (*Passerina cyanea*) and Eastern Towhee (*Pipilo erythrophthalmus*) abundances were negatively correlated with the amount of development in the surrounding landscape. Agricultural area had a positive relationship with Blue-winged Warbler (*Vermivora pinus*) abundance and a negative relationship with the abundance of Prairie Warbler (*Dendroica discolor*), Chestnut-sided Warbler (*D. pensylvanica*) and Field Sparrow (*Spizella pusilla*). These land cover variables were negatively correlated with the amount of forest. We conclude that powerline rights-of-way located in extensive forests may provide better habitat for shrubland birds.

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Ketterson, E. D., Indiana University, Bloomington, USA, ketterso@indiana.edu ATTENUATED ENDOCRINE STRESS-RESPONSIVENESS IN A RECENTLY ESTABLISHED URBAN POPULATION OF DARK-EYED JUNCOS

Urban environments expose birds to many novel and potentially deleterious stressors. Adaptation to urban living is thus predicted to include attenuated physiological response to stress, although results from prior avian studies are mixed. We compared the adrenocortical responses to handling restraint in breeding females from a recently established urban population of Dark-eyed Juncos in coastal San Diego, California to responses in females from a nearby wildland population in the ancestral montane breeding range near Mount Laguna, California. We found that birds from the urban (colonist) and wildland (ancestral-range) populations had similar levels of

baseline corticosterone (CORT), but that stress-induced CORT levels were significantly lower in the urban population at both 15 and 30 minutes post-capture. These results suggest that reduced response to stressors may be a generally important adaptation for coping with urban life, but climatic and life-history differences between populations cannot be rejected as alternative explanations. We are currently conducting a common garden study to evaluate whether the population differences in stress physiology observed in the field have plastic versus genetic underpinnings.

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BEHAVIOR, VOCALIZATIONS AND EVOLUTIONARY IMPLICATIONS OF HYBRID GREATER PRAIRIE-CHICKENS AND SHARP-TAILED GROUSE (TYMPANUCUS SPP.) IN SOUTHWESTERN MINNESOTA

Hybridization provides insight into the process of evolution following the breakdown of genetic isolation. In southwestern Minnesota, greater prairie-chickens (*Tympanuchus cupido*) hybridized with sharp-tailed grouse (*T. phasianellus*). Using observations of hybrids and 'pure' individuals on mixed-species leks, I tested two evolutionary hypotheses to elucidate the presence of hybrids: 1) behavior of 'pure' males will be similar when females of their own species or those of different species are present; and 2) hybrids will be more active than 'pure' individuals due to hybrid vigor. During the 2009 breeding season, I recorded vocalizations and conducted 10 minute focal observations to quantify behavior of particular males. One lek consisted entirely of sharp-tailed grouse; two leks had both species and hybrids; and one lek had prairie-chickens, a hybrid, and one back-cross prairie-chicken. Supporting my predictions, time spent displaying and fighting did not differ according to the species of the female present on the lek. However, hybrid males had similar levels of activity compared to either parental species. These observations suggest that isolating mechanisms may be weak in these species, despite their lek-mating breeding system.

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ASSESSING AVIAN MORTALITY RATES AND POPULATION IMPACTS ASSOCIATED WITH AN ELECTRICAL TRANSMISSION LINE IN JEFFERSON COUNTY, TX

The construction of a 230 kV transmission line lying adjacent to the J.D. Murphree Wildlife Management Area (WMA) in Jefferson County, TX began in February 2008, and the line was energized in July 2008. Carcass searches and population surveys began in August 2008. Between August 2008 and July 2009, 40 carcasses have been found. Passerines and rails were the most common victims. Population densities for all birds in the southern portion of the WMA averaged 5.84 birds/ha for the entire year, with highest densities in the winter (12.56) and lowest in the summer (1.20). Mortality rates (deaths/total birds present) attributable to the transmission line for all birds averaged 0.0023 for the entire year, with a peak in the fall (0.0029) which is most likely associated with migration. Mortality rate estimates will be revised as we collect more data and correct for potential biases. Mortality rates at the WMA were lower than many published values, possibly due to dense vegetation in the carcass search area and low numbers of birds foraging directly under the lines.

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THE BEAK OF THE OTHER FINCH: FACILITATED DEVELOPMENTAL VARIATION RECONCILES ADAPTATION AND EVOLUTIONARY DIVERSIFICATION

The link between adaptation and evolutionary change remains the most central and least understood evolutionary problems. Evolution and diversification of avian beaks is a textbook example of such a link, yet the mechanisms that enable beak's precise adaptation and extensive adaptability are poorly understood. Often observed rapid evolutionary change in beaks is particularly puzzling in light of the neo-Darwinian model that necessitates coordinated changes in developmentally distinct precursors and correspondence between functional and genetic modularity, which should preclude evolutionary diversification. My study of developmental, functional, and genetic integration in the beak of the house finch over 19 generations following colonization of a novel environment emphasizes three principal

points. First, additive genetic covariance structure represents a historical record of the most recurrent functional interactions. Second, adaptive equivalence of diverse beak configurations shields genetic and developmental variation in beak components from depletion by natural selection. Third, compensatory developmental interactions among beak components can generate their rapid reorganization under novel conditions and facilitate both the evolution of precise adaptation and extensive diversification, thereby linking adaptation and adaptability in this classic example of Darwinian evolution.

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NATAL DEPARTURE AND NOMADIC MOVEMENTS OF JUVENILE BALD EAGLES IN THEIR FIRST YEAR OF INDEPENDENCE.

We investigated the departure of juvenile Bald Eagles from natal areas and their subsequent movements, and use of temporary settling areas during their first year of independence. From 2004-2008, satellite transmitters were attached to 31 nestling Bald Eagles in New York and Ontario and movements were followed for one year post-departure. On average eagles left natal areas on 9-Sep at 15-30 weeks of age. There were no sex differences but eagles hatched from inland NY tended to have more 'false starts' and departed later than did eagles from the lakes Ontario or Erie. Initial movements from nest sites were varied in both direction and distance traveled; northern post-fledging movements up to the James Bay coast were documented for the first time in a northern Bald Eagle population. Total distance traveled in their first year ranged from 2,265 to 9,059 km. Eagles from eastern ON and NY travelled further than birds from southwestern ON. Overall first year movements consisted of nomadic movements across a broad geographic area and a wide variety of temporary settling areas were used.

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BOREAL FOREST SONGBIRDS DO NOT ALTER THEIR NEST VISITATION BEHAVIOR IN RESPONSE TO VARIABLE PREDATION RISK.

Predation is a primary cause of songbird nest failure. Therefore, parents should be sensitive to this risk and use behaviors that minimize the probability of nest predation. This may include increasing nest attendance to defend against predators, or reducing nest visitation rate to reduce the probability of nest detection. The effectiveness of each strategy depends on whether dominant predators use parental visits to locate nests, and whether parents can effectively defend their nest. Using infrared video cameras we identified red squirrels and, to a lesser degree, Sharp-shinned Hawks as the most important predators in our system. Predated nests were not visited more frequently by parents than successful nests and nest visitation rate did not vary in response to squirrel abundance. Squirrel predation was not timed to parental arrivals and departures, whereas hawk predation closely followed the parent's departure from the nest. When squirrels are the dominant predator there is little advantage to changing visitation behavior because squirrels likely locate nests using other cues. Whether songbird behavior responds to hawk activity is not clear but doing so may reduce predation risk.

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PALILA RESTORATION: IS COUNTING SHEEP RESULTING IN A 30-YEAR NIGHTMARE?

The endangered Palila (*Loxioides bailleui*) is a flagship conservation species whose small, declining population is restricted to 30 sq km of subalpine woodland on western Mauna Kea Volcano, Hawaii. Palila range above the zone of mosquito-transmitted diseases, but other major alien threats include feral cats, insect food competitors, and browsing ungulates. Feeding primarily on mamane (*Sophora chrysophylla*) seeds, Palila are especially vulnerable to long-

term habitat degradation by introduced sheep species. Vegetation surveys reveal a pulse of mamane regeneration since 1980, presumably due to aerial shooting and hunting of sheep. However, Palila recovery lags decades behind habitat recovery because Palila favor dense cover and large trees. Additionally, Palila survival and reproduction may be decreasing in response to drier conditions and subsequently declining mamane seed production, a situation that seems likely to intensify with global climate change. Eliminating sheep quickly and permanently to increase tree cover would increase seed availability and reduce drought impacts. Palila have been reintroduced to former range on northern Mauna Kea, but additional self-sustaining populations and species recovery are unlikely without greatly increased habitat restoration and other management.

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INFLUENCE OF LONG-TERM CAPTIVE BREEDING ON THE BIOLOGY OF THE AMERICAN KESTREL

Captive breeding programs can be used both to supplement depleted or extirpated wildlife populations and to provide models for wildlife research in controlled environments. While an objective of such long-term captive-breeding programs is to maintain self-sustaining populations capable of preserving most of their original heterozygosity, a captive environment and a small gene pool can lead to behavioural, morphological and physiological changes within a population over time. Understanding the effects of captivity can help identify changes that need to be made to captive regimes to maintain as much as possible a species' original wild state. The aim of this study is to determine what changes, if any, have resulted from 30 generations of captive breeding of the American Kestrel by comparing a colony of captive birds to wild kestrels using cross-fostering techniques between wild and captive nests. Initial results from 76 nests suggest that most differences in nestling morphological development, e.g. weight gain, are the result of environmental effects rather than genetic effects, and that effects vary between sexes. Male nestlings appear to be more sensitive to rearing environment than females.

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IMPACT OF SOCIAL MATING SYSTEMS ON PATTERNS OF AUTOSOMAL AND SEX-LINKED VARIATION IN BLACKBIRDS (ICTERIDAE)

Differences in variance of reproductive success between males and females of bird species are expected to affect levels of polymorphism at autosomal and sex-linked loci. In particular, high variance of male reproductive success, as expected in polygynous species, should depress levels of polymorphism in male-associated markers (such as the Z chromosome of birds, 2/3 of which reside in males). We sampled sequence polymorphism at 11 autosomal and 12 Z-linked intron loci, in three species of blackbirds (Icteridae) that represent social monogamy (*Agelaioides badius*), small harem polygyny (*Agelaius phoeniceus*), and large harem polygyny (*Psarocolius decumanus*), with the expectation that Z polymorphism would be reduced relative to that of autosomal loci in polygynous species. In contrast to expectation, we found very little evidence for reduced Z variation, with autosomal/Z ratios consistent with differences in ploidy, and the greatest departure shown by our apparently monogamous species. These results have implications for our understanding of mating systems and for the utility of different subsets of the genome in phylogenetic reconstruction.

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RATES OF HAEMATOOZA INFECTIONS AMONG BREEDING AND WINTERING RUSTY BLACKBIRDS

The Rusty Blackbird (*Euphagus carolinus*) has declined precipitously over the past decades and stressors on both breeding and wintering populations are

suspected causes. Blood samples were collected over a three-year period from breeding birds in Alaska and Maine and from wintering birds in Mississippi, Arkansas, and South Carolina to determine prevalence of hematozoan infections. The prevalence of hematozoa among breeding Rusty Blackbirds of Alaska and Maine was 44% and 67% respectively. *Leucocytozoan* was the predominant parasite with few birds infected by *Plasmodium* and *Trypanosoma* sp. Prevalence of hematozoa in wintering birds was 49% in Mississippi and Arkansas and 50% in South Carolina. Like breeding areas, *Leucocytozoan* was the most common parasite during the winter. The prevalence of hematozoa among wintering birds was much higher than expected because winter is generally a time when few transmissions occur and blood parasites are absent from the peripheral circulation in most birds. This indicates a non-seasonal relapse of hematozoan infections among wintering birds; possibly due to high levels of stress which are known to lower the immune response and trigger non-seasonal relapses.

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SAMPLING LARGE LANDSCAPES

A suite of tools for estimating population size and density, and for exploring habitat relationships, has been developed during the past decade, first in the Arctic and more recently in the southwestern United States. The tools include an ArcView extension that excludes unsuitable cover categories, partitions the remaining area into plots, assigns the plots to strata and clusters, compiles descriptive statistics such as the number of clusters and cluster size, and randomly selects plots to be surveyed. A comprehensive program is available to analyze data collected using double sampling, an "umbrella method" that includes most other methods as special cases. The program produces dozens to hundreds of estimates, all with measures of precision. The data can be stored in the Coordinated Bird Monitoring Database (CBMD), maintained by the US Geological Survey. Advice from the CBMD staff is available to help data owners format their data, protect it with passwords, and use various decision support tools for analysis. The ArcView extension, the analysis program, and use of the CBMD are all available free of charge.

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ECOLOGICAL CAUSES OF LIFE HISTORY VARIATION TESTED BY A COMPARATIVE-EXPERIMENTAL APPROACH

Three alternative hypotheses (food limitation, nest predation, adult mortality) are thought to explain latitudinal variation in reproductive strategies. We tested these alternatives by comparing responses of parental provisioning rate to natural and experimental variation in brood size among species. The reaction norm of provisioning to brood size is key because it integrates critical tradeoffs, and because alternative hypotheses predict alternative patterns of variation. We found variation among 29 bird species in the slope of reaction norms of per-offspring provisioning to natural variation in brood size was explained by variation in adult mortality. Yet, species with high adult mortality appeared to adjust offspring number to parental provisioning, consistent with food limitation. We experimentally reduced broods by half in seven bird species with divergent life histories and found reduced broods showed increased per-nestling provisioning and growth, also consistent with food limitation. However, magnitudes of manipulation effect increased with adult mortality, suggesting species with low mortality reduce effort with reduced broods. These results suggest ecological factors thought to cause life history variation may interact and shift in importance across species and regions.

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ARE STRUCTURALLY PRODUCED PLUMAGE COLORS HONEST SIGNALS OF QUALITY? A FEEDING EXPERIMENT WITH THE EASTERN BLUEBIRD.

In Eastern Bluebirds (*Sialia sialis*), ornamental plumage plays an important role in sexual selection and mate choice. Variation in expression of the ultraviolet blue structural plumage displayed by males likely also functions as an indicator of quality. Wing feathers developed as a nestling are not molted until after an individual's first reproductive attempt, thus there is selective

pressure to develop brightly colored plumage as a nestling. This study focused exclusively on a free-ranging population of bluebirds in northeast Arkansas. We used two diets to supplement developing chicks' natural diets and collected size data and feather samples prior to chicks fledging. We compared overall body size, feather brightness, and chroma between supplemented and non-supplemented chicks. As predicted, we found no significant difference in body size. While there was also no significant difference in brightness, male chicks that received a supplemental diet high in protein were significantly more blue than male chicks that did not. Our results suggest that diet likely plays a role in the development of structural plumage, and that structural plumage likely functions as an honest indicator of quality.

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QUANTIFYING THE FREQUENCY, DURATION AND EFFECTS OF SALT MARSH SPARROW NEST FLOODING EVENTS UNDER CURRENT CLIMATIC CONDITIONS

Sea-level rise poses an imminent threat to the survival of coastal species. In this study we quantified the frequency and duration of Saltmarsh sparrow nest flooding events and tested the relationship between nest flooding and nest fate. Thirty-five nests were successful, 103 failed due to flooding and 53 failed due to predation/undetermined reasons. Only 28 nests experienced no flooding events during the time in which they were sampled; 95 nests flooded three or more times. Despite clear differences in the timing and extent of flood events observed between failed and successful nests, our model selection process indicated that the best performing models did not always rely on variables related to tide data. The top performing model for nest success consisted of three variables related to sampling, whereas the top performing model for nest flooding included a combination of tide, nest timing and sampling variables. In contrast, the top model for the number of offspring lost to flooding consisted exclusively of two tide height variables; the maximum tide experienced and the maximum non-flood tide height, an indicator of nest elevation.

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WESTERN YELLOW-BILLED CUCKOOS IN COLORADO

Prior to field work conducted by the Rocky Mountain Bird Observatory (RMBO) in 2008, breeding by Yellow-billed Cuckoos (*Coccyzus americanus*) had not been documented in western Colorado since 1998. The 2008 breeding confirmation consisted of the discovery of a nest with two nestlings along the North Fork of the Gunnison River near Hotchkiss in Delta County. RMBO conducted occupancy surveys for Yellow-billed Cuckoos in the Gunnison and Yampa River drainages in the summer of 2009. Call-playback surveys were used during multiple visits to 142 points at 19 sites containing potentially suitable cuckoo habitat. We were unsuccessful at documenting Yellow-billed Cuckoos during official surveys; however, incidental sightings were recorded at three locations in western Colorado during the 2009 breeding season. In 2008 and 2009, Yellow-billed Cuckoos were found at higher elevations than recorded in any other portion of the species' range. Given the rarity of this species in its western range, this is of considerable interest to ornithologists and others working towards conservation of Yellow-billed Cuckoos in western North America.

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ESTABLISHING A SECOND POPULATION OF MAUI PARROTBILL

The critically endangered Maui Parrotbill (*Pseudonestor xanthophrys*) is comprised of a single population of 500 ± 117 birds restricted by disease and habitat destruction to suboptimal wet rainforest on windward east Maui above 4500 ft. Low fecundity and weather-related nest failure currently limits population growth. Establishing a second population in drier leeward forest is a high priority action in the USFWS Hawaiian Forest Bird Recovery Plan. Leeward habitats have fewer disease vectors and contain more koa, a preferred

foraging substrate. Unfortunately, little forest remains on leeward east Maui due to non-native, feral ungulates. Landscape scale fencing, followed by ungulate eradication, control of alien plants and predators, and out-planting of native vegetation are planned. To minimize the impact to the donor population and to ensure appropriate genetic representation, analyses of age-specific survival and genetic data will guide the selection of translocation candidates. These analyses, development of translocation techniques, and an experimental translocation are expected within 3 years. Tracking of these released birds will provide information critical to the success of this project.

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ROADSIDE RAPTOR SURVEYS OF THE SANTA ANA RIVER

WATERSHED IN RIVERSIDE AND SAN BERNARDINO COUNTIES, CALIFORNIA, 2005-2009

Since 2005, roadside raptor surveys have been conducted at various locations throughout the Santa Ana River Watershed to assess the abundance and distribution of diurnal raptors among habitat types and for future comparison in support of watershed restoration. One survey route duplicates a roadside raptor census conducted in the San Jacinto valley from 1981-83. Of the 18 diurnal raptor species expected to occur in the Santa Ana River Watershed, we observed 16 species. A total of over 1,350 raptors (not individuals) have been detected along four established survey routes (n=99 surveys). The most abundant species detected was the Red-tailed Hawk (*Buteo jamaicensis*), with 775 total sightings, followed by 268 sightings of the American Kestrel (*Falco sparverius*). Differences in species composition/abundance were noticeable among survey routes. The San Jacinto valley and Lake Perris State Recreation Area appear to not only provide important breeding/foraging areas for resident species, but also serve as important wintering grounds for the Northern Harrier, Ferruginous Hawk, Golden Eagle, Bald Eagle, Merlin, and Prairie Falcon.

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RESPONSES OF WADING BIRDS TO A NOVEL FOOD SOURCE: THE INVASIVE CANE TOAD.

Invasive species can lead to dramatic loss of native species and ecosystem change, and have been ranked as the third greatest threat to bird populations globally.

In some cases, however, the arrival of an invasive species may have positive, not negative, impacts on some components of the native ecosystem: for example, the invader may provide a new food resource for predators. The cane toad (*Bufo marinus*) is one of the world's most infamous invasive species, and has adversely affected populations of many of Australia's native predators (snakes, lizards, quolls). Remarkably, studies on the ecological impact of cane toads largely have ignored birds and scavengers. We investigated behavioral responses of native Australian wading birds to this novel and toxic food source. We presented free-ranging wading birds with cane toad tadpoles and metamorphs, and alternative native prey in choice trials. The birds avoided the toads, but did consume the native prey when presented alone. When toads were presented together with native prey, the number of native prey consumed decreased, suggesting that the presence of toads may interfere with birds foraging on native food items.

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PATHOGENIC MICROBES, AMBIENT CONDITIONS, AND LATITUDINAL TRENDS IN AVIAN LIFE HISTORY TRAITS

Differences in food and predation have been the primary factors thought to drive latitudinal patterns in two avian life history traits - a decline in clutch size and an increase in hatching asynchrony. Both factors emphasize the importance

of clutch size and hatching patterns responding to selection on processes that occur after a clutch has been laid. Ambient environmental conditions, acting primarily on events earlier in the reproductive cycle, could be a third factor driving latitudinal changes in clutch size and hatching patterns. I review how pathogenic microbes and exposure to temperature may shape clutch size, the onset of incubation and maternal allocation strategies from three complementary perspectives: (1) the fitness consequences for eggs of exposure prior to incubation to temperate and tropical conditions; (2) microbial processes on the eggshell that affect trans-shell penetration including how microbial communities on eggshells change during the preincubation period and if change is due to passive or active processes associated with parental care; and (3) avian defenses against microbial invasion by examining whether parents differentially endow eggs with antibiotic properties by laying order.

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THE EVOLUTION OF CROSSBILL DIVERSITY: ADAPTATION, MALADAPTATION, OR COEVOLUTION?

Each of the different call types of the Red Crossbill (*Loxia curvirostra*) complex appears adapted to different species or even subspecies of conifers. This is supported by the match between the average width of the lateral grooves in the palate of each of four call types and those predicted as optimal for husking seeds. In addition, the average bill depth of two call types matches that predicted as optimal for removing seeds from the average cone. However, three other call types have bill depths smaller than the predicted optima. This could represent maladaptation. Alternatively, the putative mismatch is related to the foraging behavior of the three call types. These three call types forage on smaller than average cones, which has resulted in selection exerted on the respective conifers. It has also resulted in crossbills experiencing selection favoring smaller bills. Instead of maladaptation, crossbills appear to be adapted to foraging on single species of conifers, but not on the average-sized cones. Moreover, coevolution between crossbills and conifers appears to be a common process in the adaptive radiation of crossbills.

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MOVE, ADAPT OR DIE: A 13 YEAR COMPARISON EXAMINING WHITE-TAILED PTARMIGAN CHANGES IN DISTRIBUTION, HABITAT, AND NUMBER

Because of the "montane island" effect and relative rates of climate change, alpine species may be particularly affected by changing climate. The alpine White-tailed Ptarmigan (*Lagopus leucurus*) are not well adapted to hot summer temperatures. In 1996 and 1997, ptarmigan living in Glacier National Park, MT were closely associated with remnant snow and free water in the late summer. We examined White-tailed Ptarmigan distribution, habitat, and numbers and compared 1996-1997 data with data collected from 2009. Briefly, five areas within GNP were searched for Ptarmigan during August. Habitat data were collected at flock locations. Ptarmigan flocks are presently smaller and less numerous than described in '96 and '97. Mean flock locations on Logan Pass moved 316 m uphill between the 90s and 2009. Ptarmigan in 2009 chose habitat that has the same coverage of vegetation and rock, but contains less snow and water, is farther from snow and water, contains lower soil moisture content, is higher in elevation, and steeper in slope. White-tailed Ptarmigan in GNP appear to be changing distribution, changing habitat, and perhaps on a local scale, declining.

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PUTTING BIRD POPULATION TRENDS IN CONTEXT: WHAT WAS HAPPENING PRIOR TO 1966?

Large-scale monitoring programs provide a powerful resource for examining changes in bird populations and distributions. However, the context of

observed long-term trends is largely unknown as large-scale systematic bird surveys were rare prior to the initiation of the North American Breeding Bird Survey (BBS) in 1966. One of the first widespread and systematic bird surveys in North America occurred in 1906-1908 and then again from 1956 to 1958, we repeated these surveys across Illinois from 2006 to 2008. Using occupancy modeling to account for varying effort and detection probabilities, we investigated changes in bird distribution and abundance among these three snapshots of time. In general, changes between the 1950s and 2000s were qualitatively similar to observed BBS trends for Illinois. Although some recent population increases represent population increases of formerly rare species, many recent increases represent a recovery from large declines between 1909 and 1956. Moreover, some species with recently stable populations experienced large declines prior to 1956. These results may have significant implications for our understanding of past bird communities, evaluating current conservation status, and developing future conservation efforts.

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RELATIONSHIPS AMONG SURVIVAL, BODY CONDITION, AND HABITAT FOR BREEDING SWAINSON'S WARBLERS

For migratory birds, settling in quality breeding habitats has significant implications for fitness. One potential reflection of habitat quality is body condition, which may influence adult survival. Access to abundant resources should lead to good condition and the ability to maintain or increase condition over time. From 2004 through 2007, we studied survival and body condition of Swainson's Warblers (*Limnothlypis swainsonii*) at three sites in eastern Arkansas, two that were dominated by mature forest, and one industrial forest site. Birds in better condition at initial capture had greater survival at two of three locations. Moreover, body condition of birds at all sites increased throughout the breeding season. Body condition was positively related to dense understory vegetation and negatively related to herbaceous ground cover. Our results suggest that both mature and industrial forests may provide quality habitat for Swainson's Warblers. Because of the relationship between body condition and survival, the observed habitat-related differences in body condition suggest that management actions may be used to influence survival and affect the conservation of Swainson's Warblers.

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ARE PATTERNS OF CO-VARIATION BETWEEN HORMONAL RESPONSIVENESS AND HORMONALLY MEDIATED BEHAVIOR CONSISTENT ACROSS DIVERGENT POPULATIONS OF THE DARK-EYED JUNCO?

Hormones are important mediators of life-history trade-offs, and the multiple targets of hormones may facilitate evolutionary change or present a constraint to adaptive divergence. It is not known whether hormone-phenotype relationships are preserved as species diverge, as few studies have attempted direct comparisons. Male Dark-eyed Juncos (*Junco hyemalis*) elevate testosterone (T) in response to injection of gonadotropin releasing hormone (GnRH). In Carolina juncos residing in Virginia, males that more readily elevate T are both more ornamented and more aggressive than males with a relatively lower T response. If hormone-phenotype relationships are highly integrated, we would predict that they would be consistent across divergent populations; but if hormone signal and phenotypic response evolve independently we might not. We administered GnRH challenges to breeding male white-winged juncos, the most highly ornamented subspecies of Dark-eyed Junco endemic to the Black Hills of South Dakota. As predicted, we found greater elevation of T in response to GnRH in white-winged juncos. We examine relationships between T and aggression, asking whether they generalize across populations and whether responses are stronger in the more ornamented population.

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NEEDS AND OPPORTUNITIES FOR EXPANDING BIRD MONITORING IN MEXICO

In the last two decades Mexico has greatly increased its technical and institutional capabilities to address bird conservation challenges. Nevertheless there is a tremendous need to develop a sustainable long-term platform to monitor its national avifauna to generate reliable information for planning and decision making. Mexico's territory contains several endemic species and is essential to understand bird migrations in North America. In order to contribute to address this lack of information, Mexico's National Commission for the Knowledge and Use of Biodiversity have partnered with several agencies and institutions, to design, promote and implement long term monitoring efforts such as the Mesoamerican Biological Corridor Monitoring strategy, the Breeding Bird Survey; aVerAves (eBird México); etc. We present current progress in the development and implementation of these programs and analyze opportunities, future needs and challenges to organize and operate a permanent Mexican monitoring platform particularly for highly vulnerable species associated to unclear or unknown population trends and restricted ranges.

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COMMON ENVIRONMENTAL PRESSURES OR SHARED EVOLUTIONARY HISTORY? A QUANTIFICATION OF SEXUAL SHAPE DIMORPHISM IN HUMMINGBIRD BILLS IN A PHYLOGENETIC CONTEXT.

The ecological importance of sexual dimorphism in hummingbird bill morphology has been studied for over a century. Recent work has examined the functional relationship between bill morphology (mainly curvature), food resource niche, and differences in bill morphology between the sexes in relation to foraging. However, studies of sexual dimorphism in bill shape are limited to a few taxa, and a quantitative comparative examination across species has not been performed. Sexual shape dimorphism is found in bills of the Ruby-throated Hummingbird, a temperate species whose breeding range is separate from other hummingbirds. In contrast, the breeding range of its sister taxa, the Black-chinned Hummingbird, is sympatric with several other hummingbird species. Curiously, this species does not exhibit sexual shape dimorphism in bill morphology. Using geometric morphometrics, I quantified patterns of sexual shape dimorphism in the bills of several species of temperate hummingbirds. I examined these patterns in a comparative phylogenetic context to determine the extent to which shared evolutionary history and common environmental pressures affect patterns of morphological variation in these taxa. The implications for hummingbird evolution and ecology are discussed.

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ISLAND BIOGEOGRAPHY AND THE HISTORY OF THE BEARDED MANAKINS (MANACUS) IN BOCAS DEL TORO, PANAMA.

This study uses a chain of islands, sequentially isolated from the mainland as sea levels rose after the last glacial period, to reconstruct the history of Manacus phenotypes on the adjacent mainland. The lemon-collared manakin (*Manacus cerritus*) is thought to have arisen by introgression through a present day mainland hybrid zone between the white-collared manakin (*Manacus candei*) and the golden-collared manakin (*Manacus vitellinus*). Evidence from the islands, however, shows that the lemon-collared manakin had a much wider range prior to sea level rise. This suggests that the mainland hybrid zone has moved over the last 10,000 years, and that the origin of the lemon-collared manakin is independent of today's hybrid zone. Though there is ongoing plumage introgression across the range of the lemon-collared manakin on the mainland, there is no plumage cline across the islands. Thus, the lemon-collared manakin appears to be a long-term stable subspecies of possible ancient hybrid origin that has been present in the larger region for at least the last 10,000 years. It could be one of the best examples of a long-term hybrid "species" in birds.

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ARE WE LOSING THE AMERICAN KESTREL?

According to the December 2009 issue of The Journal of Raptor Research, that American kestrels have definitely undergone a decline in some regions of North America seems hard to dispute. However, this begs two questions. First, will the slide in kestrel numbers continue to the point of endangerment or is just a blip in history? Second, what is behind the decline? There is no shortage of interesting hypotheses for the cause of the decline, by no means mutually exclusive. Predation pressure from accipiters, nest-cavity competition with starlings, and exposure to pollutants are cited as possible causes. One certainly cannot rule out the impact of widespread changes in habitats and/or invertebrate prey availability due to global warming or some other phenomenon. There is a need to ascertain beyond any doubt that the species is declining, the causes behind it, and most important, what can be done about it.

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PREDATION AT SAN CLEMENTE LOGGERHEAD SHRIKE NESTS: EVALUATION AND QUANTIFICATION VIA REMOTE VIDEO-CAMERA SYSTEMS.

San Clemente Island (SCI) is home to the endemic San Clemente Loggerhead Shrike (*Lanius ludovicianus mearnsi*; SCLS), a federally endangered subspecies. Among the challenges faced in the ongoing effort to recover the population is predation by non-native species, particularly at nest sites. Preliminary analyses suggest predation may be a primary factor limiting SCLS reproductive success. From 2003–2009 we deployed remotely operated video camera systems at 38 SCLS nest sites to quantify nest survival rates and identify nest predators. We captured 15 predation events on camera, as well as 2 additional visits by secondary predators after the primary predation event occurred. Predators documented at SCLS nests included feral cats (*Felis catus*), black rats (*Rattus rattus*), and the protected San Clemente island fox (*Urocyon littoralis clemente*). Predation was documented on eggs, nestlings, and nesting adults. These data will help to improve our understanding of the impacts of predation on SCLS population recovery efforts and allow us to better allocate predator control resources to maximize their efficacy.

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MULTI-SCALE OCCUPANCY ESTIMATION USING REMOVAL MODELING AND SPATIAL REPLICATION.

We implemented broad-scale landbird monitoring in 8 western states in 2009, using distance and removal sampling in a spatially balanced design. Sample plots were comprised of 16 replicate points. Substituting spatial for temporal replication in occupancy estimation was recently shown to result in biased estimates in some situations. We employed newly-developed multi-scale occupancy theory to combine temporal removal and spatial replication within sample plots to generate unbiased site occupancy estimates for >100 avian species. Resulting estimates will be used to monitor populations of low density species within Bird Conservation Regions.

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BOREAL NURSERY TO TROPICAL CRADLE: SHARED RESPONSIBILITY FOR A SHARED CONTINENTAL AVIFAUNA

Conservation efforts often focus at the local scale, leaving critical linkages at larger spatial scales unexamined. Identifying the distribution of North American birds across their annual cycle will aid in prioritizing our conservation efforts. We examined the distribution of native landbird species from Canada, USA and Mexico and evaluated the extent to which species responsibility was shared. Close to half are found regularly in at least 2 of the 3 countries at some point in their annual lifecycle. One-quarter are shared across all three countries, but in total we estimate that these species account for over 80% of the individual landbirds in North America. Billions of shared migrants exert a strong influence on ecosystem function as they travel across the continent. Birds shared among all three countries are particularly well represented in boreal forests during the breeding season and in Mexican forests in winter. In Mexico, shared species wintering there show a strong overlap with highly threatened resident species, suggesting shared conservation efforts in these areas will be highly effective.

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HABITAT REQUIREMENTS OF NORTHERN MIXED-GRASS PRAIRIE PASSERINES: THE ROLES OF HABITAT HETEROGENEITY AND GRAZING

Although numerous studies have explored the effects of habitat structure on avian habitat selection, very few have addressed how habitat heterogeneity affects birds. From 2006-2008, we collected baseline data within nine ungrazed and four moderately grazed mixed-grass prairie pastures. We also collected impact data in 2009, following the introduction of cattle to six of the ungrazed pastures at five grazing intensities. We used mixed models to analyze the effects of grazing intensity and habitat heterogeneity on passerine diversity and abundance. Grazing likely influenced the passerine community indirectly by altering habitat; both habitat structure and heterogeneity were strongly impacted by grazing. Passerine diversity was greater at higher levels of habitat heterogeneity, but individual species responses were both positive and negative. Species may select for homogenous patches of microhabitat contained within larger, heterogeneous habitats, or they may select for heterogeneous habitats specifically. The occurrence of simultaneous positive and negative responses to heterogeneity for some species in our study suggests that at least some species require both patchy and uniform structural components in their breeding habitats.

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OFFSPRING SURVIVAL CONSEQUENCES OF HABITAT SELECTION: SCALE-DEPENDENT TRADE-OFFS IN A PRECOXIAL SPECIES.

It is often assumed that fitness is higher in preferred habitats, but this is rarely tested. Here, we address unresolved questions about how precocial birds balance costs and benefits of selecting habitats by determining the survival consequences of habitat choices made by brood-rearing mallards (*Anas platyrhynchos*, N=582) in the Canadian prairie pothole region. Logistic regression and information-theoretic model selection were used to determine habitat selection patterns at landscape (used vs. study site) and local (used vs. random) scales. Females demonstrated preference for wetland and perennial upland habitats at the landscape-level, but duckling survival was not related to habitat selection patterns at this scale. At the local scale, females selected brood-rearing habitats with a high proportion of wetland habitat, and avoided areas with both abundant perennial cover and wetlands with little vegetative

cover. Contrary to prediction, duckling survival was lower in areas with a high proportion of wetland habitat. Consistent with expectation, survival was lower in areas with abundant perennial cover. Hence, there is inconsistent support for the hypothesis that females select brood-rearing habitats that confer the highest fitness benefits.

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EFFECT OF HABITAT DISTURBANCE ON DISPERSAL BEHAVIOR AND SITE FIDELITY OF LEAST BELL'S VIREOS (VIREO BELLII PUSILLUS)

Conservation management for endangered Least Bell's Vireos involves habitat restoration, which creates disturbance that may affect vireo breeding site fidelity or dispersal behavior. We assessed the effects of habitat disturbance on inter-annual movement of color-banded adult males and dispersal of banded juveniles at two monitored sites in San Diego County, California (Marine Corps Base Camp Pendleton, MCBCP, and Lower San Luis Rey River, LSLR) within disturbed (exotic plant removal [MCBCP] or vegetation removal related to flood control [LSLR]) and undisturbed sites. Overall > 95% of adult males (N = 188) displayed breeding site fidelity. At MCBCP, males did not differ in the proportion returning to disturbed (100%) or undisturbed (97%) sites. At LSLR return rate of males to previous year's site was significantly higher in disturbed (99%) than in undisturbed sites (90%). First-year adults at MCBCP dispersed to habitat types matching their natal habitats in similar proportions across disturbed (88%) and undisturbed (81%) sites, as was also seen at LSLR (49% and 46%, respectively). Overall, we found no adverse effects of habitat disturbance on dispersal and site fidelity of vireos.

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THE NEST-CONCEALMENT PARADOX: NEW INSIGHTS FROM EMPIRICAL, COMPARATIVE, AND EXPERIMENTAL APPROACHES

Dense foliage surrounding a bird's nest is often assumed to reduce the risk of nest predation. However, 74% of studies (n = 119) failed to support the nest-concealment hypothesis and reported that increased foliage density was not associated with reduced nest predation. We are the first to combine empirical, experimental, and comparative approaches to examine factors that contribute to the variation observed across species/studies. We suggest that variation in support of the nest-concealment hypothesis is due to interspecific differences in intrinsic factors such as female body mass and nest height. Extrinsic factors such as latitude, longitude, and elevation, which are reflective of differences in the nest predator and vegetation community, also affected the importance of foliage density on reducing nest predation. We show that timing of measurement and methods used create bias and limit our ability to adequately assess the hypothesis. Lack of support for the nest-concealment hypothesis does not imply that foliage density is unimportant, but rather that species may be trading costs and benefits associated with for example, the risk of predation to themselves versus their offspring.

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THE TIMING OF PEAK CIRCULATING LUTEINIZING HORMONE AFTER GONADOTROPIN-RELEASING HORMONE INJECTION IN BREEDING MALE DARK-EYED JUNCOS

Many of the phenotypic changes associated with reproduction in birds are regulated by the hypothalamo-pituitary-gonadal (HPG) axis. Environmental cues elicit secretion of gonadotropin-releasing hormone (GnRH) from the

hypothalamus, which in turn stimulates the pituitary to release luteinizing hormone (LH) into the general circulation. In males, LH stimulates the release of testosterone (T) from the testes, and T regulates appropriate behavioral, morphological, or physiological traits. Male Dark-eyed Juncos (*Junco hyemalis*) vary in the degree to which they elevate T in response to standardized injection of GnRH, and in related phenotype. However, it is not known whether the variation in individual T responses occurs at the level of the pituitary (LH released in response to GnRH), at the level of the gonad (T released in response to LH), or both. In June 2009, we administered GnRH challenges to 42 free-living, breeding male Dark-eyed Juncos. We determined the timing of peak concentration of circulating LH after GnRH challenge for use in future studies. Further, we examined relationships between LH and T response to GnRH, predicting correlations across these levels of the HPG axis.

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WEATHER PATTERNS AND LAYING DATE IN FLORIDA SCRUB-JAYS (APHELOCOMA COERULESCENS)

Variation in annual reproductive success often is linked to environmental variables, such as weather, food, and predation pressure. In the Florida Scrub-Jay reproductive success is linked to timing, with early egg-laying seasons predictive of greater success. We investigated seasonal weather parameters and timing of laying over 30 breeding seasons. Models included: 1) Multiple weather conditions that drive acorn mast, 2) Warm winters increase orthopteran abundance, 3) Wet autumns and balmy winters maintain herptofauna, 4) Cold winters limit resources and increase energy expenditure, 5) Cold wet fronts delay the onset of nest building or laying, 6) High mortality increases the proportion of new pairs, which breed later, and 7) The Southern Oscillation cycle can drive Florida's weather: La Niña causes warmer drier winters and El Niño causes cooler wetter winters. The most informative model included previous-year breeder mortality, cold winters, and SOI, and explained 44% of the annual variation in laying date. We discuss the relationships between weather, breeder mortality and the role of epidemics, and analyse the direct and indirect linkages through which they influence timing of breeding.

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A MINIMALLY INVASIVE APPROACH TO MONITORING NEST-SITE BEHAVIOR FOR A THREATENED SPECIES

In Grand Canyon National Park, spotted owls (*Strix occidentalis lucida*) nest in limestone cliffs in areas that are remote and difficult to access. Monitoring nest-site behavior requires large amounts of effort and is cost prohibitive for large samples. In this study we investigate the efficiency and reliability of using audio recordings as an alternative approach to monitoring aspects of nest-site behavior. Over a 180-day season, 337 days (20,220 hours) of audio data were recorded at four nest sites. Continuous recordings allowed us to monitor the onset of juvenile vocalizations, the number of vocalizing juveniles, frequency of vocalizations and feeding bouts, and date of dispersal from the nest area. As well, natural history events such as interactions with predatory species were captured. The use of spectrograms and recognition software increased efficiency of analysis and clearly distinguished among male, female, and juvenile vocalizations. Eighty six percent of human-observed owl vocalizations at nest sites (n=36) were audible on recordings. Of the 5 detections not audible, 3 were due to high winds masking the recorded audio and 2 vocalizations were > 500 m from the recorder.

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MEXICAN SPOTTED OWL HOME RANGE, HABITAT USE, AND REPRODUCTION IN THE GRAND CANYON NATIONAL PARK

Despite their threatened status, relatively little is known regarding Mexican spotted owls (*Strix occidentalis lucida*) that inhabit arid canyons of northern Arizona. We studied home range, habitat use, and reproductive output of adult Mexican Spotted Owls in the Grand Canyon National Park from 2004 – 2006. Five adult owls were radio-tracked using standard telemetry methods. We used minimum convex polygons and fixed kernel estimates to describe home range size (mean = 356 ha and 372 ha, respectively). Home ranges were dominated by piñon-juniper (*Pinus edulis- Juniperus osteosperma*) woodlands with an understory of ephedra (*Ephedra fasciculata*) and Utah agave (*Agave utahensis*). Roost and nest sites were placed in vertical walled cliffs in the Redwall Limestone geologic layer. Female fecundity (mean = 0.86) was higher than reported in other study areas however, longer-term studies may be required for accurate fecundity estimates. Following conservation recommendations from the recovery team, we delineating 40 ha protected core areas around nest sites and found these to coincide with areas of concentrated use as identified by the adaptive kernel 30% isopleths.

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A HISTORICAL PERSPECTIVE ON WOMEN IN ORNITHOLOGY

Women have been active in North American ornithological societies since early in the societies' histories, more than 125 years ago. Women have been recognized for their accomplishments in research and in service to the societies. Women have received service awards more frequently than research awards, but they have received fewer than 15% of both types of awards. Who were the women who have received awards and why were they honored? The first woman to receive Honorary Membership from the Cooper Ornithological Society, Florence M. Bailey, was selected in 1920 and was the first woman to receive the Brewster award and the first woman to be elected as a Fellow of the American Ornithologists' Union. Other women who were honored by both the COS and AOU included Hildegard Howard, Elsie Collias and Frances C. James. I will discuss the contributions of some of the women who made significant contributions to ornithology and to the ornithological societies.

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CARRY-OVER EFFECTS OF ACORN ABUNDANCE ON THE DEMOGRAPHY OF FLORIDA SCRUB-JAYS

Although seasonal carry-over effects have received considerable attention in migratory birds, they also are relevant for understanding sources of annual variation in the demography of non-migrants. Florida Scrub-Jays are territorial cooperative breeders. In the fall, jays cache acorns to be recovered as winter food. The size of the oak mast is, in part, determined by summer weather one or two-years previously (for red or white oak species, respectively). The annual acorn crop has a large positive influence on survival of breeders. Adult survival is lowest in years affected by epidemics, which occur when acorn mast is relatively low; thus scarce resources may exacerbate the risk of disease-related mortality. When breeder survival is low, the subsequent breeding season is delayed. Mean clutch size, nest success and fledging productivity all are reduced during late breeding seasons. Reproduction is further depressed by an increased proportion of inexperienced breeding pairs and reduced group size. The reduction in productivity following high adult mortality can lead to an overall reduction in density, but this may eventually increase the per capita reproductive rate through negative density dependence.

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LONG-TERM ECOLOGICAL CHANGE IN A CONSERVATION
 HOTSPOT: THE FOSSIL AVIFAUNA OF ME AURE CAVE, NEW
 CALEDONIA

Through the continuing accumulation of fossil evidence, it is clear that the birds of Pacific islands underwent a large-scale extinction event broadly coincident with Polynesian colonization. Because New Caledonia is a large and biogeographically distinct island, and was first colonized by people only about 3,000 years ago, the island provides an independent case for the study of ecological change and human impacts in the Pacific. We examined fossil birds from the Mé Auré cave site (WMD007) on the island of New Caledonia. Accumulation of bird skeletal material in the cave was primarily through barn owl (*Tyto alba*) pellets. Dating and stratigraphy suggests that the owl colonized the island only after establishment of rodent prey. Species richness of birds at the lowland cave site was quite high, and richness has decreased through time, including extinction of one species and extirpation of three other species from the lowlands. By increasing knowledge of past distributions of New Caledonian birds, this work provides a baseline for ecological restoration and conservation of habitats to insure the survival of threatened birds.

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EFFECTS OF DIETARY SELENIUM ON HEALTH AND SURVIVAL
 OF LESSER SCAUP DURING WINTER

It has been hypothesized that the lesser and greater scap population decline is due to increasing exposure to contaminants; selenium (Se) acquisition on the Lower Great Lakes (LGL) has been identified as a concern. I simulated scap staging (10-weeks) and wintering (23-weeks) durations on the LGL, and exposed birds to dietary Se levels similar to (moderate - 8.1 µg/g), and higher than (high - 20.7 µg/g), those found in mussels on the LGL in comparison to control (0.8 µg/g) birds. I investigated survival rates and several aspects of health in relation to hepatic Se concentrations. There was 100% survival of scap exposed to Se for 10-weeks but birds in the high treatment group had lower lipid reserves. There was 93% survival after 23-weeks, but no differences among treatment groups in body composition or body mass. There was no effect of Se on indices of oxidative stress and cell-mediated immunity, but immuno-stimulatory effects on antibody production. Elevated Se levels in scap on the LGL, do not likely impact health and survival, and future research efforts should focus on alternative hypotheses for the scap decline.

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RECENT EFFECTS OF WILDFIRES ON CALIFORNIA CONDOR
 RECOVERY

The occurrence of wildfires within the current and historic range of the endangered California condor has increased since their reintroduction in 1992. These fires have affected the recovering population in a variety of ways. Condor deaths in the southern and central populations in California have been linked to fire activity. However, fire has had little effect on recent nesting attempts despite several nests of different type and age falling within the burn area of large fire events. Condor use of burned areas as foraging habitat is poorly understood. Anecdotal observations in condors and quantified behavior in sentinel species, such as golden eagles and ravens, indicate that faunal mortality caused by fires could be a source of naturally occurring carrion. Use of fire affected areas is examined using GPS transmitter data for the southern and central California population prior to and immediately following burns.

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TEMPORAL VARIATION IN THE DEMOGRAPHY OF TROPICAL
 BIRDS: A 30 YEAR STUDY

Demographic studies of species inhabiting tropical latitudes now reveal reasonable variation in key life history traits among and within species. Interspecific variation in, for example, survival rate obtains from traits such as body size and social behavior. Within species, significant variation has been observed over their geographic range. Robust analyses of temporal variation in demographic traits, however, have been generally infeasible. We re-analyzed a mark-recapture data set from a study in central Panama that was established in the late 1970s and continues today. We report on temporal patterns of variation in apparent survival rate and the finite multiplication rate (or λ) which is a function of several demographic quantities. We estimated these parameters for several species of undergrowth insectivores and frugivores. Overall, we found a pattern of general stability. These data were collected over a time frame that included two significant ENSO events which - in Panama - makes for xeric conditions during the early breeding season that are expected to challenge individuals and populations. We tentatively conclude that tropical species are resilient to short-term environmental variation

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THE EFFECT OF SOCIAL CUES ON THE TIMING OF THE
 BREEDING-MOLT TRANSITION IN HOUSE FINCHES
 (CARPODACUS MEXICANUS)

Transitions between annual cycle stages (e.g. breeding, molt, migration, hibernation) allow animals to deal with seasonal environmental variation. Therefore, appropriate timing of these transitions, so that they correspond to optimal environmental conditions, can have a major impact on lifetime reproductive success. Understanding the underlying environmental cue response mechanisms is central to understanding how animals deal with environmental variation. While the responsiveness to photoperiod cues has been widely studied, less is known about how non-photic cues influence the timing of transitions between annual cycle stages. This study examined the importance of social cues in timing of the breeding-molt transition in House Finches (*Carpodacus mexicanus*). Captive males and females were housed on naturally-declining photoperiod after the summer solstice either adjacent to a hormonally-implanted opposite sex stimulus bird, or to unimplanted same-sex birds. The birds paired with hormone-implanted stimulus companions did not delay gonadal collapse or the onset of molt as predicted. Further analysis of circulating hormone levels and behavioral data may be illuminating. Precisely when in the annual cycle the social cues are experienced may be critical to the response induced.

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IS THE AUDUBON'S WARBLER A HYBRID SPECIES?

Hybrid origins have recently been shown for several animal species, but no avian examples have been documented with molecular evidence. We investigate whether the Audubon's warbler, one of four visually distinct forms in the yellow-rumped warbler (*Dendroica coronata*) complex, may have originated through hybridization between two other taxa in this group, the myrtle warbler and black-fronted warbler. Analysis of over 300 nuclear markers (AFLP) shows that Audubon's warblers carry a mixture of alleles otherwise found only in one or the other of their putative parent species. Audubon's warblers also carry two deeply divergent mitochondrial DNA lineages, each shared with only one parental form. Our results indicate that

this taxon likely originated through hybridization between two long-diverged forms. Nevertheless, broad clines between the Audubon's and black-fronted warblers in morphology and nuclear genetic markers call into question the validity of the Audubon's warbler as an evolutionarily independent taxon.

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THE MAINTENANCE OF PLUMAGE POLYMORPHISMS IN SWAINSON'S HAWKS

We examined the genetic correlates, survival, reproduction, and mating patterns of individuals with varying plumage polymorphisms in Swainson's Hawks (*Buteo swainsoni*). Results suggest that plumage polymorphisms in Swainson's Hawks are the result of a nonsynonymous substitution at the melanocortin-1-receptor gene, resulting in a simple Mendelian pattern of inheritance with one locus and two alleles. Using this data, we examined differential survival or reproduction among our morph classes, separating individuals into three categories; light, intermediate and dark. We used 25-years of mark-resight data to assess differences in survival between morph classes. We used 15 years of nest monitoring data in a mixed-model regression to assess differences in reproduction between morph classes. There was no evidence for differences in survival or reproduction among the different morph classes. Finally, we examined non-random mating using individuals whose parents were known and were recruited as breeders into this population. Males (N=20) selected mates that resembled their mother, while females (N=19) did not select a mate based on parental phenotype. Further, males chose similarly morphed females more consistently than expected by chance.

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OCCURRENCE OF BACHMAN'S SPARROW IN A POST-HURRICANE, SALVAGED-LOGGED FOREST

North American grassland birds have been declining at an alarming rate. Remaining habitat for grassland species in the southeastern U.S. often occurs within forests subject to management and hurricanes. We surveyed Bachman's Sparrows (*Aimophila aestivalis*) in Mississippi pine stands damaged by Hurricane Katrina. Our objectives were: 1) Assess stand occupancy of Bachman's Sparrows in relation to stand age and salvage logging; and 2) Determine how vegetation structure and composition affect stand occupancy. We conducted point counts and vegetation surveys in 89 stands over two seasons. Bachman's Sparrow occurrence was best predicted by a quadratic effect of increasing graminoid structure and decreasing tree density, and abundance of downed pine tree crowns and upturned root balls. Stand occupancy was higher in mature stands, regardless of salvage status, and lowest in unsalvaged, middle-aged stands, a pattern that also held for other species of birds. Our results suggest that damage from Hurricane Katrina benefited Bachman's Sparrows by thinning trees, by creating pine-crown perches for singing males, and by creating predator-escape refugia in upturned root balls.

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NATURAL HISTORY OF THE GOLDEN-FRONTED WOODPECKER

T. Brush and J. S. Brush, Univ. Texas-Pan American, Edinburg, TX, USA. The Golden-fronted Woodpecker (*Melanerpes aurifrons*) is a common but poorly known subtropical/tropical species. Birds nested at high densities in dead palms in a suburban nature center. In riparian forest, woodpeckers nested at varying densities in a variety of tree species. Overall, woodpecker nest density was affected by nest-site abundance and other habitat features. Nest-site competition was fairly low.

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HEALTH INSURANCE FOR THE WORLD TRAVELER: IMMUNITY IN MIGRANT SHOREBIRDS AND IMPLICATIONS FOR RESILIENCE IN THE FACE OF CLIMATE CHANGE

We are just beginning to study links between immunity and niche in shorebirds. Higher malaria prevalence has been found in tropical vs. temperate and aquatic vs. marine niches, but little is known about other pathogens. A study comparing innate and acquired immunity among five shorebird species suggests no general pattern at the species level, with different aspects of immunity being context dependent. Climate change may alter ecological context faster than immune systems can evolve, making flexibility in the short term important. Studies on red knots have shown the capacity for flexibility over the annual cycle, after a few months in captivity, and within migratory stopover, with different aspects of immunity changing in different ways. This makes meta-analysis difficult since studies are not comparable if the same measures are not taken or are analyzed differently. Studies among- and within-species suggest the potential for adjustment to climate change, but highlight that resilience will be affected by the multi-faceted character of immunity since climate change may affect factors influencing different aspects of immunity in synergistically negative ways.

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POTENTIAL RISK TO SEABIRDS FROM MERCURY IN FISH

Many seabirds eat fish, self-caught, stolen, scavenged or as offal. The latter categories are larger than fish typically self-caught. We examine mercury in saltwater fish collected along the New Jersey coast as a function of species and size of the fish, relate the levels to potential risk to the birds consuming them, and examine whether fish caught by birds have higher levels than those obtained in other ways. Average mercury levels ranged from 0.01 ppm in Menhaden to 1.83 ppm in tournament-caught Mako Shark. Mercury levels were significantly related to size for ten of 19 species. The published critical effects level for birds is 0.02 ppm, although seabirds are generally less sensitive. Young fish of several species greatly exceeded 0.02 ppm. Common Terns (*Sterna hirundo*) in New Jersey, bring back prey fish that are higher in mercury than those collected by seining, suggesting a greater catchability of fish high in mercury, which may also have implications for people fishing. This research was partly funded by NJDEP CRES (DE-FC01-06EW07053) and NIEHS (P30ES005022).

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SILENT SNAG: FACTORS INFLUENCING NEST PREDATION IN RED-BELLIED WOODPECKERS.

We examined factors with the potential to influence nesting success in a cavity nesting species, the Red-bellied Woodpecker (*Melanerpes carolinus*). Previous research indicated that cavity nesting birds experience higher success than open cup or ground nesting species. However, cavity nesters do remain somewhat vulnerable to predation. We tested for an association between nest survival and cavity height, nesting tree distance from forest edge, live trees versus dead snags, and surrounding land cover types. Sites were located in Missouri's Boone and Calloway counties, within Mark Twain National Forest and Baskett Research Area. We monitored parental behavior and used a cavity camera to verify nest activity and stage. Results indicated that survival was positively associated with nest cavity height from ground. Estimated nest survival rates ranged from 4.3% at 5 meters to 87.4% at 20 meters. We did not identify any associations between nest survival and distance to forest edge, live tree versus dead snag, or surrounding land cover. Our results illuminate the importance of maintaining taller nesting substrates when managing habitat for cavity nesting birds.

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MATING SYSTEM AND BREEDING ECOLOGY OF AN
ENDANGERED TROPICAL SEDENTARY SHOREBIRD IN A
SATURATED HABITAT.

Last winter we conducted the first study of the social behavior and breeding biology of the Tuamotu Sandpiper (*Prosobonia cancellata*). It is a tropical sedentary shorebird of the Tuamotu Archipelago (South Pacific Ocean), endangered due to mammalian introductions. Over 5 months on the uninhabited Tahanea Atoll, we color-banded and followed 110 individuals and monitored 17 nests, which produced 7 chicks. Distribution among islets within Tahanea was patchy with most islets unoccupied and few holding small but surprisingly dense breeding populations. On those, birds lived as strongly territorial pairs (up to 8/ha) in saturated habitat. Non-territorial birds and territorial ones intruding on others' territories to feed were constantly chased. Diet consisted of nectar, petals, invertebrates and seeds gathered in open shrubland. The breeding season appeared to start in late December and continued at least until June. Hatching success was low due to predation from unknown sources. Chicks had an unusually slow growth rate and fledging success was extremely low. We suggest that, within suitable habitat and in the absence of mammals, negative density-dependent reproductive success due to food competition may occur.

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IMPLICATIONS OF VARIATION IN NEST DEFENSE BEHAVIOR IN
THE EASTERN BLUEBIRD (*SIALIA SIALIS*)

Competition for nest boxes is a frequent cause of agonistic interactions between species of birds. The competitor is often met with an aggressive response by the occupant; however, there is variation in the intensity of nest defense behavior among individuals of the same population. Previous research has demonstrated that nest defense behavior is repeatable over time and can influence reproductive success. Competition between Eastern Bluebirds (*Sialia sialis*) and invasive House Sparrows (*Passer domesticus*) for nest sites results in aggressive interactions in which adult bluebirds and their nestlings may be injured. We investigated variation in Eastern Bluebird nest defense behavior against House Sparrows. We determined that male Eastern Bluebirds that defend their nests more intensely have higher fitness across the season; however, parental defense behavior did not directly affect nestling growth rate. The intensity of male and female aggressive response was positively correlated in social pairs. Male and female bluebirds also differed in repeatability; males did not reliably respond with the same intensity whereas female nest defense intensity was repeatable across the season.

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RESPONDING TO CURRENT CHALLENGES TO ENSURE THE
FUTURE OF ORNITHOLOGY IN NORTH AMERICA.

Over the last several decades, profound changes with far-reaching consequences have occurred in the practice of science. A move to discipline-based societies and electronic communication of science have produced a cascade of effects that challenge the structure of scientific societies generally, and ornithological societies in particular. We believe that the ornithological community needs to face these challenges, embracing and building on the benefits and opportunities they offer. We identify these challenges and outline a plan that will enable us to strengthen taxon-based societies by taking advantage of potential alliances among our societies and using the electronic media to creatively communicate our science. If we respond with a bold vision of ornithology in an electronic age, we will breathe new life into our discipline. We will attract young professionals whose enthusiasm will re-energize ornithology and carry the discipline beyond the 21st century as a vibrant science, expanding basic knowledge and solving the environmental problems that threaten the birds we love.

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REPRODUCTIVE ECOLOGY OF THE ISLAND SCRUB-JAY
(*APHELOCOMA INSULARIS*)

The Island Scrub-Jay (*Aphelocoma insularis*) is currently found solely on Santa Cruz Island, California, giving it the most restricted range of any North American bird species. Despite emerging conservation concerns, little is known about this species' demography or the factors that limit its annual fecundity. In 2008 and 2009, we followed nearly 50 pairs over two breeding seasons, documented all nesting attempts, quantified nest success, parental feeding rates, and nest attendance during incubation. Daily nest survival probability (\pm SE) was 0.948 ± 0.005 ($n=153$ nests). Nest depredation was the principal cause of nest failure, accounting for 72% of failed attempts. Mean annual fecundity (\pm SE) was 1.16 ± 0.10 fledglings per pair ($n=95$), with 35% of pairs fledging young. Territory size and habitat composition influenced parental feeding rates, nest attendance, and nest success. Our data suggest that this population, given estimated adult survival, has sufficiently high annual fecundity to sustain a stable population size.

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THE FOSSIL OWLS OF RANCHO LA BREA, CALIFORNIA

Rancho La Brea, in the heart of Los Angeles, California, is perhaps the most famous site in the world for late Pleistocene fossils, including birds. The fossil avifauna of Rancho La Brea numbers 135 named species, with 21 being extinct, and others yet to be described. Nine species of owls are present, three of which are extinct. The most abundant owls were the Burrowing Owl (230 individuals) and the Barn Owl (210 individuals), followed by two species of *Asio* with a combined total of over 160 individuals. The La Brea Owl, formerly known as *Strix brea*, has been re-described and placed into a new genus. Two new pygmy-sized owls, are also present, represented by multiple specimens. Two of the three extinct species have also been found at a second fossil locality. In all, almost 800 individual owls are represented, or, unexpectedly, more predatory owls than scavenging vultures. The owls were most likely preserved in the asphalt seeps at Rancho La Brea after being killed, or entrapped, in the act of predation on animals struggling to free themselves from the asphalt.

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EVALUATION OF AN UNLINKED ACOUSTIC LOCALIZATION
SYSTEM: MEASURING DISTANCE OF INDIVIDUAL SONGBIRDS
FROM AN OBSERVER DURING A POINT COUNT.

We used a novel acoustic localization system of eight unlinked Global Positioning System (GPS) synchronized microphones to test if the presence of an observer alters songbird behaviour during a point count survey. Field tests of the localization system showed that mean error in position estimates ranged from 1.80 ± 0.35 m near the center of the array and 4.19 ± 0.52 m up to 75m outside of the array. We compared position estimates of individual birds 15 min before the arrival of an observer and during the first 5 minutes of a point count for $n=26$ locations in regenerating pasture habitats in eastern Ontario between 1 June and 7 July 2005. There was no change in the number of individuals or species detected in response to an observer during a point count. Nor was there any change in the mean singing position of individual birds, or the onset of singing behaviour in response to an observer. Position estimation using acoustic localization systems are a significant improvement on auditory distance estimation methods and could be a powerful tool for distance sampling programs.

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MOVEMENTS AND HABITAT SELECTION OF BLACK-THROATED BLUE WARBLED ON JAMAICAN COFFEE FARMS: IMPLICATIONS FOR AN ECOSYSTEM SERVICE

Neartic-neotropical warblers deliver an economically significant ecosystem service to Jamaican coffee farms via the predation of the coffee berry-borer (*Hypothenemus hampei*). Because the provisioning of this ecosystem service depends on mobile insectivores capable of using multiple habitats and microhabitats, knowledge of bird movements and habitat selection with respect to physiognomic attributes of coffee habitats and adjacent land use is pivotal to understanding the service's spatial dynamics. Using telemetry, we investigated the movements and habitat selection of 22 black-throated blue warblers (*Dendroica caerulescens*) on two coffee farms in western Jamaica. Birds traveled up to 630 m from the farm perimeter with home ranges varying from 0.14 to 16.77 ha. 47% of locations (N=719) were in uncultivated habitat in or adjacent to the farms; 26% were in shade trees above the coffee layer. A resource selection function demonstrated an increased likelihood of home range establishment closer to forest/farm edges and uncultivated vegetation, and selection for areas closer to shade trees. This implies that birds are most likely to deliver ecosystem services near shade trees and uncultivated, forested habitats.

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ENVIRONMENTAL HETEROGENEITY DOES NOT INFLUENCE THE STRUCTURE OF THE HYBRID ZONE BETWEEN PASSERINA CYANEA AND PASSERINA AMOENA

A cadre of hybrid zones between closely related avian species in the eastern Rocky Mountains / western Great Plains of North America has led researchers to hypothesize that the ecotone between these two habitat types exerts selective pressures that maintain, at least in part, the structure of these zones. We tested this hypothesis by investigating the relationship between the variation in the frequency of hybrid individuals within sampling localities and a suite of environmental variables that encompass the environmental heterogeneity across the hybrid zone between *Passerina cyanea* and *Passerina amoena*. Using a General Dissimilarity Modeling approach, we found that only 6.4% of the variation in the frequency of hybrid individuals was explained by environmental variation. These results are much more compatible with a tension-zone model wherein the relative fitness of hybrid individuals is determined by genomic interactions irrespective of the environmental context, than with a model in which environmental heterogeneity plays an important role in structuring the *Passerina* bunting hybrid zone.

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FLAMMULATED OWL SURVEY RESULTS FROM THREE STUDY AREAS IN SOUTHERN IDAHO IN 2009 AND FUTURE DIRECTIONS FOR COORDINATED SURVEYS IN WESTERN NORTH AMERICA

To improve our understanding of Flammulated Owl habitat use and distribution in Idaho, and to field test a protocol under development by the Western Working Group of Partners in Flight (WWG-PIF) for a coordinated, range-wide survey, we conducted standardized, road-based nocturnal surveys in summer 2009 in three study areas across southern Idaho: the Owyhee Mountains, the Sawtooth National Forest (NF), and the Caribou-Targhee NF. We used a 10-min survey protocol using call-playback methodology that consisted of alternating silent listening and playback time periods. The presence of mature aspen may be an important factor affecting Flammulated Owl presence in all three study areas; specifically, aspen stands adjacent to subalpine fir forests supported especially high numbers of owls on the

Sawtooth NF. Generally, more owls were detected early in the summer (mid-May to mid-June) with detections tailing off in late June and early July; however, detections on the Sawtooth NF were more consistently high. These data add important information to our state-level and regional understanding of this enigmatic species, and will inform planning for range-wide monitoring to be implemented by WWG-PIF.

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USE OF CROSS-FOSTERING TO REAR SALVAGED WILD EGGS OF SAN CLEMENTE LOGGERHEAD SHRIKES

The endangered San Clemente Loggerhead Shrike (*Lanius ludovicianus mearnsi*), endemic to San Clemente Island, CA, has been the subject of a long-term recovery effort. The San Diego Zoo's captive breeding program also rears eggs salvaged from wild nests that were abandoned, predated, or built in unsafe sites. Usually salvage requires artificial incubation and hand-rearing producing chicks with significantly lower survival than parent-reared. In 2009, we developed protocols to cross-foster these eggs under captive females sitting on clutches of similar age. Since we cannot usually identify which parent-incubated egg hatched into which chick, we had to also test whether the cross-fostered chicks could be identified using genetic parental analysis. Eggs were initially placed in our incubators to determine if they were fertile and viable, and then transferred to captive nests. Three wild nests required salvage in 2009, eggs from two clutches were successfully hatched under captives, and the third was successfully returned to a wild nest after it was determined that the female, who initially abandoned, had returned to incubate dummy eggs placed when the clutch was removed.

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MONITORING OF COUPLED ATMOSPHERE-OCEAN SYSTEMS AS A TOOL FOR THE MANAGEMENT OF COASTAL DRYLANDS

In deserts, rain pulses trigger short periods of high resource abundance which are the driving force structuring desert ecosystems. These pulses are to a large extent linked to global atmospheric and oceanic phenomena. To investigate the effect of oceanographic/atmospheric anomalies (ENSO) on moisture pulses along the Pacific coast of Mexico drylands, the average Southern Oscillation Index values were correlated with total annual precipitation for 117 weather stations. The relationship for three separate rainfall signals: winter-spring, summer monsoon and fall precipitation was also analyzed. The results showed a distinct but divergent seasonal pattern: El Niño events tend to bring increased rainfall in above 22° latitude, but tend to increase aridity in the ecosystems of the southern tropical Pacific slope. Because these dryland ecosystems are dependent on rainfall pulses for their renewal, understanding the complex effect of ocean conditions may be critical for their management in the future. Monitoring the coupled atmosphere-ocean system may prove to be important in managing coastal drylands and mitigating the effects of large scale climatic change in the future.

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UNMANNED AERIAL VEHICLES: A BIRD'S-EYE VIEW ON BIRDS

Emerging autonomous unmanned aerial vehicles (UAVs) may have much to offer to the study and management of birds. For numerous applications including population surveys, nest sensing, radio tracking, habitat studies and nuisance bird control, UAVs promise to cut costs, enhance precision, simplify field work, reduce disturbance and risk, and introduce novel data collection possibilities. In this study, a basic hand-launched UAV was assessed as a viable small-scale survey tool. Aerial photographic surveys of migrating Canada geese (*Branta canadensis*) and Snow geese (*Chen caerulescens*) flocks were conducted with the aircraft and compared with ground-based visual

surveys to contrast counts and precision. While the low-profile appearance of Canada geese in addition to camera restrictions compromised their visibility, Snow geese were highly detectable and counts could be facilitated using computerized image analysis. The small aircraft can survey larger flocks in a fraction of the time required to count them from the ground and appears to cause no disturbance of birds. Overall promising results combined with rapid ongoing development of UAV technology and markets warrant further exploration of applications in bird research and management.

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UNDERSTANDING AVIAN-HABITAT RELATIONSHIPS: LESSONS FROM INTENSIVE STUDY OF A SAGEBRUSH PASSERINE

Identifying the habitat features that represent higher quality via enhanced fitness is critical for effective management of avian populations. Theory predicts that evolved habitat preferences should be positively linked to fitness consequences such as nesting success. However, studies of breeding birds often report mismatches between habitat preferences and fitness outcomes. I suggest several alternative explanations for such patterns, derived from comprehensive study of a sagebrush songbird, the Brewer's sparrow (*Spizella breweri*). First, the inclusion of large suites of potentially intercorrelated variables in habitat models, especially those that lack relevance to the ecology of the species, can confound analyses. Intercorrelated variables need to be teased apart via experiments and/or carefully tested predictions so that the ones actually driving patterns are discovered. Second, the spatial scale of analysis is critical; particular resources may be more important at different scales which will also be reflected in the fitness components affected. Finally, plastic responses to environmental variation such as nest predation risk can add complexity to baseline avian-habitat patterns, but nonetheless comprise an important consideration for assessment of important habitat characteristics.

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GENETICS OF HIGH-ALTITUDE ADAPTATION IN RUFOUS-COLLARED SPARROWS (ZONOTRICHIA CAPENSIS)

Here we combine population genetic data with protein modeling analyses to test for adaptive divergence in the gene that encodes the α -subunit of the major adult hemoglobin isoform (α A-hemoglobin) in *Zonotrichia capensis*, a species with an exceptionally broad altitudinal distribution. We sampled 168 individuals from 17 sampling localities that are distributed along three elevational test transects and four latitudinal control transects on the west slope of the Peruvian Andes. We sequenced the entire α A-hemoglobin gene in all of the sampled individuals. Each individual was also genotyped at four nuclear introns and four nuclear autosomal microsatellites. Two amino acid replacements within exon 2 of the α A-hemoglobin gene segregate within populations, and the frequency of these replacements is strongly associated with altitude. α A-hemoglobin gene flow estimates along the control transects were 70 times greater than those estimated along the elevational transects. Gene flow was not similarly reduced for the other nuclear loci. The severe reduction of altitudinal gene flow in the absence of similar reductions for putatively neutral loci is consistent with local adaptation of α -A hemoglobin to different altitudinal environments.

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DOCUMENTING NESTING ACTIVITY AND CAUSES OF NESTING FAILURE IN MISSISSIPPI KITES USING VIDEO RECORDING SYSTEMS

Relatively little information exists regarding causes of nesting failure in Mississippi Kites (*Ictinia mississippiensis*), particularly within the Mississippi River Valley where studies of nesting kites have reported relatively low nest success rates (18 – 42%) compared to those reported for kites nesting in the Great Plains (49 – 76%). To determine factors contributing to this low reproductive success, we located nests within the White River National Wildlife Refuge, eastern Arkansas, during the 2008 and 2009 breeding

seasons. We used infrared time lapse video recording systems to document reproductive success and causes of nesting failures. We located 41 Mississippi Kite nests, 9 (22%) of which successfully fledged one young. We deployed cameras at 17 nests and documented eight nesting failure events. Five of the eight failures were caused by predators; three by black rat snakes (*Elaphe obsoleta*) and two by Barred Owls (*Strix varia*), suggesting that predation may be a primary cause of nesting failure. In addition, our use of cameras at kite nests (mean nest height = 27.4 m) demonstrates the effectiveness of this approach to monitor nesting events of difficult-to-study species.

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ECOLOGICAL AND SOCIAL FACTORS INFLUENCING THE TIMING OF NESTING IN A TROPICAL BIRD

Timing of the first clutch varies among individuals within a population, particularly in tropical species showing less pronounced breeding seasonality. We examined the ecological and social factors influencing the timing of nesting of Red-throated ant-tanagers (*Habia fuscicauda*) in Panama. We studied a population of ~25 pairs from February through July, 2007- 2009. Our goals were to determine 1) whether pairs with access to more insect food start nesting earlier and 2) whether early nesting is associated with higher hatching success. Secondly, we determined male song initiation date and whether this is related to 1st egg date. Over the three years, first clutches were initiated within the first 6 weeks of the breeding season. Females that laid earlier had a diet higher in insects and lower in fruit (as measured by blood $\delta^{15}N$), but hatching success was not related to 1st egg date. Preliminary data indicate that male song initiation does not predict their mate's 1st egg date, and we are currently investigating the role of song output and testosterone in mating success.

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PHYLOGEOGRAPHY OF A WIDESPREAD NORTH AMERICAN WOODPECKER: PICOIDES VILLOSUS

The Hairy Woodpecker (*Picoides villosus*) is the most geographically widespread and morphologically variable of all North American woodpeckers. Both of these features make it a prime candidate for phylogeographic study. We studied 300 individuals from throughout the species' range, with 15 of 17 widely recognized subspecies represented. Analysis of mtDNA ND2 sequence data revealed two shallow but well defined clades. Clade A is comprised mostly of birds from the Eastern US and Canada; whereas, Clade B represents Pacific Coast, western montane (US and Mexico), and Central American populations. Clade A is genetically depauperate, consistent with recent expansion into much of eastern and northern North America. In contrast, populations in Clade B are highly structured genetically, suggesting a longer period of occupation and greater population stability in western and southern regions. Members of these clades meet and introgress extensively in the Pacific Northwest, providing a likely explanation for the observed cline in plumage coloration in this region. Overall, the mtDNA data did a poor job explaining the dramatic shifts in size and plumage color within this species. Additional analysis with faster molecular markers is warranted.

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PHYLOGEOGRAPHY OF THE SAGE SPARROW (AMPHISPIZA BELLI): MICROSATELLITE AND GIS ANALYSES

We present results from ongoing studies of three subspecies of Sage Sparrow (*Amphispiza belli*) that breed in the continental United States. Previous

work shows strong differences among subspecies in size, plumage color, migratory tendency, habitat preference, allozymes, and mitochondrial DNA. Furthermore, changes in phenotype, mtDNA, and environment occur sharply where *A. b. nevadensis* and *A. b. canescens* contact in Owens Valley, eastern California. We expanded on earlier studies by analyzing 10 microsatellite loci for 494 individuals from 29 populations, and by using point locality data from ORNIS (<http://ornisnet.org>) to model bioclimatic niches among subspecies and mtDNA haplotypes. Analysis of microsatellite data using the program Structure resulted in the lowest likelihood score for $k=3$ populations, and patterns of genotype-phenotype assignment were fairly congruent with mtDNA variation. One interesting difference between the mtDNA and microsatellite results is the apparent greater geographic extent of *A. b. canescens* introgression with *A. b. belli* and *A. b. nevadensis* when the genome is considered as a whole. GIS-based analysis revealed environmental niche differences that are broadly congruent with the current subspecific designations, molecular evidence and ecology.

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 ORNIS: CURRENT STATUS, RESEARCH USES, AND FUTURE DIRECTIONS

ORNIS (<http://ornisnet.org>) is one of several distributed data networks for vertebrates that have greatly facilitated research on phylogeography and systematics, species distribution modeling, emerging diseases, impacts of climate change, and conservation. These networks provide a single portal for querying masses of data across institutions, and apply standardized georeferencing methods to localities for spatial analysis. The success of ORNIS far surpasses what was originally envisioned when funded by the National Science Foundation in 2004. Initially proposed for 29 institutions, ORNIS currently contains 45 data providers that serve over 4M specimen/ audio and 50M observational records. Georeferencing, which is in progress, has used recently developed tools (BioGeomancer, <http://www.biogeomancer.org/>) to efficiently and collaboratively assign coordinates to localities, with a focus on North America. As a next step to secure the future of ORNIS and the other taxon-based networks (HerpNet, MaNIS, FishNet2), an umbrella consortium (VertNet, <http://vertnet.org>) was formed to unite and maintain these projects, add new members, capitalize on economies of scale, and develop integrated online technologies. Plans include soliciting additional community involvement, enhancing the portal, and developing a dynamic cache for better performance.

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 TRACKING BIRDS MIGRATING AT NIGHT THROUGH AN URBAN-RURAL CORRIDOR AND QUANTIFYING THE EFFECTS OF LIGHT AND NOISE POLLUTION

Many migratory bird species are in serious decline. Understanding how birds assess and use increasingly large, brightly lit, and noisy cities as they travel through urban landscapes and encounter tall buildings, towers, and aircraft is essential to their conservation. However, little is known about how birds evaluate the obstacles presented by cities during migration, which generally occurs at night and is confounded by ubiquitous, yet highly variable, light and noise pollution. We test a novel approach to tracking birds migrating through an urban-rural corridor and quantifying the effects of light and noise pollution on such migration. We recorded nocturnal flight calls at multiple sites along an urban-rural corridor from New York City north and simultaneously collected data on measures of light and noise. Some studies suggest that birds are drawn to brightly lit areas and that bird density is artificially increased in cities. Consistent with these studies, we documented more nocturnal flight calls in brighter, noisier locations than in nearby quieter, darker green spaces. These higher calling rates may reflect increased confusion of birds in noisy urban environments.

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 HABITAT CONDITION, PTILOCHRONOLOGY AND WATERBIRDS: A TALE OF TWO ESTUARIES.

The use of focal species in determining the condition of a habitat is a growing trend in conservation and management. In coastal-marine environments, bioindicators have been identified as the most ecologically relevant focal species for guiding coastal estuary monitoring programs. Colonial waterbirds have long been used as bioindicators due to their intimate connection with the hydrologic regime and central place foraging at breeding locations. Population-level observations are frequently used for monitoring the health of near-shore habitats utilized by waterbirds, however these data are often limited to indicating that change has taken place and lend little predictive power to causality. Individual-level observation may serve as a more useful tool for identifying the proximate factors leading to population-level fluctuations. Attributes of the individual that can accurately represent the threat associated with change are useful bioindicator tools and, when coupled with population-level data, may serve useful for ecosystem monitoring. I propose using the relatively novel approach of ptilochronology to determine the nutritional health of nestling waterbirds in two locations of drastically different environmental qualities. When coupled with observations of diet, intestinal parasite-load and nest-site interactions, ptilochronology may accurately reflect local foraging habitat health and further strengthen the use of waterbirds as bioindicators of coastal estuary condition.

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 CORRELATES AND CONSEQUENCES OF BREEDING DISPERSAL IN THE BLACK-THROATED BLUE WARBLER

Our knowledge of breeding dispersal patterns in migratory songbirds remains limited, despite decades of ecological work. We analyzed the ecological causes and consequences of adult dispersal for black-throated blue warblers (*Dendroica caerulescens*) breeding at the Hubbard Brook Experimental Forest, New Hampshire, from 1998 – 2008 ($n = 426$). Female dispersal distances (mean = 235 m, SE = 23) were significantly greater than male's (mean = 151 m, SE = 11). Dispersal distance was not correlated with age in females, whereas older males moved less between years than yearling males. Female dispersal significantly correlated with annual reproductive success: individuals with low annual fecundity dispersed significantly farther between years than did individuals with high fecundity. Male dispersal behavior was most influenced by habitat quality. Males on low-quality territories dispersed farther between years than males on high-quality territories. Contrary to our expectations, female fecundity was unrelated to dispersal distance. Males that moved shorter breeding dispersal distances, however, tended to fledge more offspring. Our results suggest that the cues and selective pressures that shape dispersal decisions in *D. caerulescens* differ by bird sex and age.

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 COUPLED AVIAN-HUMAN INTERACTIONS IN URBAN AREAS

Contact between humans and other animals can create positive or negative outcomes and these interactions can be quite numerous in urban areas. In particular, many avian species appear to have adapted to living in cities among high densities of humans. Here we explore the relationship between humans and birds (corvids and small songbirds) in Berlin, Germany by surveying residents' attitudes and actions concerning birds and then testing bird behavior towards humans (flight distances and foraging behavior). We found that humans vary in their encouraging actions (e.g., feeding) depending on their age and if they own their home. Furthermore, due to demographic differences across sites, encouragement of birds was higher in suburban and outlying areas compared to the city center and in high-rise apartments. Discouraging actions were not prevalent. Bird behavior did not vary due to level of encouragement by humans; rather, behavioral responses differed due to human density and habitat type (e.g., degree of vegetation).

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SUBADULT PLUMAGE OF YEARLING FEMALE TREE SWALLOWS MAY SIGNAL FEMALE QUALITY AND MALE REPRODUCTIVE INVESTMENT.

There is currently much interest in the signaling potential of avian plumage, and in particular the ultra-violet (UV) component which is invisible to humans but within the visual space of diurnal birds. Female tree swallows (*Tachycineta bicolor*) entering their first breeding season (yearlings) display a brown, subadult plumage that is thought to function in reducing conspecific aggression; however, to date its reflective properties have never been examined. We measured the spectral reflectance of yearling female subadult plumage within the avian visible range and found that females with higher UV-reflectance were in better condition during the breeding season and raised young that were heavier at fledging. Also, females with longer wavelength hues and high values of red chroma (i.e. browner) raised young that were heavier at fledging than those with hues at shorter wavelengths and lower red chroma. These yearling females were also mated with males that fed their young more frequently which may suggest that they are assessing female quality based on the plumage characteristics of yearling females, and increasing their reproductive effort in response to this assessment.

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HIGHGRADE LOGGING AND NEST-SITE LIMITATION IN CAVITY-NESTING BIRDS OF A THREATENED SUBTROPICAL MOIST FOREST

Highgrade logging is a widespread anthropogenic disturbance that removes the economically valuable trees in many tropical rainforests, perhaps reducing cavity availability below a critical threshold for cavity-nesting birds. From 2006 to 2009 we assessed the availability and occupancy of natural cavities and conducted a BACI nest box addition experiment to determine whether nest sites were limiting for cavity-nesting birds in primary and logged Atlantic forest in Argentina. Logged forest had half the basal area and 9 times fewer cavities, compared to primary forest. Birds occupied only 25% of cavities overall, but 80% of cavities 55-100 cm deep. The density of breeding pairs increased in both logged and primary forest after nest box addition. Nest site availability appears to limit breeding density for at least some species of secondary cavity-nesters, even in primary forest. Conventional logging reduces breeding density further by removing key nest sites. We recommend preserving the largest live trees >100 cm diameter in logged forest and agricultural areas.

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SPECIES THAT BREED AT MULTIPLE ELEVATIONS: DOES THE RELATIONSHIP BETWEEN SPRINGTIME TEMPERATURE AND LAYING DATE VARY AMONG ELEVATIONS?

We examined whether the relationship between pre-laying temperature and lay initiation date varied across years for populations of passerine species breeding at different elevations. We analyzed data for Mountain Chickadees nesting in two forest types (low and middle elevations) and Dusky Flycatchers nesting in three (low, middle, high). For both species in all forest types, lay initiation date and May temperatures were negatively associated. Of the models tested that related regressions of lay initiation date on temperature at different elevations, the model that assumed that both the slopes and intercepts of the regressions differed was most supported for both species. In Mountain Chickadees the higher-elevation population bred at colder temperatures in years with comparatively cold springs rather than breeding later in the season when temperatures were greater. The relationship of middle- versus high-elevation Dusky Flycatchers was the same. However, comparing Dusky Flycatchers at low- versus middle-elevations, middle elevation populations bred comparatively later in colder years. Overall,

populations at lower elevations appear to be under less pressure to initiate breeding earlier at colder temperatures than those at higher elevations.

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MOVEMENT ECOLOGY OF RED-EYED VIREOS (VIREOS OLIVACEUS) DURING SPRING STOPOVER

Migrants have to balance the immediate need to move to access food resources while having little information about the predation risk from avian predators attracted to movement. We conducted an experiment to simulate the arrival of nocturnal migrants at unfamiliar stopover sites and followed their movement from the initiation of stopover. We translocated red-eyed vireos (*Vireo olivaceus*) with varying fuel reserves and released them before dawn in three habitat types in two sites and followed them continuously throughout the day. We translocated 49 red-eyed vireos during April and May of 2007 (n=17) and 2008 (n=32) into hardwood (n=17), mixed (n=15) and pine habitat (n=17). Arrival energetic condition, time of season, landscape, habitat type, and minimum daily temperature all influenced initial movement rate and linear displacement. We also found evidence for temporal variability in the factors influencing movement during stopover. The mean stopover period was 2.81 ± 1.94 days (n=44) and decreased as energetic condition, time of season, and minimum daily temperature increased. Our results suggest that internal state as well as environmental conditions influence movement decisions during stopover periods.

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AN ANALYSIS OF THE BLACK-CAPPED VIREO NEST PREDATOR ASSEMBLAGE

Predation is a primary limiting factor of nest success, including for federally endangered black-capped vireos (*Vireo atricapilla*) that breed in central and southwest Texas. However, little information exists about nest predators across the range of an endangered species, especially on private lands, a primary focus area for future recovery efforts. In 2008 and 2009, we identified nest predators across the black-capped vireo range on private properties in Coryell Co., TX and public properties in Val Verde Co. (2009 only) & Kerr Co., TX. We used continuous recording digital video cameras with infrared light to record predation events. We also collected vegetation and concealment data at each nest. We monitored 114 nests and documented >37 predation events by >10 predator species. Overall, snake spp. (n=11) and brown-headed cowbirds (*Molothrus ater*; n=9) were the most frequent nest predators identified; however, major predator species varied by location. Vegetation and concealment did not affect the risk of predation. Our results will further our understanding of nest predator assemblages on public and private land, leading to increased effectiveness of future recovery efforts for black-capped vireos.

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FACTORS INFLUENCING INTRASPECIFIC VARIATION IN THE DEGREE OF HATCHING ASYNCHRONY IN BURROWING OWLS

The function of hatching asynchrony in birds has been the topic of much debate. Different species of birds have been categorized as either having synchronous or asynchronous hatching, whereas variation among individuals within a species has been relatively ignored. In reality, the degree of hatching asynchrony is a continuous rather than a discrete trait that can vary among individuals. Environmental variation is a key component of most hypotheses proposed to explain the evolution of hatching asynchrony. However, most studies of HA have focused on brood manipulations and relatively few have

examined the factors associated with individual variation in the extent of HA. We monitored burrowing owls (*Athene cunicularia*) nesting in artificial nest boxes in the Imperial Valley of California to document variation in laying chronology, onset of incubation, and degree of hatch asynchrony. We also examined the factors that influenced the degree of hatching asynchrony. Laying interval, onset of incubation, and degree of hatching asynchrony all varied widely among females. Breeding date and clutch size both influenced the degree of hatching asynchrony in Burrowing Owls.

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USING RAPID ASSESSMENT OF FOREST BIRDS TO COMPARE CONSERVATION POTENTIAL OF COFFEE FARMS: EXAMPLES FROM CENTRAL AMERICA

Coffee cultivation coincides with some of the most biologically-rich areas on earth, forested foothills in the tropics. Providing an incentive for landowners to preserve a portion of these farms as undisturbed forest - and developing incentives for consumers to select coffee from these farms - represents a market-based approach to preventing catastrophic loss of species and biodiversity here. We compare results of bird surveys from clusters of coffee farms in three regions of the Pacific foothills of Mexico and Central America to assess the ability of these properties to retain forest-dependent, endemic and threatened bird species. Properties in Chiapas (Mexico) supported the fewest endemic and extinction-prone species, while those in Panama held the highest numbers of each, collectively supporting 25 endemic bird species. We highlight the role of farms in Chiapas in maintaining populations of forest-dependent birds otherwise extirpated from the landscape, and reveal how consumer demand for boutique coffee is driving land-use practices that are degrading endemic-rich forests in Chiriqui, Panama.

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"CHICK-A-DEE" CALLS OF TUFTED TITMICE CONVEY INFORMATION ABOUT PREDATOR SIZE AND THREAT

The alarm calls of chickadees (*Poecile* spp.) are known to convey information to conspecifics about predator size and degree of threat. Little is known, however, about the information conveyed by the similar 'chick-a-dee' calls of Tufted Titmice (*Baeolophus bicolor*). During the winters of 2008 and 2009, we presented flocks ($N = 8$) of free-living titmice with mounted specimens of several raptors that varied in size and degree of threat. Smaller, higher-threat predators, such as the Eastern Screech-Owl (*Megascops asio*), elicited longer mobbing bouts and more D-notes per unit time than larger, lower-threat predators, such as the Red-tailed Hawk (*Buteo jamaicensis*). Like chickadees, Tufted Titmice appear to use their 'chick-a-dee' call to provide conspecifics with information about predator size and degree of threat. Titmice, however, appear to convey that information by varying the total number of notes given per unit time rather than the number of notes per call. Compared to chickadees, titmice also exhibited a greater response to larger raptors, perhaps because their larger size makes them more vulnerable to predation by such raptors.

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Blancher, P. J., Environment Canada, Ottawa, Canada, peter.blancher@ec.gc.ca MAPPING BIRD CONSERVATION PRIORITIES AT THE CONTINENTAL LEVEL

Policy-makers and land managers require scientifically rigorous information at a variety of scales in order to set policy direction and to make prudent environmental management decisions. Partners in Flight is currently identifying conservation priorities for landbirds at the scale of the North American continent. This 'big picture' approach is very useful for emphasizing the interconnectedness of North American avifauna and the importance of international cooperation to its conservation. Maps are an integral component of this approach, due to their ability to synthesize large volumes of information and present it in a simplified form. As part of the Partners in Flight Species Assessment process, we developed mapping and analysis techniques capable of handling the several thousand bird species contained

in NatureServe's database of bird range maps of the Western Hemisphere. Key products include maps that depict the overlap of neotropical migrants with Mexican residents in winter, identify key linkages among countries, and describe general patterns of avian diversity at the continental scale.

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DIFFERENCES IN THE ENERGETIC CONDITION OF BLACKPOLL WARBLERS BY SEASON AND LOCATION

We evaluated the condition of Blackpoll Warblers (*Dendroica striata*) during stopover to investigate possible differences between spring and fall migration and differences based on coastal proximity. In our initial analysis we used data from two inland and two coastal stopover sites. During spring blackpolls had higher average fat scores, average mass, and average condition index than during fall at all sites ($p < 0.001$). Additionally, both males and females had a higher mass and condition index during spring than fall at three of the four stations. At one inland site however, only males had a higher condition index during spring ($p < 0.05$). These results indicate that this pattern of better condition during spring than fall may be typical of northern stopover sites.

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POST-FLEDGLING MOVEMENTS OF RED-BELLIED WOODPECKERS IN A FRAGMENTED LANDSCAPE

Natal dispersal may be the key to healthy metapopulations in many resident avian species, as it is often the only time individuals make substantial movements from one territory to another. However, little is known about the temporal, spatial, and social factors affecting dispersal. We investigated foray and home range movements in post-fledgling Red-bellied Woodpeckers (*Melanerpes carolinus*). We radiotagged sixteen woodpecker nestlings between May and July 2009 in central Missouri and tracked movements away from natal areas. We tested for the effects of landscape structure and composition on forays by comparing land cover within movement paths to random paths. Parents demonstrated brood splitting within three days of fledge. Estimated natal home range size was 11.6 ± 5.48 Ha ($N=7$). Juveniles made repeated forays from the natal area prior to dispersal. Mean foray distance was 0.9 km ($N=17$) with a duration range of 54-150 minutes before returning to the natal territory. Juvenile Red-bellied Woodpeckers followed forested corridors when moving through fragmented habitats, demonstrating the importance of habitat connectivity to dispersing juvenile resident birds.

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EXPLAINING VARIATION IN NEST SURVIVAL RATES VIA PREDATOR IDENTIFICATION

Nest survival rates can vary in time and space because of differences in predator communities and activity. We identified predators ($N = 98$) at nests of forest passerines in the Midwest to explore sources of variation in nest survival among nesting guilds, between nest stages (e.g. incubation and nestling periods), and for other nest attributes (e.g. nest height) known to influence predation risk at our study sites. By contrast with shrub nesting species, Acadian Flycatchers (*Empidonax virens*), a sub-canopy nesting species, did not suffer predation from large mammals (e.g. raccoons) and tended to have a lower risk of predation from snakes. For all species, predation risk from raptors during incubation was significantly lower than during the nestling period, but no other predator guild exhibited a similar pattern. Predator abundance and activity are important factors that affect variation in predation rates between species and nest stages. Identifying predators may help explain other patterns in nest survival as well, can inform conservation actions, and can contribute to our understanding of the evolution of life history traits.

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THE SINGING BEHAVIOR OF THE NEW ZEALAND GREY WARBLER (*GERYGONE IGATA*).

This study was undertaken to investigate the previously undescribed singing behavior of male Grey Warblers. The Grey Warbler is a small New Zealand song bird that occupies both native as well as non-native forests. All recordings used in this study were recorded in Kowhai Bush, a native forest on the east coast of South Island, New Zealand. The recordings, made 1981-1984, were digitized and analyzed using the program RAVEN. Each male sang two song types. One song type consisted of a series of simple introductory notes followed by two complex phrases (phrase A and phrase B) which were alternated until the male stopped singing. The second song type began with the same introductory phase followed by a much shorter phrase that was repeated 6-8 times. Evidence suggests that the two song types are used in different contexts. For each male recorded, song types were highly stereotyped over several years. All males recorded in Kowhai Bush sang very similar song types and these song types were structurally different from those sung in other geographical locations suggesting the presence of dialects.

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TEMPORAL CHANGES IN MORPHOLOGY ACROSS A SHIFTING CHICKADEE HYBRID ZONE

Geographically shifting hybrid zones provide excellent opportunities to investigate the dynamics of interbreeding. I used data spanning a decade from four southeastern Pennsylvania sites to examine the degree to which morphology has shifted in concert with genetic changes among hybridizing Carolina Chickadees (*Parus carolinensis*) and Black-capped Chickadees (*P. atricapillus*). Field study and genetic analyses have shown that to date Carolina and Black-capped chickadees occur exclusively at Great Marsh and Tuscarora State Park respectively (80 km apart). Size and shape of breeders at geographically interjacent Nolde Forest have changed from intermediate, but variable, values to averages that have become indistinguishable from those of Carolina Chickadees at Great Marsh, although the Nolde population continues to consist predominantly of hybrids. Morphology of resident chickadees at Hawk Mountain overlaps with that of Black-capped Chickadees at Tuscarora, but shifts toward Carolina measurements at Hawk Mountain are evident, coincident with increases in the percentage of hybrids in that population. Causes of the northward shift of this hybrid zone remain undetermined and genetic structure is complex, but morphological evidence supports clear and rapid movement.

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PAIR DUETS ARE A COOPERATIVE ENDEAVOR IN YELLOW-NAPED AMAZONS

Duets are coordinated signals typically given by a mated pair. Two primary functions hypothesized for duets are: 1. Duetters cooperate for the same shared goals, as in resource defense, or 2. Duets are conflict-based, as in mate-guarding. Yellow-naped amazons (*Amazona auropalliata*) duet with their mates on nesting territories in what we hypothesize is cooperative territory defense. We examined duet function via a playback experiment that contrasted pair responses to three treatments: I. standard duets (male and female calls), II. Female monets (female calls only) and III. Male monets (male calls only). We predicted that if duets had a conflict-based function then individual members of the pair would respond most aggressively to same-sex monets (ex. male responds more to male monets). In contrast, we predicted that if duets had a cooperative territory defense function then both pair members would respond the same to all treatments, or respond more to duet treatments. Pairs responded to playbacks by approaching the speakers and giving growls (an aggressive call type), and there were no differences among treatments. These results are consistent with a cooperative function.

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THE PEACOCK'S IRIDESCENT EYESPOTS: MALE ORIENTATION DURING COURTSHIP INFLUENCES FEMALE CHOICE.

The brilliantly-colored iridescent train of the peacock is a remarkably complex sexual signal. We previously showed that displaying peacocks orient their erect trains at about 45° to the right of the sun's azimuth when courting females, and that they attempt to manipulate the position of female observers. Here, we investigate female choice for male plumage colors seen by females at this display orientation. We show that peacocks with brighter eyespot iridescence, illuminated at 45° to the feather surface, mate with more females. Together with an experiment where we manipulated eyespot colors, this finding suggests that females prefer males with brighter iridescent eyespots. We also test several hypotheses for the function of the 45° orientation using models of peafowl color perception, and show that it maximizes the contrast that females perceive between adjacent color patches in the eyespot. Thus, peacock courtship displays maximize the impact of a sexual signal in a way that influences female choice. Our results underscore the importance of considering presentation behavior, in addition to trait measurements and perceptual models, in the study of sexual signals.

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MOISTURE REDUCTION AS A MECHANISM FOR THE ANTIMICROBIAL EFFECTS OF AVIAN INCUBATION

Microbial infection of eggs is a major source of mortality for embryos of many oviparous organisms, and water is essential for microbial growth and penetration into the egg contents. Recent studies have shown that incubation dramatically lowers bacterial load on shells; however, the mechanism for this inhibition is unknown. We hypothesized that the inhibitory effects of incubation are achieved through reduction of moisture on egg surfaces. We experimentally tested this hypothesis in two ways. First, we placed the first- and second-laid eggs of tree swallow clutches in unincubated holding nests with either ambient or increased moisture for five days, and then returned them to their original nest for incubation. Eggs in wet nests had higher bacterial growth on shells than eggs in ambient nests, and both had higher growth than naturally partially incubated controls. Second, we measured water loss of wet artificial eggs subjected to natural incubation. We found that incubated eggs lost almost three times as much water as unincubated artificial eggs. Together these findings suggest that moisture reduction is a critical component of the antimicrobial effects of incubation.

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PARTIAL HARVESTING AND ITS EFFECTS ON DENSITY, PRODUCTIVITY AND FOOD PROVISIONING IN THE BROWN CREEPER (*CERTHIA AMERICANA*)

Many species show a numerical or behavioural response to forest harvesting, even at moderate intensity. The Brown Creeper is among the songbird species most sensitive to partial harvesting in North America. We have studied its response experimental single-tree selection (30-40% basal area removal) by comparing nest density, productivity, food provisioning at the nests, and predator abundance between treatments and controls. Nest density was 35% lower in treated sites, whereas productivity (number of young fledged) was nearly two times lower. Preliminary data show that the number of feeding trips per unit time is lower in treatment plots than in controls owing to the lower density of large-diameter trees. Invertebrate biomass/m² of bark did not appear to vary according to treatment. There was no apparent treatment effect on the abundance of potential nest predators (squirrels and chipmunks). However, fledging success was clearly linked with the abundance of predators.

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STRESS LEVELS AND CAROTENOID ORAMENTATION IN COMMON REDPOLLS

Indicator models of sexual selection suggest that ornamental traits, such as brilliant plumage, reliably signal quality because they are often condition dependent and costly to produce. We investigated relationships between carotenoid-dependent plumage in Common Redpolls (*Carduelis flammea*) and various measures of quality and condition, including level of corticosterone in feathers. Signal intensity was estimated using a composite measure of hue, saturation and size of red patches on the breast and rump. After controlling for sex, birds with lower levels of corticosterone were in significantly better body condition. Among females and young males there was no relationship between red signals and levels of feather corticosterone; however, levels of feather corticosterone in adult males increased significantly with the degree of expression of red signals. We found that adult males, which had the largest red signals, had significantly lower corticosterone levels than females. We interpret these findings in light of the stress of social dominance and sexual selection theory.

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INBREEDING AND IMMUNE FUNCTION IN GREAT FRIGATEBIRDS

Inbreeding depression is a widely documented phenomenon that can affect growth, survival, and reproduction. Although inbreeding can lead to homozygosity at genes of the major histocompatibility complex, relatively little is known about how often inbreeding actually causes reduced immune function in wild animals. As an indirect measure of inbreeding in the great frigatebird (*Fregata minor*), a long-lived species for which pedigree data are not available, we used 12 microsatellite loci to measure genetic similarity between parents, mean heterozygosity of nestlings, and mean size difference between alleles of nestlings. To assess the immune function of nestlings, we measured the swelling response to PHA injection, the capacity of natural antibodies to agglutinate rabbit erythrocytes, and the capacity of adaptive antibodies to agglutinate sheep erythrocytes after an initial exposure. Analyses show no relationship between inbreeding and these measures of immune function. In-progress analyses are examining inbreeding in relation to the ability of plasma to kill an unfamiliar strain of non-pathogenic *E. coli* and in relation to measures of nestling growth and nestling parasite load.

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SEASONAL DECLINE IN CLUTCH SIZE: A TEST OF SIX ALTERNATIVE HYPOTHESES

SEASONAL DECLINES IN CLUTCH SIZE: A TEST OF SIX ALTERNATIVE HYPOTHESES. K.L. Decker and C.J. Conway, USGS Arizona Cooperative Fish and Wildlife Research Unit, University of Arizona, USA. Seasonal declines in clutch size are common in birds, but the mechanisms underlying this pattern remain largely unknown despite extensive research on the subject. We simultaneously tested six hypotheses proposed to explain declines in clutch size throughout the breeding season: female age, nest predation (a fixed response), nest predation (a plastic response), female condition, food for egg production, and food for young. We used a combination of experimental and observational tests and found support for 3 of these mechanistic hypotheses. Seasonal change in the average age of breeding females, seasonal decline in the availability of food for nestlings, and a plastic response by females to reduce clutch size in re-nests after a depredation event all appear to contribute to the observed seasonal declines in avian clutch size. Our results highlight the importance of testing multiple hypotheses simultaneously to elucidate the ecological processes underlying commonly observed patterns in life-history traits.

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BUILDING INTERNATIONAL CAPACITY FOR BIRD CONSERVATION IN MEXICO - THE POWER OF REGIONAL PARTNERSHIPS

Effectively addressing many of the highest North American bird conservation priorities will require focused international attention on ecological and socio-political factors influencing birds and their habitats in Mexico. Several relatively new international collaborations are helping improve the capacity for bird conservation in Mexico by coordinating efforts of partner organizations, leveraging and directing resources towards common goals, promoting awareness and political support, and advancing partnership approaches modeled after successful efforts elsewhere in North America. At the heart of these collaborations is the acknowledgement that successful conservation of North American avifauna must be grounded in principles of full life-cycle stewardship, and must address species sustainability issues at landscape scales. While there is an emphasis on building functional capacity within Mexico to better address long-term bird conservation challenges, this is a tenuous goal as most of these initiatives are only just becoming established. Success and expansion of these initiatives, and the ultimate conservation of birds in Mexico demands sustained commitment and support from international partners.

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TRACKING FALL TRANS-GULF MIGRATION OF SONGBIRDS VIA AUTOMATED RADIO-TELEMETRY

Many fundamental questions regarding how small migratory birds traverse geographic barriers remain unanswered. We radio-tagged 22 Swainson's Thrushes, 25 Gray Catbirds, and 9 Red-eyed Vireos in Alabama during fall 2009. In the first three weeks of monitoring, we have successfully tracked three thrushes from Alabama to the Yucatan Peninsula using three Automated Radio-telemetry Units (ARUs) in southern Alabama and seven ARUs along the northern extent of the peninsula. Flight durations ranged from 22-29 hrs (mean=24.8); birds left Alabama between 18:00-19:30 hrs and arrived at the peninsula between 16:00-24:00 hrs. Thrushes arriving in the Yucatan Peninsula departed Alabama in a range of directions (162-214 degrees), and an individual following a "western" route across the gulf had the longest flight. For birds departing in the direction of their arrival location, ground speed was 44.1km/hr. Arrival locations in the peninsula were 173-182 degrees from their origin, suggesting that birds' true arrival locations on the other side of the gulf can be quite different than predicted from their departure directions, likely due to wind conditions. These results offer valuable insight into understanding trans-gulf flights.

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FIRST-YEAR SURVIVAL IS AN IMPORTANT DRIVER OF POPULATION DECLINES IN MIGRATORY LANDBIRDS

We assessed the importance of productivity, recruitment, and adult survival in driving BCR-scale spatial variation in MAPS population trends for 28 species of Nearctic-Neotropical migratory landbirds. We estimated trends (time-constant lambda), adult apparent survival rates, and recruitment rates from capture-recapture models; and indexed productivity from constant-effort capture data. Productivity was important in driving recruitment and trend for just 9 species, while recruitment was important in driving trends for 25 species, implicating the major importance of first-year survival. Adult survival was important in driving trends for 10 species. Species for which first-year survival was important tended to have declining trends, species for which adult survival was important tended to have stable trends, and species for which productivity was important tended to have positive trends. These results indicate that enhancing survival (especially first-year survival) will be important for slowing declines and stabilizing populations, while enhancing productivity may be necessary to recover populations whose declines have been arrested. We conclude that identifying relationships between vital rates and winter habitat and weather will be critical for migratory bird conservation.

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RESPONSE OF WINTER SPARROWS TO A SEED MANIPULATION EXPERIMENT

Seed abundance and diversity likely plays a large role in winter avian community composition and site selection. We tested the hypothesis that avian abundance and community composition would be influenced by the abundance and diversity of seed within open and shrub encroached grasslands in New Mexico. Our experiment was designed with four treatments (A, B, D, E) and two variables: seed diversity and seed amount, and a control. Treatment A was a five seed mixture applied at a rate of 20 kg ha⁻¹. Treatment B was the same mixture at a rate of 40 kg ha⁻¹. Treatment D was 20 kg ha⁻¹ of sand dropseed. Treatment E was 40 kg ha⁻¹ of sand dropseed. In open grasslands, birds exhibited a strong response to seed abundance and diversity with the highest avian abundance on plots with the most seed. In shrub encroached grasslands, the relationship was less clear and avian response was not related to seed abundance or diversity. Avian community composition was similar between years within grassland types but was more diverse in the shrub encroached grasslands.

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A REVIEW OF ECOSYSTEM SERVICES PROVIDED BY SCAVENGING BIRDS

Carrion use by birds is more prevalent than generally assumed, and, rather than a curiosity of behavior, is a key ecological process with important implications for ecosystem services. By rapidly consuming animal carcasses produced in various habitats, scavenging birds limit the spread of diseases and help regulate populations of mesocarnivores and commensal rodents. Although Old-World and New-World vultures are best adapted to use carrion, other avian taxa also scavenge to some extent. The costs and benefits associated with carrion use have influenced the evolution of scavenging behaviors in birds, resulting in a continuum of facultative scavengers that use carrion to varying degrees. Although the recent rapid decline in Indian vultures resulted in obviously detrimental ecosystem-wide phenomena (i.e., population explosions in dogs and rats), ecological relationships between avian scavengers, mammalian scavengers, decomposers, and carrion availability and abundance are poorly studied overall. A deeper understanding of carrion use by birds will improve our knowledge of many ecosystem processes, including those benefiting humans.

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DYNAMICS OF MYCOPLASMA CONJUNCTIVITIS IN HOUSE FINCHES

The epidemic of mycoplasma conjunctivitis caused by a novel strain of *Mycoplasma gallisepticum* (MG) began in 1994 in eastern North America and caused a considerable reduction in eastern House Finch *Carpodacus mexicanus* abundance. The pathogen spread westward and has now reached southern California. Among native house finches in western North America disease prevalence is lower than in eastern populations and the impact on house finch numbers seems to be minor. Using a common garden experiment we tested two hypotheses to explain the different impact of the epidemic in east and west: (1) native western House Finches are genetically more variable and therefore on average more immunocompetent than the genetically bottle-necked eastern populations; (2) MG has evolved lower virulence as it spread into the west. Although western house finches are genetically more variable than eastern birds they responded similarly to MG infection. The original eastern MG isolate impacted house finches more severely than a western isolate. The differences in the epidemic characteristics are probably mainly caused by changes in MG virulence as it evolved temporally and geographically

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WINTER FORAGING ECOLOGY OF RUSTY BLACKBIRDS IN THE SOUTH CAROLINA COASTAL PLAIN

I studied the foraging ecology of Rusty Blackbirds (*Euphagus carolinus*) during three winters, 2006-2009, in the coastal plain of South Carolina as part of a longer-term project to assess foraging and roosting behavior, habitat characteristics, diet, and hydrological preferences. While sufficient data for meaningful quantitative analysis has not been gathered thus far, I have observed and documented previously undescribed foraging techniques and food items. Such observations include multiple-site verification of Rusty Blackbirds: feeding upon free-swimming mosquitofish (*Gambusia* spp.), feeding upon earthworms on flooded lawns after rain events, plunge-diving for minnows (videotape obtained), feeding upon standing corn in flooded waterfowl impoundments, feeding upon dried sugarberries (*Celtis laevigata*), feeding upon Chinese tallow (*Triadica sebifera*) berries, and feeding upon small fish and aquatic invertebrates in recently drained impoundments. Results to date indicate that Rusty Blackbirds in the South Carolina Coastal Plain feed upon vertebrate prey (principally small fish) more than previously suspected, are moderately frugivorous in winter, benefit from fluctuating water levels in wooded wetlands and impounded wetlands, and benefit from certain human activities that produce crushed acorns, pecans and other nuts.

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SURVIVAL OF JUVENILE SAN CLEMENTE SAGE SPARROWS ON SAN CLEMENTE ISLAND, CALIFORNIA

The San Clemente Sage Sparrow (*Amphispiza belli clementeae*) is a federally threatened subspecies endemic to San Clemente Island, California. Critically low population levels were attributed to habitat degradation and predation by non-native mammals. A recent population viability analysis suggested that low juvenile survival and increased drought frequency could result in risk of extinction approaching 99% over 50 years. During the summer of 2009, we conducted the first year of radio telemetry to directly investigate if low survivorship estimates based on mark-resight data were accurate.

We attached 60 transmitters to juvenile Sage Sparrows, monitored them for 1,043 transmitter days, and documented 6 confirmed mortalities. All mortalities were attributed to predation. Predators included American Kestrels (*Falco sparverius*), black rats (*Rattus rattus*), and the endangered San Clemente Loggerhead Shrike (*Lanius ludovicianus mearnsi*). When extrapolated over a year, we found that estimates of annual juvenile survival from known-fate data were low (12%) and supportive of survival estimates from 2003–2008 mark-resight data (11%). These findings will assist us in understanding the population and developing plans to recover the species.

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HOST SPECIFICITY OF BLOOD PARASITES IN AFRICAN BIRDS

Parasites and their hosts are in a constant state of evolution, and often they evolve in response to each other. We examined the host colonizing strategies of avian malaria (*Plasmodium*) lineages to determine whether specialist lineages, which infect just one species of bird, differ in their rates of parasitemia from generalist lineages, which infect many different avian species. Real time PCR experiments quantified the number of parasites in blood samples from olive sunbirds (*Nectarinia olivacea*) of west Africa. Understanding the colonization strategies employed by different malaria lineages will help us to predict the behavior of parasites within their hosts and to identify future routes of transmission across species lines.

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PHYLOGEOGRAPHY OF GRAY JAYS: UNCOVERING PATTERNS OF POST-GLACIAL AND BARRIER-MEDIATED DISPERSAL

Gray Jays (*Perisoreus canadensis*) have the most extensive distribution of any jay in North America, ranging throughout coniferous and mixed coniferous-deciduous forests from Alaska through Newfoundland and south to New Mexico. We have limited knowledge of patterns of Gray Jay post-glacial dispersal nor do we understand how barriers such as mountains and large water bodies affect the species' current population structure. Our study uses genetic markers to elucidate range-wide patterns of genetic variation. We collected blood and tissue samples at locations across North America, in historically ice free (e.g. Alaska) and glacier covered (e.g. Quebec) areas as well as on both sides of purported barriers to dispersal (e.g. Rocky Mountains). Using a 1 kb sequence from the mitochondrial DNA control region, we assessed population structure in this high latitude resident species. Preliminary analyses suggest that Gray Jay populations are highly divergent and several genetic breaks correspond to physical barriers. Understanding historical dispersal patterns may help us to predict contemporary dispersal of this species in response to shifting habitats caused by climate change and other anthropogenic processes.

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SPRAGUE'S PIPIT NESTLING PROVISIONING RATES IN PLANTED AND NATIVE GRASSLANDS: IMPLICATIONS FOR HABITAT CONSERVATION

For passerines, it is in both parents' and nestlings' best interest for adults to provide food in a manner that maximizes growth and minimizes time spent in the nest. Little is known about parental care by Sprague's Pipit (*Anthus spragueii*) or how provisioning might be affected by habitat quality. We quantified and compared provisioning rates in native and planted grassland habitats near Last Mountain Lake, Saskatchewan. In 2006-7, we recorded 1,154 hrs of video footage at eight nests in planted grassland and seven in native grassland. We used mixed models to compare provisioning rates between habitats and assess how rates were affected by nestling age, precipitation, temperature, and Julian date. In 2006, provisioning rates at early-season nests were positively affected by age and negatively affected by low temperatures and heavy precipitation. In 2007, provisioning rates were positively affected by age and not affected by other factors. Our results suggest that planted grasslands can offer suitable habitat for Sprague's Pipit in this region.

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USING STABLE ISOTOPE TECHNOLOGY TO PREDICT ORIGINS OF MIGRATING AND DISPERSING RED-TAILED HAWKS

We investigated whether feather stable hydrogen isotopes ($\delta^2\text{H}$) can be used to estimate the origin of red-tailed hawks (*Buteo jamaicensis*) captured at migration monitoring sites in the western United States. We also compared stable hydrogen isotope signatures of known breeding or natal Df signature for birds outfitted with satellite telemetry units as well as for a recaptured bird banded as a nestling. Predicted origins frequently were both to the north and south of migration monitoring stations and covered large geographic areas. The $\delta^2\text{H}$ of the satellite telemetry individuals and the recaptured nestling did not correspond to predicted signatures in most cases. Identifiable migration patterns existed only at one of five sites where individuals from lower latitude migrated through earlier than individuals from higher latitude and during one season when females migrated through later than males, although small sample sizes may have been a factor at the other sites. The broad possible source areas for migrating red-tailed hawks in the fall rendered this technique ineffective for determining breeding locations or natal origins using our procedures.

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SEASONAL INTERACTIONS IN MIGRATORY SONGBIRDS: ASSESSING THE STRENGTH OF CARRY-OVER EFFECTS IN THE YELLOW WARBLER (*DENDROICA PETCHIA*; AESTIVA GROUP)

Winter to breeding season carry-over effects have been measured in three passerine species. We tested the hypothesis that reproductive performance in a common migratory songbird on the Western flyway, the Yellow warbler, would be indirectly affected by the location and quality of habitat this species used over winter. Feather samples, arrival dates and breeding productivity were collected for 72 males and 58 females breeding in Revelstoke, B.C., Canada. Winter location and habitat quality was inferred from the stable H and C signatures of feathers grown on the wintering grounds. We found winter location influenced date of arrival for young females and habitat quality influenced the date of arrival in older females, no such effects were detected in males. Arrival dates had stronger impact on breeding success in young versus older females. Our results provide evidence for carry over effects, mediated through wintering location and habitat quality, within the western lineage of Yellow warblers.

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INTERACTIONS BETWEEN LOGGING AND FIRE AND THEIR EFFECTS ON THE DYNAMICS OF A KEYSTONE PRIMARY EXCAVATOR IN THE EASTERN BOREAL FOREST OF NORTH AMERICA

The black-backed woodpecker (*Picoides arcticus*) is considered a fire specialist throughout its breeding range. Given its high abundance in recent burns, it has been hypothesized that these habitats may be source habitats for this primary excavator. We conducted a 3-year post-fire study in high-severity burned black spruce forests that varied in pre-fire age in central Quebec, Canada. Our objectives were (1) to evaluate the occupancy and reproductive success of black-backed woodpeckers and (2) to examine factors involved in the selection of cavity snags and nest site selection. Pre-fire forest cover conditions were an important component of the quality of black-backed woodpecker's nesting habitat. Reproductive success was higher in areas with high proportions of burned late-seral forests than in areas dominated by burned early-seral stages. Burned forests likely functioned as source habitats for the first two years following fire, although this status varied with pre-fire forest age. Post-fire forests may thus significantly contribute to black-backed woodpeckers population levels. Current forest management which reduces late-seral forest cover can affect, however, the quality of post-fire habitats important to the black-backed woodpecker and other cavity users.

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HABITAT SELECTION BY NESTING WILLIAMSON'S SAPSUCKERS IN SOUTHERN BRITISH COLUMBIA

The Williamson's sapsucker is a medium-sized migratory woodpecker that breeds in mixed conifer forests of western North America. Within Canada, the breeding range of Williamson's sapsucker is restricted to the southern interior of British Columbia, and the species is currently listed on Schedule 1 of the Species at Risk Act as "Endangered". We conducted a resource selection analysis to determine the habitat features that best explain the probability of occurrence of Williamson's sapsucker nests in two geographic regions within its presently defined area of occupancy. Probability of nest occurrence was strongly tied to densities of potential nest trees, which were older-aged trembling aspen and ponderosa pine in the Western Region, and open forests with large (diameter-at-breast-height >57.5 cm) western larch in the Okanagan-East Kootenay Region. Our results can be used to guide identification and protection of critical habitat as required by the Species at Risk Act in Canada. In particular, management should focus on protection of aspen stands within proximity to ponderosa pine forests, and on the maintenance and recruitment of a veteran layer of western larch trees.

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ESTIMATING SPECIES DETECTION PROBABILITIES IN THE SOUTH DAKOTA BREEDING BIRD ATLAS

Breeding Bird Atlases (BBA) aim to map breeding bird distributions by collecting 'presence-absence' data on 9 sq. mi. survey blocks. However the possibility of 'false absences' (species present but not observed) confounds interpretation of distribution maps. To quantify this uncertainty, we estimated species detection probabilities using occupancy modeling for the South Dakota BBA. In 2009 we made three survey visits, each conducted for four hours along the same route at the same time of day, to each of 43 atlas blocks. Median detection probability for the 82 species analyzed was 0.63 and detection probabilities for 75% of the species were greater than 0.5. Spotted Sandpiper (DP=0.16), Black Tern (0.22) and Sora (0.22) had the lowest detection probabilities, indicating that these species may need special surveys to produce more accurate distribution maps. As groups, wetland and woodland species averaged lower detectabilities than grassland, shrub, urban, or aerial foraging species. This approach provides valuable information for interpreting breeding bird atlas data and should be a viable alternative for BBAs not willing or able to use point counts for estimating detectability.

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VOCAL PERFORMANCE AS AN INDEX SIGNAL

One measure of vocal performance for songs consisting of simple trills is deviation from an upper bound regression of frequency bandwidth on trill rate. Vocal performance in this sense has been proposed to be an index signal, that is a signal whose reliability is determined by physical constraints and which therefore cannot be cheated upon. We show that swamp sparrows do cheat on this signal by increasing vocal performance of particular song types when singing in an aggressive context. Increased vocal performance is achieved by increasing both bandwidth and trill rate. In territorial playback tests, male swamp sparrows discriminate vocal performance differences on the order seen between males, responding more aggressively to songs of high performance than to songs of low performance. Males, however, do not discriminate performance differences in the range seen in within-male modulation. Thus although swamp sparrows modulate this signal, they do not do so sufficiently to allow them to cheat effectively. These results reinforce the classification of vocal performance as an index signal.

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RELIABILITY OF A PCR TEST TO DETECT MICROFILARIA IN TWO SPECIES OF GALÁPAGOS SEABIRDS

Reliable detection of microfilariae (Order Spirurida, Superfamily Filarioidea), known to infect Galápagos Penguins and Flightless Cormorants, is critical for health surveys currently underway for these species. Blood smears are one reliable diagnostic tool; however, examination of blood smears is labor-intensive and smears are not always available. We use PCR to screen DNA from 29-30 individuals of each species, which were previously categorized based on examination of blood slides as having high, medium, or low-level infections. PCR tests were also performed on 20 individuals for which blood smears showed no infection. PCR results showed successful detection of microfilaria in all individuals categorized as having high or medium-level infections, in all but one individual categorized as having low-level infections, and in 3 of the 20 individuals categorized as uninfected. Results suggest this PCR test is reliable at high and medium-level infections, but that a two-pronged approach is best when dealing with low-level infections. Microfilaria exist globally in a wide range of avian hosts; thus we expect these methods will be useful to ornithologists studying this hemoparasite in other bird species.

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EXPERIMENTAL INFECTION OF HOUSE SPARROWS WITH NY99 AND WN02 GENOTYPES OF WEST NILE VIRUS.

House sparrows have been implicated as an important amplifying host for West Nile virus (WNV). In North America, the originally introduced strain of WNV (NY99) has been displaced by the genotype WN02. In order to determine if displacement was host driven, we measured viremia and mortality in house sparrows experimentally infected with representative strains of both genotypes isolated in NY during routine surveillance testing. In addition to the aforementioned strains, we included a Czech Republic strain of WNV that represents a separate, new lineage. Viremia and mortality varied among NY strains of WNV, but not necessarily by genotype. Viremia levels and mortality also differed across years. Viremia was undetected in birds inoculated with the Czech strain, and in fact, birds were refractory to infection with 10e4 PFU. Results of these studies indicate that sparrows were not primarily responsible for the displacement of NY99 by WN02. Year to year and strain differences within the same population of hosts emphasizes the need for caution when assessing competence. Spatially and temporally relevant virus strains should be considered when performing these types of studies.

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SEASONAL VARIATION IN SURVIVAL RATES IN A NON-MIGRATORY PASSERINE

Studies of seasonal variation in survival have largely focused on the effects of harvest on game birds, or migration in migratory birds. Rarely have such analyses been undertaken for non-game, non-migratory birds even though resident birds also face several distinct seasons with potentially very different stressors, due to changes in behavior or environmental conditions. Identifying periods in which survival is most limited will provide important information for population management and conservation planning. We conducted a mark-recapture analysis to estimate annual and seasonal survival rates for known-age individuals (N=4,697) in a non-migratory population of Song Sparrows (*Melospiza melodia*). This population has been studied year-round for 30 years at the Palomarin field station in central coastal California by PRBO Conservation Science. Models allowing for survival to vary by age class, year, and seasonally were much more strongly supported over models with no seasonal effect.

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INFLUENCE OF CONTINENTAL CLIMATE PATTERNS ON WESTERN BOREAL SONGBIRD MIGRATION

Billions of songbirds migrate annually from Canada's north to winter in southern habitats. Yet, our understanding of how songbirds use landscapes and the limiting factors during their long migrations is limited. Using standard protocols, we banded over 34,000 landbirds of more than 90 species during fall migration from 1997-2009 at Mugaha Marsh in northern British Columbia. Despite the remarkable opportunity for variability, we demonstrate the repeatable, consistent structure of songbird migration, like other animal migrations. Numbers of northwestern Blackpoll, Tennessee, Magnolia and MacGillivray's Warblers are positively correlated, and Wilson Warbler's negatively, with the large-scale climate pattern of the Pacific Decadal Oscillation; which is linked with insect outbreaks and terrestrial productivity. Warblers are moulting during migration and these species-specific patterns can help distinguish between migrant and more locally breeding populations. Standard migration data are effective for understanding migration strategies, variability of songbird populations, and their flexibility to ecosystem change. We present trends of Neotropical fall migrants in relation to local and large scale climate patterns, including variation in timing of migration related to age and moult condition.

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MERCURY AS A CONTRIBUTING STRESSOR IN THE POPULATION DECLINE OF THE RUSTY BLACKBIRD

Limited knowledge of Rusty Blackbird (*Euphagus carolinus*) has created difficulty discerning the complex of causes for population decline; habitat loss and degradation rangewide are implicated. We examined mercury concentrations in the birds as a possible contributing factor. Blood and feather samples were collected during 2005-2009 from Rusty Blackbirds on wintering grounds in the southcentral and southeastern U.S., and on breeding grounds in Alaska and the Northeast U.S./Canadian Maritimes. Blood total-Hg concentrations in the Northeast/Maritimes were 3.4x to 26x those of the remaining regions, with an average concentration of 1.06 ppm and a maximum concentration of 3.42 ppm observed in a male breeding near Kejimikujik National Park in Nova Scotia. Feather total-Hg concentrations in the Northeast/Maritimes were approximately 5x those of the other regions, with an average concentration of 19.2 ppm, and a maximum concentration of 52 ppm in northeast Vermont and northern Nova Scotia. Approximately 30% of the Rusty Blackbirds sampled in the Northeast/Maritimes exceed a current working Lowest Observed Adverse Effect Level (LOEL) for mercury toxicity in songbirds, representing a potential stressor to a declining population.

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THE DYNAMIC LIVES OF TREE CAVITIES: A DEMOGRAPHIC ANALYSIS OF FACTORS INFLUENCING CAVITY REUSE AND LONGEVITY

Tree cavities are a critical nesting and shelter resource for more than 40 species of cavity-nesting birds and mammals in interior BC, Canada. Cavity quality is emerging as an important limiting factor for cavity-nesters in both North American and tropical ecosystems. Despite apparent cavity abundance, nest box additions result in increased cavity-nester densities. Cavities are a

dynamic resource that change in abundance and quality as they are created, destroyed, and modified by excavators, predators, and decay processes. Little is known about the temporal stages in the life of a cavity that could influence its use. Application of demographic concepts to populations of tree cavities enables us to identify key factors affecting their fecundity (reuse rates and species richness) and longevity. We will track cavity use and characteristics for 1669 cavities involving use by 32 species over a 15-year study over 29 sites that vary in forest type. Holes excavated by Northern Flickers were reused by 16 species, a higher rate than all other excavators. Cavity abundance varied from 1.1 to 12.1 nests/ha across sites, and 4% of cavities died annually.

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SYMPATRIC MEADOWLARK HABITAT USE AND SETTLEMENT PATTERNS MEDIATED BY HABITAT HETEROGENEITY AND INTERSPECIFIC INTERACTIONS

The sympatric zone shared by Eastern and Western meadowlarks has changed dramatically in the North Central Midwest since these species have come into secondary contact. We examined the relationship between structural habitat heterogeneity and heterogeneous species composition of plants and insects, and its influence on Eastern and Western meadowlark distribution patterns at a large remnant sand prairie within their sympatric zone. To evaluate interspecific influences on distribution patterns, we examined conspecific and heterospecific responses to song playback experiments. We found that the two species segregate across the site, and while Western meadowlark abundance has declined, Eastern meadowlark abundance has remained stable. Vegetation composition and structure varied across the prairie, and vegetation height was the best predictor of the proportion of Eastern to Western meadowlarks at study plots. Meadowlarks responded more aggressively to both Eastern and Western meadowlark playbacks than the control playbacks. Individual meadowlarks varied in the aggressiveness of their response between heterospecific and conspecific playbacks, though overall, preliminary results suggest no difference in meadowlark response between Eastern and Western meadowlark playback.

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QUANTIFYING BROADLEAF MANAGEMENT TARGETS FOR SONGBIRD CONSERVATION IN TIMBER PLANTATIONS

In a growing market for wood fiber, industrial forest managers have increasingly emphasized intensive forest management techniques to maximize timber production. Aerial spraying of silvicultural herbicides suppresses the natural early-seral deciduous stages of forest succession. Our objectives were to understand how the extent of deciduous hardwood cover influences (1) occupancy, and (2) reproductive success of hardwood-associated songbirds nesting in early-seral Douglas-fir plantations. We selected timber stands to reflect a gradient in hardwood composition. We sampled songbird occupancy across a hardwood gradient by point count survey in 250 stands, and mistnetted in 28 stands to determine a productivity index. We found a strong positive influence of stand-level hardwood cover on the occupancy of Rufous Hummingbird (*Selasphorus rufus*), and a positive relationship between hardwood cover and number of young of Orange-crowned Warbler (*Vermivora celata*), Wilson's Warbler (*Wilsonia pusilla*) and Swainson's Thrush (*Catharus ustulatus*). Evidence of non-linear threshold relationships suggests that small changes in habitat amount or quality may have disproportionately large effects on species occurrence or demography. Small changes in intensive forest management practices could result in large biodiversity benefits.

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BREEDING PASSERINES ASSESS NEST PREDATION RISK THROUGH EAVESDROPPING: AN INTERSPECIFIC COMPARISON

For breeding passerines living in a heterogeneous world, information that reliably predicts the location of spatial refugia from nest predators can increase the probability of reproductive success. Predator communication may provide an important source of current information for nest-site and territory decisions. To determine if passerines eavesdrop on nest-depredating chipmunks we conducted a playback experiment to create spatial heterogeneity in perceived risk. We established plots broadcasting: chipmunk vocalizations, frog calls and no playback (silent). Nest distributions and point counts of migrants were compared between treatments. Interspecific differences were observed in response to treatments. Significantly fewer ground-nesting warblers and Veeries (*Catharus fuscescens*) were recorded on chipmunk plots than controls whereas canopy-nesting migrants showed no treatment effect. However, only ground-nesting warblers placed nests significantly farther from chipmunk plots versus controls. Our experiment provides a mechanistic explanation for how some nesting passerines locate spatial refugia from predators. Furthermore, results suggest the existence of interspecific differences in information use potentially affecting community structure.

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ROBIN'S EGG BLUE: IS EGG COLOR A SEXUAL SIGNAL?

A recent hypothesis suggests that in birds blue-green egg colour may be a signal of female quality that males use to make parental investment decisions. Although this hypothesis has found some correlational support, experimental evidence has been lacking except in one cavity-nesting species with pale blue-green eggs. We isolate the influence of egg colour on male behaviour by replacing natural American robin clutches with artificial eggs at one or the other extreme of natural colour intensity. After incubation, three nestlings were fostered into each nest and parental behaviour was monitored at nestling ages 3, 6, and 9 days. For the youngest nestlings, male provisioning rate significantly increased with the vivid egg colour treatment, but there was no experimental effect at the older nestling stages, in each case controlling for variation in female behaviour. Male feeding rate at unmanipulated nests was also significantly related to natural egg colour. These results suggest that blue-green egg colour can act as post-mating signal in this species, but do not exclude the possibility that the blue-green pigment also serves other adaptive purposes.

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GENETIC IDENTITY AND POPULATION STRUCTURE OF NONBREEDING WESTERN SANDPIPER IN MEXICO

Most Western Sandpipers (*Calidris mauri*) migrate along the Pacific Flyway and winter from California to Peru, but many migrate to the Atlantic Coast. We studied the genetic identity and population structure of nonbreeding Western Sandpipers in Mexico. A 513 bp fragment of the control region of mtDNA was sequenced for 343 individuals from locations along Baja Peninsula and Sinaloa, on the Pacific coast, and Yucatan Peninsula, on the Atlantic coast. Thirty two variable positions defined 68 haplotypes, of which 43 were present in single individuals. The two most common haplotypes occurred in 38% and 22% of all individuals and in all locations. Genetic differentiation among wintering populations from the Pacific and Atlantic coasts was low but significant (FST = 0.0385; p < 0.05), suggesting differences in wintering ground preferences.

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INDIRECT EFFECTS OF NONNATIVE FISH ON THE GRAY-CROWNED ROSY-FINCH

Adjacent food webs may be linked by cross-boundary subsidies. Nonnative predators introduced into a donor ecosystem can affect recipient ecosystems in unexpected ways. Here we show that the Gray-crowned Rosy-Finch (*Leucosticte tephrocotis dawsoni*), a generalist songbird typically considered a seed-eater, is indirectly affected by fish introduced to naturally fishless habitats. Indirect effects were mediated by competition for different life stages of the same aquatic invertebrates, specifically mayflies. We compared the abundance of aquatic insects and Rosy-Finches at fish-containing versus fishless lakes. At fish-containing lakes, trout outcompeted Rosy-Finches for emerging insects; fish-containing lakes had 98% fewer mayflies than fishless lakes. At fishless lakes Rosy-Finches showed an aggregative response to emerging mayflies; nearly six times more Rosy-Finches were observed at fishless than at fish-containing lakes. Despite protections afforded to Rosy-Finch breeding habitats, including national parks and wilderness areas, the availability of an important food resource has been negatively altered by a recreational fishery, potentially affecting Rosy-Finch populations. Because fish have been introduced to mountain lakes worldwide, this fish-insect-passerine interaction may be more general to montane systems than previously recognized.

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SHOULD PASSERINES BE CONSIDERED WHEN DETERMINING THE FUTURE OF FISH STOCKING IN CALIFORNIA?

In 2007, the Sacramento Superior Court ordered the California Department of Fish and Game to evaluate its state-wide fish stocking program. The stocking of mountain lakes is controversial primarily because of its impacts on native aquatic organisms. An unexpected effect, however, is that on birds. Here I will discuss indirect effects of nonnative fish on the Gray-crowned Rosy-Finch (*Leucosticte tephrocotis dawsoni*). Although I found Rosy-Finches preferentially foraged at fishless lakes during mayfly emergences, I did not find convincing evidence that breeding habitat was preferentially selected in regions with the greatest mayfly-rich, fish-free habitat. Instead, the landscape-scale pattern of Rosy-Finch distribution matched what the historic distribution of mayflies would have been in the absence of trout. This suggests that in the context of fish introductions, Rosy-Finches select breeding habitat using an inaccurate indicator of food-rich habitats at the whole-basin scale, signifying imperfect information regarding the regional distribution of the aquatic insect subsidy. I will relate these findings to the politics of fish stocking and to the CDFG's Environmental Impact Report on their stocking program, anticipated to be finalized by early 2010.

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POTENTIAL IMPACTS OF AN EXOTIC SPECIES ON NESTING COMMON BLACK HAWKS (*Buteogallus anthracinus*) AND THE CORRESPONDING MANAGEMENT CONUNDRUM.

Previous work has indicated that amphibians were an important component of the diet of Common Black Hawks (*Buteogallus anthracinus*), while aquatic invertebrates were rarely noted. However, data collected in 2008 on prey brought to nests (n=6) revealed an opposite pattern: amphibians were rare, while an exotic crayfish were abundant at several nests. Two hypotheses were then examined based on this potential diet shift. First, crayfish prevalence in the nesting diet is due to preference over native fauna and second; crayfish affect nesting productivity of Black Hawks. In 2009 we then further examined the diets of nesting Black Hawks (n=13) and created an index

of prey availability at each nest. Using optimal foraging theory as a model, results indicate reptiles are preferred prey at most nesting locations. Diets rich in reptiles also had increased diet diversity, brood size, and nest productivity. However, there appears to be a dichotomy in terms of crayfish abundance in the diet. High abundances in early nesting stages often result in brood reductions but in later stages crayfish appear to be an important food source.

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THE EFFECTS OF PRESCRIBED BURNS ON VEGETATION AND SWAINSON'S WARBLER SPATIAL USE IN ST. FRANCIS NATIONAL FOREST, ARKANSAS.

The Swainson's Warbler (*Limnothlypis swainsonii*) is a species of conservation concern in the southeastern U.S. In fall 2006, prescribed burns were implemented in St. Francis National Forest, which provided us an opportunity to assess the effects of this management practice on Swainson's Warblers. In 2008-2009, we tracked 45 male warblers occupying burned and unburned areas. Birds occupying burned areas had larger home-ranges (N=17, mean = 12.41 ha) than compared in unburned areas (N=28, mean = 8.16 ha). Vegetation data were collected to compare points used by the birds to randomly-selected points. Used burned sites had a higher percentage of forbs, total number of understory stems, and leaf litter depth than used unburned sites. Moreover, random burned sites had a higher number of shrubs and cane stems, percentage of forbs, shrubs and cane cover, and total canopy cover than random unburned sites. Our data suggest Swainson's Warblers tolerated the effects of prescribed burns and that this management may improve habitat quality by increasing the numbers of cane and shrub stems ≥ 2 years following the burn.

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ENVIRONMENTAL ANOMALIES, SEABIRDS, AND THE CONSERVATION OF THE GULF OF CALIFORNIA'S MARINE WILDERNESS

Understanding effects of climatic anomalies on the dynamics of marine and terrestrial environments is critical for ecological research, as many ecosystems depend on environmental pulses for renewal. Several papers show that oceanographic anomalies modulate the productivity of sea and land. The warm phase of the Pacific Oscillation (El Niño) brings a strong decline in ocean productivity, but increase winter precipitation in Baja Californian deserts, replenishing water supplies of canyons, flushing freshwater and nutrients into coastal lagoons. Deserts rainfall pulses are major forces structuring biological assemblages. Plants and animals have developed adaptations to take advantage of ephemeral abundance. High-rainfall anomalies play a critical role in the renewal of drylands that cover Baja California. In the sea, similar pulse-driven dynamics exist. In the productive upwellings of the Gulf's Midriff, sardines and anchovies caught in this small area concentrate 20–30% of the national fishery landings, but oscillates wildly from year to year. Seabirds ecology combined with oceanographic data are used to accurately predict sardine catch. These results are central part of the discussion on the certification of Mexican sardine fishery as sustainable.

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Arendt, W. J., US Forest Service, Luquillo, USA, waynearendt@mac.com STEADY SURVIVAL BUT LONG TERM POPULATION DECLINES IN PUERTO RICAN BIRDS

We report on long-term monitoring of resident and winter resident bird populations with constant-effort mist netting in the Guanica Forest of Puerto Rico. One line has been operated annually since 1973 (except 2 years); 8 new lines were added during 1989-1991, with the same 9 lines operated from 1991-2009. Capture rates comprised first captures of birds over a 3-day, dawn-to-dark netting period. Survival rates were estimated using program MARK models with rainfall covariates. Trends for bird capture rates over two decades have shown that most species are declining dramatically. Although winter resident capture rates were normal during the period 1989-2001, since 2002 we have

consistently had the lowest capture rates ever at this site. Most resident bird species show declines in capture rate, although the length of the decline varies by species. Survival rate models for both residents and winter residents generally suggest stable survival rates over time; we propose that lack of recruitment of new winter residents and reduced production of resident young explains these declines, with both factors perhaps affected by global climate change.

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INFERRING PHYLOGENETIC AND DEMOGRAPHIC HISTORIES ACROSS MULTIPLE AVIAN LINEAGES FROM HISPANIOLA

Mitochondrial DNA (mtDNA) sequences can be used to infer the historical demographies of a given species or population. The primary objective of this research is to reconstruct not the historical demography of a single population or species, but to do so simultaneously for an assemblage of ~30 species. Specifically, we are studying bird mtDNA sequences to discern evolutionary forces that have shaped avian populations on the island of Hispaniola (i.e., Haiti and the Dominican Republic). Islands offer unique opportunities for the study of evolution, and Hispaniola in particular is a major hotspot of avian biodiversity; it has a large concentration of endemic species. Our dataset currently consists of mtDNA sequences from over 300 individuals. Haplotypes have been determined and mismatch distributions have been created for those species where our sampling is deep (>25 individuals). Unimodal mismatch distributions are typical of rapid population expansions whereas multimodal distributions suggest long-term equilibrium. The four species that have been analyzed so far show a unimodal mismatch distribution that corresponds to the null model of a population expansion. Thus, our preliminary data suggest these four species share a similar historical demography, as might be expected if they faced similar climate or habitat changes over the last few millennia.

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MANAGING A CAPTIVE POPULATION OF CRITICALLY ENDANGERED BIRDS TO PROMOTE HIGH POST-RELEASE SURVIVAL AND MAXIMAL GENETIC DIVERSITY.

The endangered San Clemente Loggerhead Shrike (*Lanius ludovicianus mearnsi*) is endemic to San Clemente Island (SCI), CA. In 1990, the U.S. Navy contracted the San Diego Zoo to develop hand-rearing and artificial incubation protocols, and to establish a captive population housed on SCI. In the early years of the project (1991-1996), no released captives survived to recruit. In response to this we adjusted out management. We developed methods to monitor potential pairs to assess compatibility. We changed our approach from mainly hand-rearing to mainly parent-rearing. We provided live vertebrate prey to all captives year-round and offered fledglings a graded course of easy to hard to hunt vertebrate prey. After revision of release protocols by the Shrike Working Group and our improved management, captive-bred shrikes survived to breed in the wild. Once this was achieved we then were able to maximize the genetic diversity and equalize founder representation of both the captive and wild populations through selective breeding and release. At this point almost all shrikes living in the wild on SCI are either captive bred or have some captive ancestry.

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USE OF SOCIAL INFORMATION FOR HABITAT SELECTION IN GOLDEN-CHEEKED WARBLERS.

Habitat selection research has focused on association between species occurrence and vegetative characteristics or on competition. Positive intraspecific interactions can influence habitat selection for migratory songbirds. I conducted an experiment on 16 pairs of sample units in

woodland patches with a range of canopy cover in Texas in 2008 and 2009 to investigate the use of conspecific vocal cues on territory selection by golden-cheeked warblers (*Dendroica chrysoparia*). Treatment consisted of broadcast conspecific vocalizations during warbler arrival and territory establishment. Territory density was significantly higher in treatment plots ($p = 0.001$); sign tests show the probability that 15 of 16 treated plots had higher density than controls was 0.02, suggesting the results differ significantly from chance. Territory density increased in response to treatment even in low canopy covers typically considered poor or suboptimal habitat. Identifying information used for habitat selection decisions is critical for understanding resulting patterns of habitat use, identifying fitness consequences of these decisions, and creating accurate predictive habitat models for conservation and management of migratory songbirds including the golden-cheeked warbler.

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THE CONTEXT DEPENDENCE OF HUMMINGBIRD COMPETITION
Elevation and resource density constrain the costs of hummingbird flight. Consequently, these two factors are expected to influence the level of aggression used by hummingbirds in the defense of nectar flowers. It is not known how the two factors interact to affect aggression and foraging activity. We measured the frequency of chases and activity density in Black-chinned Hummingbirds *Archilochus alexandri* at feeders in Western Colorado during the 2009 breeding season. We used three resource density and four elevation treatments and replicated the experiment in four landscapes. We recorded all activity in 60 minute sessions. We found that the activity density of male Black-chinneds increased with increasing elevation for low and medium resource density treatments. However when resource density was high, male activity density was similar across all elevations. The pattern of male activity density mimicked the pattern of female aggression toward males. This suggests that the ability for females to limit male foraging activity through aggressive behavior varies based on morphological and physiological traits and the environment in which those traits are expressed.

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URBAN BIOACOUSTICS: CONSEQUENCES OF ANTHROPOGENIC NOISE ON NORTHERN MOCKINGBIRD (*MIMUS POLYGLOTTOS*) SONG

Urbanization can increase anthropogenic noise, which consists primarily of low frequency sounds. This likely affects birds by masking song, inhibiting important signals for reproduction. However, research has shown that birds can increase the minimum frequency (pitch) of their songs in urban habitats. In this study we investigated the hypothesis that Northern Mockingbirds (*Mimus polyglottos*) sing at a higher minimum frequency in urban environments relative to non-urban environments. We recorded a total of 54 male mockingbirds' songs for 15 minutes in parking lots, residential neighborhoods, pastures, and wildlife preserves around Gainesville, Florida. For each song we found the minimum frequency of each syllable using Raven Pro. We found that urban mockingbirds sing at a higher minimum frequency than non-urban birds. Additionally, we conducted a sound-transmission experiment in each habitat to determine if higher-pitched tones transmit better in urban environments. Preliminary evidence suggests that lower frequency notes degrade faster in urban environments. Mockingbirds may be successful urban dwellers because they are able to adjust their song to notes that transmit more effectively in urban noise.

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Lank, D. B., Simon Fraser University, Burnaby, Canada, dlank@sfu.ca POPULATION STRUCTURE OF WESTERN SANDPIPERS WINTERING IN NORTHWESTERN MEXICO

Western Sandpipers (*Calidris mauri*) were studied at seven wintering sites, ranging from the Colorado River Delta in Baja California to Huizache-

Caimanero in Sinaloa, separated by over 1600 km. Previous work has established that Western Sandpipers are differential migrants by sex, age, and body size. We tested the consistency of these latitudinal patterns. As expected, males predominated at northern wintering sites in the Baja, and females at the southern wintering sites in Sinaloa. Contrary to our expectations the distribution of age classes did not vary with latitude. For the morphological data, bill and wing length, but not tarsus, increased in both males and females from north to south. Body mass for both sexes did not vary with latitude, but it differed among sites. Even though these analyses are preliminary, they suggest that latitudinal variation interact directly with local ecological conditions to define the Western Sandpiper population structure and morphology.

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THE EFFECT OF BURN SEVERITY ON THE RESPONSE OF RIPARIAN BIRDS AND VEGETATION TO CATASTROPHIC WILDFIRE.

We evaluated riparian bird and vegetation responses to the 2007 wildfires in southern California at three drainages in San Diego County. Our goals were to 1) compare bird abundance over time for burned sites and one unburned reference site, 2) assess the effects of burn severity on bird abundance, and 3) quantify changes in vegetation structure in burned riparian. In 2008 and 2009, we counted birds at 24-40 points per drainage to calculate species abundance and recorded percent cover by height of vegetation along transects (N=100) centered on points. From 2008 to 2009, abundance of 7 of 15 species (>20 detections/site) significantly changed at one of three burned sites; four increased and three decreased. In each case, abundance at the other two sites either followed the same trend or did not change. Bird abundance differed significantly by burn severity, for 7 of 15 species in 2008, and 5 of 15 species in 2009. Rapid growth in understory and middle canopy vegetation from 2008 to 2009 allowed for less selective use of habitat by burn severity for most species.

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COMPARATIVE DIET COMPOSITION OF SEABIRDS NESTING IN ISLA RASA, GULF OF CALIFORNIA, MEXICO.

Isla Rasa, situated in a highly productive area of the Gulf of California, has the largest nesting colony of Royal Tern (*Thalasseus maximus*), in the Mexican Pacific, (15,000 individuals) and the largest nesting colonies of Elegant Tern, (*Thalasseus elegans*), and Heermann's Gull (*Larus heermanni*), (200,000 and 260,000, respectively). We compared their diet composition. The diet of Royal Tern is significantly different from that of the other two seabirds. Royal Terns fed on 22 species of fishes (16 families). Elegant Tern and Heermann's Gull fed on 11 taxa (7 families). Pacific Sardine (*Sardinops sagax*), Northern Anchovy (*Engraulis mordax*), and Pacific Mackerel (*Scomber japonicus*), form over 90% of the Elegant Tern and Heermann's Gull diet, and only 64% of Royal Tern diet, which is richer in species and covers greater habitat diversity. Their prey are mainly pelagic (87%), while almost all (99%) of the prey taken by the other two seabirds are pelagic. In all three seabird species, the richness in the species composition of their diet seems to be related to oceanographic conditions, with diversity being higher when productivity is lower.

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PREDICTING THE OCCURRENCE OF ELUSIVE SPECIES: A MULTI-MODEL APPROACH TO ASSESSING HABITAT SELECTION OF THRASHERS

Information on distribution and habitat requirements is difficult to obtain for species that are elusive and occur at low densities, such as the Le Conte's and Crissal thrashers. We evaluated the distribution and habitat selection of these thrashers within Clark County, Nevada, at the northern edge of their ranges. We used a call-broadcast approach to sample 432 stratified random locations. To model habitat, we used site-specific and landscape level information. We modeled habitat occupation using logistic regression with the information theoretic approach to finalize model selection, followed by model averaging, to estimate parameters. Le Conte's thrashers occurred in areas with little topographic relief and were never observed on slopes greater than five degrees – areas generally targeted for development. These thrashers also had positive associations with saltbush, wash, cholla, and Mojave-mixed scrub vegetation. Crissal thrashers were influenced by variables describing latitudinal climatic patterns associated with the study site location at the northern edge of the Mojave Desert, and they were positively associated with riparian and wash vegetation. The predictive maps improved on existing habitat models for these species within southern Nevada.

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FACTORS DETERMINING NEST-SITE SELECTION BY A KEYSTONE ENGINEER, THE RED-NAPED SAPSUCKER

The Red-naped Sapsucker (*Sphyrapicus nuchalis*) is one of the predominant cavity excavators in aspen woodlands of western North America. This woodpecker is a model example of an ecosystem engineering keystone species, because it usually makes a new nest cavity every year, providing future nest chambers for other cavity-nesting species. Sapsuckers also create sap wells in willows, supplying food for other sap feeders. Our objective was to determine which habitat characteristics were most important to the sapsuckers in their choice of nest sites. Thus, we compared features of sites with sapsucker nests to those of randomly selected sites without nests (null sites) in the Elk Mountains of Colorado. The strongest predictor of nest sites was prevalence of *Phellinus tremulae*, a heartrot fungus that facilitates cavity excavation by softening aspen heartwood. Nest sites also tended to have more willow cover within 300m but were found at slightly lower elevations than null sites. Other significant effects were associated with aspen stand structure. Multivariate analyses revealed complex relationships among habitat components, suggesting that sapsuckers also integrate these factors when selecting nest sites.

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VARIATION BY TIME AND ELEVATION IN ISOTOPIC SIGNATURES OF BIRDS: A 100-YEAR COMPARISON (SAN JACINTO MOUNTAINS, CALIFORNIA, 1908-2008)

We compared ratios of carbon and nitrogen isotopes in feathers of birds (n = 354) collected along an elevational gradient in southern California in 1908 and 2008. In a pairwise comparison of 15 species, the $\delta^{13}C$ in 2008 was greater than in 1908 by 0.4‰ (P = 0.06). Enrichment in ^{13}C , opposite of the trend found in $\delta^{13}C$ of plants, might be related to changes in climate. The $\delta^{15}N$ of birds from the two periods differed by 1.3‰ (P < 0.001). Depleted ^{15}N in 2008 was not related to trophic patterns but may be due to N from air pollution. From species to species, isotopic compositions

varied by 10‰, variation apparently related to dietary differences but not to trophic level. For C, differences between the two periods were not correlated with elevation zone. For N, isotopic ratios differed significantly in the Upper Sonoran, Transition, and Boreal zones but not in the Lower Sonoran zone. Changes in isotopic compositions are likely due to a complex interplay among long-term climate change, air pollution, and dietary differences.

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IS CALL-PLAYBACK NECESSARY TO MONITOR HAIRY WOODPECKER AND MOUNTAIN QUAIL IN THE SIERRA NEVADA?

In May-July 2009, we surveyed 414 transects on ten National Forests in the Sierra Nevada of California to monitor avian indicator species. We used call-playback surveys following four passive point-counts to detect two species: Hairy Woodpecker and Mountain Quail. Transects consisted of four passive point count locations clustered around one call-playback location with a minimum of 250m between points. We examined the effectiveness of call-playback surveys by counting the unique records contributed to the total sample through call-playback survey observations. Each species was detected on 38% of our transects. For Hairy Woodpecker, call-playback samples were responsible for 28% of all records (i.e. if only passive point counts were conducted our sample would have been 28% smaller). Approximately 13% of the Mountain Quail records were unique to call-playback samples. Small differences due to phenology (early/late summer) may have affected our detection rates. Our findings show that adding call-playback survey after passive point counts increases detection rate for these two species and may be warranted in other monitoring protocols depending on the additional effort required to conduct the call-playbacks.

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UNDERSTANDING HABITAT SETTLEMENT CUES FOR MIGRATORY BIRDS IN LIGHT OF CHANGING CLIMATES

Spring migratory patterns have presumably evolved to exploit advancing phenology to optimize resource availability at stopover and breeding locations. Global climate change is likely to shift local phenology and potentially disrupt cues that predict habitat suitability and migratory timing across spatial and temporal scales. Using experimental and observational evidence we demonstrate that migratory patterns through the desert southwest closely track the phenology of local trees which predict avian food resources and ultimately shape stopover decisions. The tight correlation between local habitat phenology and migratory patterns and behaviors is important because over the last 50 years the relative rates of climate change differ significantly between migratory and breeding locations throughout western North America. Such differences may impede the predictability of habitat decisions by creating discordance in the phenology of resources, the cues that predict resources, and the timing of migratory events across the vast geographic areas annually occupied by migratory birds. Ultimately, the discordance in habitat predictability will increase costs to individual birds, limit responses to changing climatic conditions, and threaten the long-term viability of many migratory populations.

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GENOTYPING OF AVIAN CHOLERA OUTBREAKS ACROSS NORTH AMERICA

Avian cholera is the leading infectious disease of waterfowl in North America. The disease is caused by the bacterium, *Pasteurella multocida*, which was first observed in wild waterfowl in the 1940s in California and Texas. The disease has since spread to all major flyways, causing massive annual die-offs of >10,000 birds, typically at breeding, wintering, or stopover sites of migratory birds. Serotype 1 has been the predominant cause of avian cholera outbreaks throughout North America, with serotypes 3 and 3,4 more common in the Atlantic coast of the United States. Using *P. multocida* isolates obtained from previous outbreaks in Canada and the United States, we investigated the genetic basis of these and other major serotypes, and assessed the variation within each serotype using a recently developed Multilocus Sequence Typing scheme. Serotype 1 was considerably divergent from the other known serotypes based on 7 housekeeping genes, with numerous single nucleotide polymorphisms that appear diagnostic for most serotypes. This genetic variation should provide the basis for rapid differentiation of serotypes and detection of disease population structure and dispersal across the US and Canada.

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CAN MICROPHONES AND RECORDERS HELP EXPAND COVERAGE OF THE BREEDING BIRD SURVEY?

The Breeding Bird Survey (BBS) is the primary survey for monitoring landbirds in North America, but coverage in Canada is limited largely to the south. Suitable roads exist to expand farther north, but there are insufficient skilled birders in most areas to run routes. We evaluated the use of microphones and digital recorders to record BBS routes for later expert identification on 4 routes in Ontario and Quebec. More species per stop and more species overall could be identified on recordings than were reported by field observers. Only 3 species were reported from the field and not on the recordings, all of which regularly vocalize. However, individual birders listening to recordings differed considerably in the number and selection of species detected. Variation in recording equipment had a smaller effect. Intensive analysis with multiple observers and computer spectrograms was needed to obtain relatively complete and accurate species lists. We conclude that recording equipment could potentially be used to expand BBS coverage, but efficient analysis methods and careful calibration of equipment are needed to prevent bias due to changes over time.

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THE INFLUENCE OF VOCAL FREQUENCY AND FLEXIBILITY IN PREDICTING RESPONSE TO NOISE POLLUTION

We examined the influence of species' vocal attributes in explaining nest site selection in responses to anthropogenic noise (noise). Specifically, we assessed whether signal frequency and frequency flexibility influenced nesting patterns. We collected nesting data during the summers of 2005-2007 when we isolated noise experimentally through use of natural gas wells with (noise treatment sites) and without (control sites) noisy compressors. Compressors were also turned-off during searches as to not bias nest detection. In 2009, we recorded songs of species throughout our study area within a variety of noise conditions. We estimated species' responses to noise as the ratio of nests on noisy treatment vs. quiet control sites. Vocal frequency was positively related

to noise amplitude for a few species. For the community, nesting response to noise was positively related to vocal frequency, suggesting that acoustic masking of vocal signals may explain species-specific tolerances to noise and that frequency flexibility in response to noise may be relatively uncommon among birds. Those most likely to suffer from noise in human-altered habitats are species with little vocal flexibility and low frequency signals.

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EXPLAINING VARIATION IN THE TIMING OF FLIGHT FEATHER MOULT: A TEST OF THE FEATHER CONDITION HYPOTHESIS

The timing of migration and moult represent a forum for conflict and trade-offs in the evolution of avian life-history strategies. Variation in flight feather moult strategy at both the individual- and species-level can be used to investigate what selective forces are important in driving the timing of moult relative to migration. Feather condition has the potential to affect both the survival and energetic costs of migration, thus impacting fitness. I investigated whether this hypothesis could explain variation in the timing of moult of Western (Calidris mauri), Least (C. minutilla), and Semipalmated Sandpipers (C. pusilla). I tested whether individuals with poor quality feathers are more likely to moult earlier by using a moult-migration strategy. I also tested whether second-year birds, who were expected to have more worn feathers, are more likely to moult-migrate. Birds with more worn feathers were not more likely to use a moult-migration strategy than birds with feathers in better condition. Only in Western Sandpipers did second-years have feathers of poorer condition than after-second-years, and second-years of all species were not more likely to use a moult-migration strategy.

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EFFECTS OF ENVIRONMENTAL METHYL MERCURY EXPOSURE ON MATE CHOICE AND STEROID HORMONE EXPRESSION IN WHITE IBISES (EUDOCIMUS ALBUS).

While methylmercury is known to negatively affect reproduction in birds, most experimental research has focused on decreased hatch success, developmental abnormalities, and parental behavior as endpoints. We raised over 200 White Ibises (*Eudocimus albus*) from chick stage to sexual maturity on environmentally relevant diets containing 0, 0.05, 0.1 and 0.3 ppm methylmercury ww in groups of 40 birds each. We found male-male pairing behavior increased with mercury exposure, with up to 55% of males participating in long term male-male and reproductive activities. Male-male pairing was also responsible for a significant decrease in reproductive success in dosed groups. Male-male pairing was not related to sex ratio, constrained mate choice, or group location. After controlling for stage of nesting, mercury exposure was also correlated with altered patterns of fecal testosterone, estrogen and corticosterone. Within dosed groups, hormones of homosexual males differed from heterosexual males in the same direction as groups did with increasing mercury exposure. We suggest that low, chronic mercury exposure altered both mate choice and endocrine expression to a degree that would affect demographic trajectories in the wild.

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SEASONAL VARIATION IN SEX ALLOCATION IN THE HAWAII AKEPA: ADAPTATION AND DEMISE

Seasonal variation in sex allocation occurs when the more expensive sex is reared predominantly when food conditions are best. The Hawaii akepa (*Loxops coccineus coccineus*), with clutch size of two eggs, has such allocation because sexual dimorphism of fledgling bill length exceeded that of adults, gradually reaching adult level 2 months later. Arthropod food levels are greater when sons are produced. Larger sons have two years of subadult plumage before attaining adult plumage attractive to all females, and undergo stabilizing selection in bill length beginning their second year. Timing sons with greater food resources ensures that bill length is adequate for their fourth year. Parental females may also have the advantage of lower cost of producing sons because they molt their flight feathers while their dependent sons are still growing. Exploitative competition with introduced Japanese white-eye

(*Zosterops japonicus*) is differentially affecting months when daughters are produced, resulting in drastic reduction of the sex ratio of young akepa from 57% to 13% females. The endangered akepa will go extinct from lack of female recruitment unless white-eyes are managed.

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INTRODUCED BIRD STUNTS GROWTH AND LOWERS SURVIVAL THROUGHOUT A NATIVE HAWAIIAN BIRD COMMUNITY
 Exploitative competition from introduced birds has rarely been documented but is recognized as a threat. The introduced Japanese White-Eye (*Zosterops japonicus*) coexisted with all species of native birds at Hakalau Forest National Wildlife Refuge on the Island of Hawaii from 1987-1999, but increased during 2000-2005. With the increase in white-eye numbers, juveniles of all native birds measured had shorter bills and shorter tarsi, and most had lower mass and fat. Lower mass resulted in lower juvenile survival in most species. Shorter bills resulted in lower second-year and older adult survival. White-eyes had less stunted growth than native birds and did not suffer the survival consequences. In a nearby study site at lower elevation with five-times fewer white-eye captured in mist-nets, native birds had normal growth. Analysis of density data indicate that white-eyes increased by 43% in the important middle elevation stratum of the refuge, so the declines of native species throughout the stratum are likely caused by competition from this introduced bird. The white-eye is the most immediate and important threat to native birds.

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A PROGRESS REPORT ON RECOVERY EFFORTS FOR HAWAII'S LISTED AND CANDIDATE SEABIRDS.

We describe critical management and research needs for Hawaii's listed and candidate seabirds, the endangered Hawaiian petrel (*Pterodroma sandwichensis*), threatened Newell's shearwater (*Puffinus auricularis newelli*), and candidate Band-rumped storm-petrel (*Oceanodroma castro*). These priorities are part of a five-year action plan for conservation of these species developed jointly by the State of Hawaii Division of Forestry and Wildlife and the U.S. Fish and Wildlife Service with extensive input and review by our scientific peers and partners in island seabird conservation. Five-year objectives set forth in the plan include documenting, maintaining, and improving species distributions; developing and implementing standardized population monitoring statewide; and improving knowledge of marine habitats and threats. We provide a summary of current projects undertaken by a wide range of entities to address research and management priorities. Examples include ungulate fencing on private lands and monitoring studies on Kauai, reproductive monitoring and predator control on private lands on Lanai, a social attraction project on a National Wildlife Refuge on Kauai, and satellite tracking and nest-site attendance monitoring in a National Park on Maui.

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HABITAT MANAGEMENT FOR HAWAIIAN BIRDS: VISION, CHALLENGES, AND APPROACH

Landscape habitat management to address the full suite of threats to Hawaiian birds is essential to stabilize and recover remaining species. Most of the large and contiguous lands essential for this work are public lands and a relatively small number of private landowners with large holdings. Progress has been limited by the magnitude of the threats, insufficient funding, influential opposition, and inadequate political support. Partnerships have

now been established to provide the basic framework for collaborative habitat management on a meaningful scale. However, essential steps remain to secure funding, engage communities, establish political will, and lay a blue print for the future of Hawaii's wildlife and their habitats. The state Department of Land and Natural Resources is now at a critical point in which bold and thoughtful planning and implementation can provide process, mechanisms, and tools to achieve success on a scale that has been elusive to date. The department must now secure committed political leadership, establish a contiguous network of managed habitat that restores lost and degraded habitats, implement landscape methods for threat control, and employ community participation.

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GEOGRAPHICAL VARIATION OF HERMIT WARBLER TYPE I SONGS IN NORTHERN CALIFORNIA

As with other parulids, Hermit Warblers (*Dendroica occidentalis*) possess two distinct song types. Many researchers believe the first song type is for attracting a mate, whereas the second is territorial in function. During April through July 2009, we made 115 recordings of type I songs at 15 locations throughout the northern Sierra Nevada, southern Cascades and Klamath mountains of California. Based on our analysis of syllables and phrases, we found a greater diversity of distinct type I songs in the west (i.e., Klamath mountains) than in the east (i.e., Cascade and Sierra mountains). We also found that western type I songs were more complex in structure than eastern type I songs. This finding appears contrary to sound transmission principles that simpler, more tonal songs should predominate in denser habitats.

Furthermore, the causes of dialect divergence among eastern and western populations, whether genetic or cultural, remain unclear. This uncertainty necessitates more detailed examination of forest structural conditions and phylogenetics of Hermit Warbler before conclusions about song-habitat interactions can be drawn for this species.

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Hamel, P. B., US Forest Service, Stoneville, USA, phamel@fs.fed.us BIRD USE OF FOREST UNDERSTORY IN A TEMPERATE OLD-GROWTH FOREST AREA AFTER A TORNADO

We measured bird use of understory of Overcup Oak Research Natural Area on Delta National Forest, Sharkey County, Mississippi, USA, using mist nets in September 2009. We compared bird use of the portion of that Research Natural Area (RNA) heavily impacted by a tornado (EF2, 190 kph winds) in March 2008 to that in the unimpacted portion. We used a random sampling design to distribute effort equally. Redgum RNA, located 1.6 km away, served as control. Bird use of the less flood-prone Redgum RNA exceeded that in the more flood-prone Overcup Oak RNA. Within Overcup Oak RNA, bird use of the understory in the tornado-damaged portion was significantly greater than that in the undamaged portion. We infer that this greater use reflected the larger amount of woody debris on the ground and increased herbaceous vegetation in the tornado damaged. Although we conducted our sampling during the height of fall migration, the number of actual migrating birds, rather than of resident species or of breeding individuals of migratory species, was very low in both RNAs.

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Navara, K. J., University of Georgia, Athens, USA, knavara@uga.edu EFFECTS OF CORTICOSTERONE ON PRIMARY SEX RATIO MANIPULATION AT THE TIME OF MEIOTIC DIVISION IN THE ZEBRA FINCH

The primary sex ratios of avian offspring vary significantly in relation to a variety of environmental and social cues. In a previous study, we found that a single acute injection with a pharmacological dose of corticosterone during sex chromosome segregation stimulated a skew towards males. We aimed to determine whether an acute physiological stressor administered immediately prior to meiosis I affects sex ratios in a similar manner compared

to acute injections of pharmacological corticosterone doses. Laying females were stressed by handling in a cloth bag for 5 min, 5h prior to ovulation. In addition, to determine if the effects of the physiological stressor on sex ratio were dependent on the production of corticosterone, a subset of birds were also treated immediately prior to the stress protocol with 2.3 mg of metyrapone, a blocker of CORT production. F1 follicles undergoing sex chromosome segregation during the treatments were laid two days later and were collected for molecular sexing analysis. Primary sex ratios from stressed females treated with metyrapone, vehicle control and untreated females were compared. Results and implications will be discussed.

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SINGING AS AN ALTERNATIVE SIGNAL OF DOMINANCE STATUS IN WINTERING GOLDEN-CROWNED SPARROWS.

In migratory birds, song functions primarily in male-male competition and female choice in the breeding season. Some species, however, also sing on the wintering grounds, and the function of this non-breeding song is unclear. We found that in golden-crowned sparrows (*Zonotrichia atricapilla*), both sexes are as likely to sing in the winter. This suggests that winter singing is not just an incidental carryover of breeding song because females do not sing during the breeding season. We tested whether winter singing serves as a signal of social dominance. We scored dominance based on interactions between individuals at seed piles and found that singing individuals had higher dominance ranks than non-singers. Paradoxically, previous work in this population showed that dominant individuals have larger areas of black and yellow plumage on the crown, but singers had average values for these dominance signals. Intriguingly, singers did have significantly duller gold coloration on their crowns than non-singers, but the signaling function of crown brightness has not been explored. Together, these results suggest that there may be alternative dominance strategies in wintering populations of golden-crowned sparrows.

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EFFECTS OF RESTORING VEGETATION COMMUNITIES FOR THE BENEFIT OF ENDANGERED RED-COCKADED WOODPECKERS ON THE REST OF THE AVIAN COMMUNITY

Restoration of Longleaf Pine (*Pinus palustris*) ecosystems to benefit endangered Red-cockaded Woodpeckers (RCWs) (*Picoides borealis*) has been one of the primary tools in the ongoing recovery of this species. Burning and mechanical clearing have been used to clear mid-story vegetation in areas where Longleaf Pines persisted, and density and abundance of RCWs has increased as a result. However, in areas where multiple at-risk species (such as Bachman's Sparrow *Aimophila aestivalis*) can potentially co-occur, managing for one species may impact others. We examined how RCW habitat management practices impacted diversity and abundance of other birds by surveying points along a gradient of RCW habitat quality from April-July 2009 at Camp Lejeune, NC, where RCWs have been managed for >20 years. Areas of high RCW habitat quality were characterized by a greater diversity and abundance of species associated with pristine Longleaf Pine forests, whereas areas of low RCW habitat quality were characterized by a higher abundance of species associated with hardwood or riparian habitats. Improving habitat for endangered species may be a cost-effective strategy for ecosystem restoration.

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SEARCHING FOR COST EFFICIENCIES OF RIPARIAN RESTORATION

In the Central Valley of California, riparian habitat has been lost or degraded, contributing to the decline of riparian-associated birds. Active restoration of riparian plant communities in this region has increased local population sizes

and species diversity of landbirds. With limited financial resources available for habitat restoration, information that ensures and accelerates success is needed to economize effort and maximize benefit. The number of tree species planted, willow planting densities, and Valley oak (*Quercus lobata*) planting densities were important predictors of bird response to restoration. We established several restoration scenarios, had restoration practitioners price out each scenario, and developed a bird response index to search for cost efficiencies of riparian restoration. Return on investment for tree species richness is linear, with additional investment, the change in birds species continued to rise. For willow and Valley oak planting densities, investment diminishes as planting densities increase. Our results show how combining bird response data with information on restoration design and associated costs provides ecologic and economic guidance to improve restoration cost efficiencies.

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HABITAT ASSOCIATIONS OF FALL MIGRATING SONGBIRDS AT AN INLAND MIXED BOTTOMLAND FOREST IN NORTHEASTERN ALABAMA

Migratory songbirds are sensitive to food availability at stopover sites, when they need to gain energy stores to continue migration. We tested the hypothesis that songbird migrants show different habitat associations during migration stopover in the fall. Birds were captured at an inland stopover site in the Walls of Jericho of northeastern Alabama during the fall of 2006, 2007, and 2008. We captured a total of 2612 individuals at the wetland site, and 2147 at the forested site. Ninety-four species were captured including 14 residential species, 22 temperate migrant species, and 58 Neotropical migrant species. We used non-metric multidimensional scaling to determine the community structure of migratory birds and their relationship with local habitat features. Omnivorous species such as Indigo Bunting were concentrated at the wetland, while fruit-eating species such as Wood Thrush showed stronger associations with the forest. Other species, such as Magnolia Warbler and Ovenbird, showed more flexibility in habitat use during stopover. Recognizing habitat associations of en route migrating songbirds is an important step in their conservation.

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IMPACT TO RAPTORS FROM A WINDFARM LOCATED NEAR AN IMPORTANT BIRD AREA

A Before-After-Control-Impact study design was used to investigate the effects upon raptor species of a 129 megawatt windfarm in Wisconsin. The windfarm is located along the edge of Horicon Marsh, an internationally recognized Important Bird Area (IBA). Raptor counts were conducted before and after construction in order to obtain information on abundance, diversity, and behavior. The effects of weather and temporal variables, distance from the marsh, proximity to turbines, and habitat characteristics on avian use patterns were investigated. Both abundance and diversity were lower after construction, but the decline in abundance was restricted to the area within 2 km of the IBA. Neither post-construction abundance nor diversity was influenced by proximity to the IBA or the turbines. Turkey Vultures and Red-tailed Hawks flew more often within 100 m of turbines compared to other species. Flight height was not changed by the presence of turbines. Estimated mortality rates were low. These results support previous studies in the region and the rest of the U.S., and suggest that set-back distances from areas of high quality habitat should be an important siting consideration.

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REPLACEMENT CLUTCH LAYING IN AN ARCTIC-BREEDING SHOREBIRD IN RESPONSE TO EXPERIMENTAL REMOVAL.

Replacement of lost clutches is thought to be rare among Arctic-breeding shorebirds, due to energetic and time constraints of relaying, incubating and rearing offspring. During 2007—2009, we experimentally removed clutches

from Dunlin to determine replacement clutch laying rates. Adults were radio-equipped at initial nests, their clutches were removed during early (mean= 5.2 days, N = 60) and late incubation (mean= 13 days, N = 29), and individuals were followed to detect replacement nests, assess divorce rate, and examine re-nest intervals. Eighty-seven percent of the females laid replacement clutches after early removal, while only 43% replaced clutches after late removal. Divorce rate was low in all years (8 %), and in all cases, males remained on their original territory while females moved (> 5 km) to re-nest. The average re-nest interval was six days for both early and late removal treatments. This unexpectedly high rate of clutch replacement suggests a female's propensity to lay a replacement clutch is not likely constrained by latitudinal factors as expected.

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PLUMAGE COLORATION OF A HAWAIIAN HONEYCREEPER
ALONG GRADIENTS OF BIOGEOGRAPHY

Plumage is a phenotypic indicator of the evolutionary past; an artifact of avian life histories and social mating systems. Plumage coloration has not been extensively studied in Hawaiian honeycreepers; the few studies conducted on Hawaiian bird coloration were based upon human vision. I measured the breast and rump patches of adult male and female Hawai'i 'amakihī (Hemignathus virens virens) from twelve sites spanning six climatic categories (elevation/rain) on the island of Hawai'i. I tested Gloger's rule, a biogeographical rule that states birds are darker-pigmented in areas of higher moisture. I found that plumage coloration of Hawai'i 'amakihī varied by the environmental effects of elevation and rainfall on the island of Hawai'i, but these results did not support Gloger's rule. Rather, mean brightness was higher in wetter habitats than in drier habitats. Sexual dichromatism decreased as mean annual precipitation increased. The differences in plumage I detected by the factor of elevation may serve as a morphological complement to the altitudinal genetic structure documented in 'amakihī. My results suggest that biogeographical factors played a pertinent role in the selective pressures exerted on plumage traits of 'amakihī.

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AVIAN NIGHT MIGRATION CONCENTRATION AREAS IN
MICHIGAN: KNOWLEDGE IMPORTANT TO THE SITING OF
WIND FARMS AND OTHER TALL STRUCTURES.

The Great Lakes shorelines have a propensity for high, steady winds making them ideal locations for wind farm development. Portions of these shorelines are also of high value to migratory songbirds and several studies have documented localized migrant songbird concentration areas. The USFWS is generally suggesting that turbines be placed >3 miles from Great Lakes' shorelines. In an effort to provide data and ensure these wind resources are developed sustainably, we used NEXt generation RADar (NEXRAD; Weather Surveillance Radar-1998 Doppler; WSR-88D) to quantify the flight period, migration concentration areas in relation to the Michigan shorelines (Great Lakes of Superior, Michigan, Huron, and western portions of Erie). ArcGIS was used to spatially delineate migration concentration areas based on existing state level radar data. As wind developers and resource managers work toward more informed wind farm siting decisions, it is important to determine, at a site specific scale, if migrant concentration areas coincide with areas proposed for development. Our research and mapping efforts provide information and recommendations that are based on sound science; thereby leading to more sustainable development of renewable energy.

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HABITAT ASSOCIATIONS AND SEASONALITY EFFECTS FOR
BIRDS OF THE HIGH ANDEAN PEATLANDS OF CENTRAL AND
SOUTHERN PERU.

Puna peatlands and grasslands (4000-5200 m) provide habitat for more than 100 poorly understood resident and migratory bird species. Data

were collected during wet and dry field seasons in 2008 and 2009 using line transects (N=86) through a mixture of peatland and adjacent grassland microhabitats including bofedal (permanently saturated fens), cesped (short-grass wetland), bunch grass, standing water, running water, rocky outcrops, and bare ground. Habitat association and abundance data were analyzed for 40 common species using a simple proportion technique (Bonferroni's utilization test) and a more sophisticated approach (factor analysis and a mixed model approach) to determine habitat preferences and explore the effects of seasonality. Three patterns were found: habitat specialists, seasonal habitat specialists, and habitat generalists. Bofedales and cesped revealed the strongest effects of seasonality.

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INFLUENCE OF ENERGY DEVELOPMENT ON SAGEBRUSH-
OBLIGATE SONGBIRDS

Understanding how species respond to anthropogenic disturbance is essential for effective management and conservation of populations. Our study aims to test hypotheses about the effects of habitat loss, alteration, and human disturbance due to oil and natural gas energy development on the abundance, diversity, nest success and offspring quality of sagebrush-obligate songbirds. We studied the Brewer's sparrow (*Spizella breweri*), sage sparrow (*Amphispiza belli*) and sage thrasher (*Oreoscoptes montanus*) at three energy fields in southwestern Wyoming, in 2008 and 2009. We examined response metrics across a gradient of energy development intensity and found that songbird nests in higher well density areas had a significantly lower probability of daily nest survival. Additionally, abundance of some songbirds decreased in higher well density areas. Avian predator abundance did not vary by well density, and so did not directly account for decreases in nest survival. Nest survival was positively correlated with increasing distance from well pads and roads. Patterns from preliminary analysis suggest energy development can potentially have demographic effects on sagebrush songbird communities.

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MOLECULAR PHYLOGENY OF THE MOTMOTS
(CORACIIFORMES: MOMOTIDAE) BASED ON SEQUENCING OF
THE COMPLETE ND5 GENE

The motmots (family Momotidae) are brightly colored Neotropical birds that are known for their barbed spatulate central rectrices (tail feathers). A phylogeny of motmots was reconstructed using the mitochondrial gene, NADH dehydrogenase subunit 5 (ND5; 1818bp), for all 9 extant species and one subspecies (*Momotus momota aequatorialis*). DNA for 10 of the 12 samples was recovered from study skins from the American Museum of Natural History. As outgroups, we used other coraciiforms including a true roller (Coraciidae), kingfisher (Alcedinidae) and two todies (Todiidae). Phylogenetic trees were assembled using maximum likelihood, maximum parsimony and Bayesian methods. Nodal support was evaluated using bootstrapping and posterior probabilities. All trees placed the motmots as a monophyletic group that can be divided into two major clades. Disagreement over branch placement and nodal support values among the various tree reconstruction methods was likely due to nucleotide transition saturation at third positions of codons. Additionally, placement of *M. m. aequatorialis* outside of the *M. momota* clade warrants further investigation of the status of various subspecies within the *M. momota* complex.

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IDENTIFYING PRIORITY BIRD SPECIES FOR CONSERVATION
IN THE TROPICAL ANDES: A CASE STUDY IN YANACHAGA
NATIONAL PARK, PERU

The tropical Andes is a megadiverse hotspot in which nearly every undisturbed area has very long species lists. For this reason, it is especially critical to identify which of these species should be assigned high priorities for conservation. To approach this problem, a method of selection of priority bird species was created based on a bird survey of Yanachaga National Park (IBA PE078), Peru. This method consisted of assigning values to different

criteria for conservation (presence of endangered species, endemics, etc) and monitoring (detectability); then selecting the species with the highest scores. The survey in the park covered the main ecosystems in a gradient; from Andean paramo to lowland rainforest. A total of 321 bird species were found, which is 61% of all bird species ever recorded in the park. I found 61 new records for the park, 12 Peruvian endemics and 20 species were identified as indicators of this IBA. All ecosystems had very high diversity and low similarity between them. The method used proposes 17 species as conservation and monitoring priorities.

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CONTEXT-DEPENDENT VOCAL MIMICRY: CHANGES OVER THE NESTING SEASON IN A PASSERINE BIRD.

Previous work has shown that Greater Racket-tailed Drongos (*Dicrurus paradiseus*) mimic contextually, incorporating the alarm calls of other species, or predator calls, into their own alarm vocalizations, while incorporating other species' songs into their own non-alarm vocalizations. What are the adaptive benefits of this behavior, if any? We observed the vocalizations of adult drongos during an annual reproductive cycle in a rainforest in Sri Lanka. We found that drongos increase the occurrence of their alarm mimicry during the nesting season, with this behavior reaching its highest level during the interval between chick hatching and fledging. Playback experiments to young birds were not interpretable due to parental vocalizations and interference. Playback experiments to another potential audience, heterospecific birds in mixed-species flocks, showed that the mimicry of other species' mobbing calls induced mobbing in other species, but the mimicry of raptor calls did not elicit a strong response. These results suggest that there are both heterospecific and conspecific audiences for alarm mimicry, with the conspecific audience being young drongos that might benefit from learning dangerous sounds in association with drongos species-specific alarms.

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BODY SIZE CHANGES OVER 38 YEARS IN COASTAL CALIFORNIA

Climate change has been shown to have a variety of effects on songbirds and other small landbirds. Most research has focused on behavioral changes such as migration and laying date; less is known about changes in morphology such as body size and weight. As with all climate change research, there is a challenge in obtaining sufficiently long-term datasets to examine this trend. The PRBO Conservation Science has operated a continuous, year-round banding program in coastal California since 1971. Using this banding data, I examine how bird body size and weight have changed in the 29 most abundant species captured. For morphological traits, Bergman's rule predicts a simple, negative correlation between temperature and body size; as global temperatures rise, birds are expected to get smaller. This expected result has been corroborated in the majority of studies on bird size and climate change. However, preliminary analysis of the PRBO data shows that 19 of the 29 species are increasing in size, and 9 are increasing in weight.

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PARASITIC BRONZED COWBIRDS RECOGNIZE HETEROSPECIFIC SONG

During the breeding season of 2008-2009, we investigated the hypothesis that Bronzed Cowbirds (*Molothrus aeneus*) use host activity to locate potential nest sites and predicted that cowbirds will be differentially attracted to vocalizations of different host species. Bronzed Cowbirds' response to host song varied with species and habitat. The Altamira (*Icterus gularis*) and Hooded Oriole

(*I. cucullatus*) songs elicited 35% and 39% of all responses, respectively, while Audubon's Oriole (*I. graduacauda*) elicited 22% and the Olive Sparrow (*Arremonops rufivirgatus*) only 4%. Bronzed Cowbirds responded more to species more likely to successfully raise cowbirds which were still present in or near the study site. Also, most Bronzed Cowbird responses (82%) occurred in wooded habitats most likely to contain nests of suitable hosts, with the rest in open habitats used mainly for foraging by cowbirds. Bronzed Cowbirds do distinguish between songs of different host species and may use host activity (i.e. song) to identify areas to search for suitable nests.

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MOLT-MIGRATION TRADEOFFS: A MECHANISM FOR THE COST OF REPRODUCTION IN MIGRATORY SONGBIRDS

For migratory birds, the carry-over effects of reproduction into the period with the highest energetic tradeoffs, the post-breeding feather moult and pre-migratory fattening period, have rarely been examined. Here, we tested if a high reproductive effort, in the form of double brooding, increases post-breeding corticosterone levels, delays moult and results in moult-migration overlap. We monitored nesting success of wood thrush (*Hylocichla mustelina*) throughout the breeding season and captured individuals during the post-breeding moult period. We used stable hydrogen isotopes (δD) to determine geographic location of feather growth. Birds that were double brooded had higher baseline (0 min) and elevated (30 min) corticosterone levels during the moulting period. Double brooded birds also delayed moult by an average of 2 weeks and were significantly more likely to moult flight feathers on migration. Finally, feathers moulted during migration were grown slower, suggesting a lower nutritional state. These carry-over effects of high reproductive effort could negatively affect survival via moult-migration overlap and competition for winter territories in high quality habitat. Our study identifies tradeoffs during the moult period as a likely mechanism for a cost of reproduction in migratory songbirds.

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VARIATION IN STREAMFLOW INFLUENCES THE ABUNDANCE OF AN ENDANGERED RIPARIAN OBLIGATE SONGBIRD, THE SOUTHWESTERN WILLOW FLYCATCHER.

We evaluated the influence of variation in streamflow of the Gila River, Arizona on the annual abundance of an endangered riparian obligate songbird, the Southwestern Willow Flycatcher (*Empidonax traillii extimus*). Condition of habitat during flycatcher settlement in spring is likely a determining factor of occupancy at sites; however, the exact time period of increased streamflow essential for development of high quality habitat is unknown. We performed a series of linear regressions on the number of territories per breeding season from 1998 to 2009 as related to streamflow over a variety of seasonal time periods and found a positive relationship between streamflow and the number of territories. The beginning of the previous monsoon season to the beginning of the breeding season (July–April) had the strongest relationship to the number of territories ($R^2 = 0.50$, $P = 0.01$), while winter/spring (Dec–March) streamflow showed a comparatively weak relationship ($R^2 = 0.35$, $P = 0.04$); breeding season streamflow showed no relationship. Results suggest a cumulative effect of increased streamflow on habitat quality during the 10 months prior to flycatcher settlement.

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MTDNA PHYLOGEOGRAPHY FOR THE HAIRY WOODPECKER: INSIGHTS FROM A SINGLE LOCUS ANALYSIS

The Hairy woodpecker (*Picoides villosus*) has one of the largest distributions in North America, and its range extends from the far north in Alaska to the highlands of Panama. While previous studies have documented plumage

and morphological variation across its' range, genetic variation is poorly understood. We analyzed mtDNA (control region) for birds (n=200) from populations (n=21) across the North American range of the Hairy Woodpecker. A haplotype network using TCS shows two distinct geographical groups, in which birds of the US Rockies are separate from birds found in the rest of North America. Within the US Rockies clade there is an east to west split where birds on either side of the mountains are genetically distinct from each other. Information gained from this study will be used to answer questions about colonization patterns following the last glacial maximum and to see if natural barriers limit gene flow for Hairy Woodpeckers.

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INTERSPECIFIC DOMINANCE RELATIONSHIPS BETWEEN MOUNTAIN CHICKADEE AND BLACK-CAPPED CHICKADEE AND THEIR IMPLICATION ON LIFE HISTORY.

Black-capped chickadee (*Poecile atricapillus*) and mountain chickadee (*P. gambeli*) are ecologically segregated due to differences in habitat preference. Mountain chickadees are associated with coniferous habitat whereas black-capped chickadees prefer mixed forest with a higher deciduous component. In western Canada, forestry practices have created a mosaic of coniferous and deciduous forests which induce sympatry between these two closely related species and heterospecific flocks have been reported. In *Poecile* species, social hierarchies amongst conspecific individuals are known to influence life-history parameters such as winter survival and breeding behaviour. Previous studies have also indicated that black-capped are dominant over mountain chickadees in interspecific contests, yet these studies often don't control for sex and age of interactants, which are known to affect social status in *Parids*. By conducting both field observations and aviary experiments controlling for sex and age, we were able to confirm that black-capped chickadee are dominant over mountain chickadees. As dominance status is known to influence mate choice in *Parids*, the social hierarchy between these two species might influence presence of hybrid anecdotaly reported in sympatric populations of these two species.

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HABITAT QUALITY, FOOD AVAILABILITY AND SONG STRUCTURE IN CHICKADEES

In vocal learners, such as songbirds, song stereotypy is a highly adaptive parameter that may be used both by females and males to assess the singer's condition. For instance, the internote ratio in the black-capped chickadee fee-bee song, which corresponds to the difference in frequency between the end of the fee note and the beginning of the bee note, seems to be more stable in the song of dominant males than in the song of subordinate males. However, the link between song stereotypy and habitat quality has never been explored in chickadees. In the present study, we compare the song stereotypy of birds occupying different forest age classes and determine that there are fundamental differences in the fine structure of songs across habitats. Moreover, we show that these differences are not alleviated with supplemental feeding in the spring. Our results suggest that the difference in song stereotypy across habitats originates from differences in habitat quality during the song learning period. Long-term food limitation from settling in suboptimal habitat could permanently affect song centre development and consequently alter the song learning process.

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HISTORICAL POPULATION TRENDS IN TRICOLORED BLACKBIRDS
 We analyzed historical trends in population status of Tricolored Blackbirds

(*Agelaius tricolor*) using a database of 2643 records during 1907-2009.

Breeding bird numbers declined 90% over 70 years with the largest colonies in the Central Valley and smaller colonies in Southern, Northern and Coastal California. Habitat types from most to least important were cattails, blackberry, Triticale (a wheat-rye hybrid), bulrushes and thistles. Colonies in cattails were larger in early censuses, but declined more rapidly than colonies in other habitats. By contrast, colonies in blackberry and bulrushes were smaller but declined less through time. Most records for blackberry and Triticale occurred within the last 20 years. Colonies in Triticale were larger than in other habitats since 1990, but were short-lived, with no recorded re-use. Breeding habitats also varied across regions but were not clearly relatable to observed differences in population trends among regions. Surprisingly, colony size was also negatively correlated with annual rainfall across California, perhaps implicating flooding or unrecorded changes in habitat quality. Increased concentration in agricultural and non-native habitats on private lands present significant conservation challenges for this species.

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THE SHIFTING MOSAIC OF YELLOW-BILLED CUCKOO HABITAT ON THE SACRAMENTO RIVER

A 132 km study reach on the meandering sector of the middle Sacramento River was studied to document spatial shifts in yellow-billed cuckoo habitat patches due to hydro-geomorphic processes, vegetation recruitment, and succession over a 35 year period. The co-occurrence of natural vegetation and floodplain age were used to model patches of the willow-cottonwood plant association. Of the 1,664 ha of habitat patches in 1952 only 247 ha (15%) were coincident with 1987. Of the 62 patches delineated for 1987, 17 (27%) emerged anew and independently of the 1952 patches; and the remaining 83% formed from shifting adjacent to the patches from 1952. The degree to which the surrogate variable "floodplain age" can predict the presence or absence of yellow-billed cuckoos was tested using four years of observation data and it was found that 75% of patches were correctly predicted for cuckoo presence or absence in 1987. The commission error and the omission error were each 12.5%. These findings suggest sustaining yellow-billed cuckoo habitat requires the river be managed such that regenerative natural hydrodynamic processes are encouraged to operate.

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NEW NATIONAL APPROACHES TO BIRD CONSERVATION IN HAWAII

Recent convergent efforts to highlight the serious conservation needs of Hawaiian birds have attracted new National recognition, support, and partners. In 2008, a small group of State and Federal partners developed proposals for Nihoa Millerbird, Maui Parrotbill, Iiwi, and Palila and submitted them to the National Fish and Wildlife Foundation for funding under their Keystone Species Initiative; three were adopted collectively under a Hawaiian Forest Bird initiative. In addition, the 2009 State of the Birds report highlighted the plight of Hawaiian birds, which led to a \$3M boost to FWS to plan and implement conservation for forest birds with special emphasis on Hawaii. To build on this momentum familiar and new partners convened in May 2009. A key outcome was a commitment to develop a plan consisting solely of species' needs profiles and project descriptions to facilitate funding by diverse sources and meet the needs of all partners. The geographic scope was expanded to include American Samoa, Guam, the Commonwealth of the Northern Marianas, and other U.S. possessions and territories. This plan is under development.

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BILL SIZE AND DIMORPHISM IN TIDAL MARSH SPARROWS: ISLAND-LIKE PROCESSES IN A CONTINENTAL HABITAT

Conditions favoring trophic character divergence can be similar to conditions that increase sexual dimorphism or variance. We tested for parallel increases between dimorphism and overall increase in bill size in tidal marsh sparrows. Bill size showed the following patterns in tidal marsh sparrows compared to non-tidal species: 1) an increase; 2) a greater increase in males than females; 3) an increase in sexual dimorphism; and 4) greater variation in females. A high

degree of sexual dimorphism in bill size is consistent with the hypothesis that low levels of interspecific and high levels of intraspecific competition select for intra-specific niche divergence. Alternatively, increased sexual selection in tidal marsh sparrows, vis-à-vis high densities and hence increased male-male competition, may account for the differentially large increase in bill size in males. Both hypotheses depend upon processes, particularly increases in population density, that are similar to those often reported for island passerines. However, the low species diversity and increased intraspecific competition of salt marsh faunas are probably a result of abiotic constraints (tides and salinity) rather than the isolating distances of island biotas.

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HOW YOU CAN HELP US - IRBTG PROTOCOLS FOR FEATHERS, PARASITES, BODY CONDITION, METABOLITE COLLECTION

Converting research data into conservation action is difficult to arrange for any bird species. When populations of the species are declining at precipitous rates, the challenges multiply. We in International Rusty Blackbird Technical Group (IRBTG) have accepted this challenge for one such species. No smoking gun exists to explain the birds' plight; scant comparative data exist from across the species' extensive range. Our initial collective efforts suggest that disease, poor quality habitat, and heavy metal contamination of environments occupied by the species all contribute to the decline, in addition to extensive nonbreeding habitat destruction and possible climate change effects on breeding range. We collaborate, and we invite you to collaborate with us. To this end, we have developed a standard protocols for gathering feather samples; blood samples both for genetic, heavy metal analysis, and blood parasite screening, and metabolite determination of diet quality; and assessment of body condition in live animals. We share our methods here, and request assistance from all interested persons in our integrated study of the biology and conservation of this fascinating species.

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A RANGE-WIDE PERSPECTIVE INTO THE ECOLOGY OF A SPECIES IN DECLINE, THE RUSTY BLACKBIRD

The Rusty Blackbird (*Euphagus carolinus*) breeds in boreal wetlands, winters in bottomland forests, and has exhibited the steepest decline of any North American landbird. Breeding Bird Surveys suggest a cumulative decline of >95% over the last 40 years. Christmas Bird Counts indicate a range-wide cumulative decline of >85%. Analyses of ornithological accounts suggest the species has declined for over a century. Range retractions are documented in the southern boreal but limited data suggest abundance is more stable in northerly areas. The major hypotheses for the decline include degradation of boreal habitats from logging and agricultural, mercury contamination, and wetland desiccation from global warming. Other likely reasons include loss of wooded wetlands of the southeastern U.S and mortality from abatement of nuisance blackbirds. The decline was the best-known aspect of the species' natural history until 2005 when a team of biologists began studying this species throughout its range. In this symposium, we bring together the

findings of these initial studies to present the progress made in understanding the range-wide ecology of this declining species.

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RISK OF NEST PREDATION INFLUENCES PRIMARY REPRODUCTIVE INVESTMENT IN AMERICAN KESTRELS (FALCO SPARVERIUS): AN EXPERIMENTAL TEST.

Although resource availability is thought to drive variation in avian life-history strategies, nest predation is the primary cause of nest failure. Birds should therefore adjust parental investment to minimize the costs associated with nest predation. There is evidence that nest predation influences nest-site selection, and drives variation in clutch size and parental behaviour. We experimentally tested how the perception of the risk of nest predation from red squirrels (*Tamiasciurus hudsonicus*) influenced nest-site selection and reproductive investment of American kestrels (*Falco sparverius*) in boreal Saskatchewan. Little is known about how kestrels perceive predation risk, and how these cues influence their settlement and reproductive investment. Although ambient risk of nest predation influenced nest-site selection, experimental manipulations of risk of nest predation did not. However, experimentally increasing the perceived risk of nest predation induced kestrels to initiate breeding later, and to lay larger clutches. Parents did not appreciably alter incubation behaviour in response to our manipulation. We discuss the implications of these findings within the context of avian life-history theory and with reference to the pressures faced by kestrels at our study area.

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PARENTS DO NOT ADJUST CLUTCH SIZE AND EGG VOLUME ACCORDING TO THE PRESENCE OF HELPERS IN A NEOTROPICAL Tanager

Parents can benefit from the presence of helpers by reducing reproductive effort in cooperative breeding birds. We investigated clutch size and egg volume variation in relation to the presence of helpers in 20 groups of the Neotropical cooperative White-banded Tanager (*Neothraupis fasciata*). We searched nests and determined the size of each group of birds in a 100-ha plot located in a 10,500 ha reserve in the central Brazilian Cerrado (savanna like habitat) from early September to early October 2009. We found no correlation between the number of helpers in each group and clutch size ($N = 20$; $r = 0.10$; $p = 0.680$) and between the number of helpers and mean egg volume in each clutch ($N = 18$; $r = 0.05$; $p = 0.830$). Also, clutch size and mean egg volume were uncorrelated ($N = 18$; $r = 0.11$; $p = 0.673$). Apparently, benefit to parents in the presence of helpers does not come from reproductive effort reduction in terms of reduced egg investment in the White-banded Tanager

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PHYLOGENY OF WOODPECKERS (PICIDAE) INFERRED FROM NUCLEAR DNA SEQUENCES

We investigated relationships among woodpecker genera using 2872 bases of the RAG-1 locus. Phylogenetic reconstruction was accomplished using maximum likelihood analysis, and strength of nodal support was assessed using likelihood bootstrapping. We compared the resulting trees to previous hypotheses of relationships proposed by Lester L. Short (1982). The Tribe Melanerpini and the Subfamily Jynginae proposed by Short were both supported as monophyletic, whereas his tribes Campephelini, Meiglyptini, Picini, Colaptini, and Campetherini, as well as his Subfamily Picumninae, resolved as non-monophyletic. In general, woodpeckers showed a relatively high rate of nucleotide substitution for RAG-1. We found little variation in base composition across taxa except that *Picumnus temminckii* showed an

elevated proportion of GC. Trees of relationships of these genera exhibited strong structure and, in general, high levels of bootstrap support at basal and terminal levels.

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ACCEPTANCE OR REJECTION OF COWBIRD PARASITISM: CUES USED IN DECISION-MAKING IN YELLOW WARBLERS (*DENDROICA PETECHIA*).

The proximate cues for clutch abandonment are unclear for many species, including Yellow Warblers, which abandon clutches via burial or desertion parasitized by cowbirds. In 2008, eggs added to nests before sunrise (natural parasitism time) were abandoned at a similar frequency as naturally laid eggs. The most aggressive individuals were more likely to bury. In 2009, eggs added to nests before vs. after sunrise were abandoned at similar frequencies, suggesting that timing is not important in eliciting abandonment. Warblers returning to nests after egg addition peered longer at their clutch, shuffled their bodies more frequently and spent more time probing eggs. Only non-mimetic eggs were ejected from some nests. Therefore, warblers use tactile and visual cues to determine they have been parasitized. Finally, few individuals that buried did so a second time, when less time remained to breed. Therefore, egg rejection in Yellow Warblers is influenced by environmental cues. This may be true for other hosts of avian brood parasites that use clutch abandonment as a form of egg rejection, which is costly in terms of time and energy.

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GENDER DIFFERENCES IN SOUTHWESTERN WILLOW FLYCATCHER HABITAT PREFERENCES, MANAGEMENT IMPLICATIONS

We used spot-mapping to determine off-nest habitat preferences of male and female Southwestern Willow Flycatchers (*Empidonax traillii extimus*) in a Coast Live Oak (*Quercus agrifolia*) dominated southern California riparian corridor. Female Willow Flycatchers preferred lower perches than did males and more frequently used shaded glades within the forest as well as young, closed canopy forest with patchy, well-developed understory. Males preferred isolated perches within grassy meadows; small branches in isolated patches of shrubs and small trees; and forest edge perches in the upper third (including tops) of larger trees. Unused sites exhibited more uniform vegetation; higher tree density or tall, dense, expansive shrub layer; and typically lacked shaded and unshaded glades and a well-developed understory. Female and male habitat (and micro-climate) preferences must be incorporated in the design of recovery-oriented restoration sites for this endangered species as well as management of its currently occupied habitats. The absence of periodic scouring at our study site may render unsuitable currently occupied areas whereas management (e.g., thinning, burning, planting) of unused sites may contribute significantly to the species' persistence.

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CLIMATE CHANGE AND THE ROLE OF AVIAN IMMUNITY

Climate change may alter the frequency and pattern of transmission of disease organisms in many ecosystems. The survival of wildlife species in response to altered threats of infection will reflect their species-specific immune systems. Species adapted to respond to a broad spectrum of immune challenges – often invasive species – may adapt to climate change more successfully. We study the parasitic cowbirds (*Molothrus* spp., Icteridae), which have experienced selection for enhanced immunity as a result of their life history strategy. As generalist brood parasites, they lay their eggs in the nests of other species, where young cowbirds face unique exposure to diverse parasites and microbes of their foster parent species. We show that the immune defenses of cowbird

species are significantly more effective than those of non-parasitic relatives, both in experimental infection studies with virulent encephalitis viruses and in cellular-level assays of innate immune defenses. Generalist brood parasites are good model organisms for understanding how evolution shapes enhanced immune responses and for predicting which aspects of immunity will respond most effectively to changes in parasite patterns.

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AVIAN SUBSPECIES AND THE U.S. ENDANGERED SPECIES ACT

Scientific debate over identification of taxa below the species level has persisted for centuries. This issue can be especially problematic for avian species, because dispersal is often orders of magnitude greater than other vertebrates, leaving genetic differences among groups proportionately smaller. While the debate lingers, management decisions, often with millions of dollars and potential extinctions resting on the outcome, are regularly made by agencies tasked with maintaining lists of threatened and endangered taxa. With outdated taxonomic treatments and no formal policy or guidelines for defining species or subspecies, agencies have no authority to cite in determining limits to species or subspecies ranges, etc. Lack of guidance from professional organizations regarding taxonomic criteria and lists does not benefit these species of concern. Here we describe how subspecies designations are evaluated under the Endangered Species Act, tradeoffs between maintaining the Biological Species Concept in avian taxonomy versus adopting a Phylogenetic Species approach, and why it is imperative for scientific organizations to maintain updated taxonomic treatments regardless of the species concept they operate under.

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LONG-TERM ISOLATION OF MAGNIFICENT FRIGATEBIRDS ON THE GALAPAGOS DESPITE EXTENSIVE GENE FLOW ACROSS MUCH OF THE REMAINING RANGE

Tropical seabird populations typically show strong geographic structuring, despite their capacity for long-distance flights. Magnificent frigatebirds (*Fregata magnificens*) are especially well-suited for a life in the air, even compared to other seabirds. We analyzed genetic variation at three marker systems (mitochondrial DNA, microsatellites and nuclear introns) in samples from Atlantic, Caribbean and Pacific populations. Across genetic methods, we consistently found signatures of extensive gene flow over most of the range. Even the isthmus of Panama, a major barrier to gene flow in other tropical seabirds, does not appear to significantly limit dispersal in this species. In contrast, we found that magnificent frigatebirds from the Galapagos are strongly differentiated from all conspecifics, consistent with isolation for several hundred thousand years. Phenotypic characteristics confirm the differentiation of Galapagos population and further stress the uniqueness of the Galapagos magnificent frigatebirds.

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ESTIMATING AVIAN MORTALITY AT A UTILITY-SCALE WIND FARM IN NORTH-CENTRAL TEXAS

Wind power has become the fastest growing source of renewable energy worldwide and is now a mainstream option for electricity generation. Despite the recognized environmental benefits of wind power, concerns persist over

the potential threats to wildlife from the construction and operation of wind energy projects. From March to October 2009, we conducted systematic post-construction mortality searches at a 112.5 MW wind farm in north-central Texas. We will summarize patterns of bird mortality and relate these estimates to weather data, operations data, and features of the landscape that may be important predictors of risk (e.g. wind turbine proximity to forest edge or permanent bodies of water). We will compare bird mortality patterns with bat mortality patterns. We will also discuss the effects of search strategy, plot design, searcher and scavenger efficiency trials, and the effects of search interval on estimates of mortality.

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FROM ACADEMIA TO THE NON-PROFIT WORLD: A VIEW OF ORNITHOLOGY

Linnea S. Hall is Executive Director of the Western Foundation of Vertebrate Zoology, a non-profit museum in California that holds the largest collections of birds' eggs and nests in the world. Hall always thought she would be an academic ornithologist, but after teaching at a university for 4 years, she chose a different path. In 2002 she began working in the non-profit world, and has found it to be highly challenging in many unexpected ways, but also uniquely rewarding. Hall will discuss her transition from academia to the non-profit world, and her view of the pros and cons of working in the two sectors.

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CHARACTERIZING DISPERSAL PATTERNS IN A THREATENED SEABIRD WITH LIMITED GENETIC STRUCTURE

Genetic assignments provide an appealing approach for characterizing dispersal patterns, but require sufficient genetic differentiation to accurately identify migrants. We demonstrate that assignments can characterize dispersal patterns in a marbled murrelet (*Brachyramphus marmoratus*) population from central California that numbers approximately 600 individuals and is only moderately differentiated ($F_{ST} \sim 0.03$) from larger northern populations. Using coalescent simulations we selected a significance level that resulted in a low and approximately equal expected number of type I and II errors and then used this significance level to assign 589 individuals to a population of origin using 13 microsatellites. The proportion of migrants in central California was greatest during winter when 83% of individuals were classified as migrants compared to the breeding (6%) and post-breeding (8%) seasons. Dispersal was also biased toward young and female individuals. A greater number of migrants than expected under equilibrium conditions, a lack of mixed-ancestry individuals, and few source populations, allowed us to use assignments to characterize dispersal patterns for a population that was larger and less differentiated than typically thought required for the identification of migrants.

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PARENTAL CARE IN THE YELLOW-BILLED CUCKOO

Little is known of the nesting biology or parental care of Yellow-billed Cuckoos (*Coccyzus americanus*). We followed 28 adult cuckoos with transmitters and placed video cameras on four nests in southeastern Arizona from 2001-2005. Both sexes constructed the nest. Eggs were laid within 24 hours of nest initiation. Males did all nocturnal incubation and females did the majority of diurnal incubation. Females decreased food deliveries on days five and six, and stopped feeding on day seven (average fledge age). In this study, we observed

a pattern of male-dominated parental care. Males provided the majority of incubation and food to nestlings and all fledgling care. Five transmitted females were observed during nestling care; two of these birds abandoned viable nests to the male's care and initiated nests with another male. One of the nests had a third adult in attendance. This third adult assisted with the first nest effort, and may have been tolerated as a secondary food provider. We observed one incidence of infanticide at this nest by an unbanded adult. Yellow-billed Cuckoos appear to be facultatively serially polyandrous.

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FACTORS INFLUENCING COLONY ATTENDANCE BY DOUBLE-CRESTED CORMORANTS IN THE NORTH CHANNEL OF LAKE HURON

Double-crested cormorants *Phalacrocorax auritus* have been increasingly involved in human conflicts since their population resurgence. Of the movement studies published for cormorant breeding grounds, few have focused on cormorant colonies on the Great Lakes. The objective of my study was to describe factors influencing colony attendance and visits to adjacent colonies on the Great Lakes. We radio-tagged cormorants (n=8/island) nesting on two islands in the North Channel of Lake Huron to monitor colony attendance and intercolonial movements from 31 May – 30 September 2009. Over 14,000 lines of presence/absence data were recorded by the data loggers. During the incubation stage, both breeding and non-breeding birds exhibited a bimodal attendance pattern. The average number of detections per hour for all birds decreased during the nestling stage compared to the incubation stage. Non-breeding birds were consistently detected less often than breeding birds. Six of eight cormorants tagged on Fortin Rock, visited Magazine Rock throughout the breeding season, though the frequency of visits increased during the nestling stage. In August, two cormorants were recovered from Manitoulin Island, 40km southeast of the study area.

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USE OF MOLECULAR TECHNIQUES TO EVALUATE THE CAPTIVE BREEDING PROGRAM OF THE ATTWATER'S PRAIRIE-CHICKEN.

The Attwater's prairie-chicken (*Tympanuchus cupido attwateri*) has been listed as federally endangered since 1973, and today, less than 80 individuals exist in the wild, most of which originated from the captive breeding program initiated in 1992. All existing birds have descended from 19 founder individuals. In April 2006, the entire captive population (n=161) was genotyped with eight microsatellite loci to evaluate the genetic status and studbook data used in the captive breeding program. Our analyses indicate that levels of observed heterozygosity have been maintained in the captive population since its initiation (0.642 ± 0.067 & 0.693 ± 0.031). However, we observed thirteen misidentified parentage assignments from information given in the studbook. Decedents of these miss-assigned individuals make up 17.5% of the spring 2009 captive population (n=160). Genotype information is being used to help identify correct parentage and evaluate the potential impact misidentified parentage may have had on minimizing mean kinship in the captive population. Results of this study further suggest that endangered species recovery programs should periodically check their studbook for mismatched parentage assignments.

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HABITAT CHARACTERISTICS OF YELLOW-BILLED CUCKOO IN RESTORED RIPARIAN FORESTS ON THE SACRAMENTO RIVER, CALIFORNIA

Habitat restoration strives to create habitat for wildlife with the hopes of increasing populations that have been negatively impacted by habitat loss. The ongoing restoration effort along the Sacramento River, California, has

identified a suite of target wildlife species that are indicative of riparian health. Yellow-billed Cuckoo are one of the focal species, although they are not readily detected in bird surveys. I investigated cuckoo presence and absence in restored riparian forests along the Sacramento River, California in the 2007 and 2008 breeding season for this species. I investigated variables at various spatial scales to see what habitat features cuckoos were associated with. I found that willow shrub area was an important predictor variable for cuckoo presence. Cottonwood forests comprised a higher percentage of the landscape composition than any other habitat type. The results of this research indicate that cuckoos may be using habitat features at various spatial scales when selecting habitat on the breeding ground. These results will help guide future restoration efforts for cuckoo habitat, though this study does not examine habitat use by cuckoos.

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MATING SYSTEM AND SOCIAL BEHAVIOR OF RUSTY BLACKBIRDS ON YUKON FLATS NATIONAL WILDLIFE REFUGE, ALASKA.

Rusty Blackbirds (*Euphagus carolinus*) have suffered one of the steepest declines of any bird species in North America with populations reduced by 90% since 1966. Observations of Rusty Blackbirds on their breeding grounds suggest that the sex ratio is biased in favor of males. It is unclear if this bias is related to their mating system, a function of ratio at hatching, or to differences in survival of males and females after hatching. Thus the study of their mating system is important in understanding possible reasons for this bias and to develop effective conservation measures. Rusty Blackbirds' mating system, social behavior, and sex ratio of nestlings were studied in 2009 on Yukon Flats National Wildlife Refuge, Alaska. Adults were color banded (n=29) and monitored to assess feeding of nestlings and nest defense. Nestlings were banded (n=30), and blood was taken from both adults and nestlings for DNA analysis, to examine the relationship between nest investment and relatedness. Microsatellite DNA fingerprinting and observations suggest that Rusty Blackbirds do not have a classic monogamous mating system.

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LOCAL-SCALE STRUCTURE, DYNAMICS, AND ENVIRONMENTAL CORRELATES OF BREEDING BIRD DISTRIBUTION MARGINS ALONG A DESERT GRADIENT UNDERGOING RAPID CLIMATE CHANGE

Local-scale processes at distribution margins can affect larger-scale distribution dynamics, but are rarely studied. The objective of this research was to elucidate the nature of distribution limits by studying the comparative structure, dynamics, and environmental correlates of breeding bird populations at their distribution margin. We studied distribution patterns along a low-elevation (200-1800 m) desert gradient in southern California that is undergoing rapid climate change (locally, annual mean maximum temperature has increased by 3.8°C since 1962). We used logistic regression with hierarchical partitioning to determine the independent effects of environmental variables on distribution limits vs. within-range patterns at the margin. We found that distribution patterns were highly individualistic among species, but were remarkably static over three study areas and three years. Climate was relatively important for distribution limits of lower-elevation-limited species (chaparral birds), and there was a shift to greater importance of biotic habitat for within-range patterns. However, upper-elevation-limited species (desert scrub birds) were more likely to shift upward in elevation over a 26-year period. This research highlights the importance of biotic interactions in forecasting distribution shifts.

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NEST-SITE SELECTION AND PRODUCTIVITY OF VESPER SPARROWS BREEDING IN GRAZED HABITATS

Livestock grazing in the Intermountain region of British Columbia is predicted to impact ground-nesting bird communities. We examined nest-site selection and nesting success in Vesper Sparrows at plots with different grazing histories. We tested vegetation characteristics known to be affected by grazing as predictors of nest-site selection, daily nest survival probability and nestling condition, to determine how grazing could influence habitat selection and productivity at a fine scale. We also assessed grazing history as a predictor of nest survival probability and nestling condition, to determine whether grazing influenced productivity at a broader scale. Vesper Sparrows selected nest sites with vegetation conditions characteristic of ungrazed habitats. Daily nest survival probability was linked with the same suite of variables as nest patch choice, revealing a case of adaptive selection. However, while productivity of Vesper Sparrows was clearly negatively associated with grazing effects at a nest-site scale, plot-level differences in daily nest survival were related to site effects rather than grazing history.

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BIRD DIVERSITY, MACROINVERTEBRATE ABUNDANCE AND VEGETATION STRUCTURE IN EXURBAN AREAS.

We examined whether macroinvertebrate abundance and vegetation structure is associated with changes in bird communities in exurbanized forest on the Cumberland Plateau in Tennessee, USA. We randomly located sampling points across a gradient of exurbanization. We used point counts to quantify bird communities; sweep netting, soil cores, and pitfall traps to quantify macroinvertebrate diversity; and live and dead tree sizes to assess vegetation structure. Bird communities had higher richness and abundance in exurban areas compared to forests, and lost some species of conservation concern but gained others. The macroinvertebrate community was slightly more abundant in exurban areas, with a slight shift in taxonomic composition. The abundance of macroinvertebrates in soil core samples (but not pitfall traps) predicted the abundance of ground-foraging birds. The abundance of macroinvertebrates in sweep nets was not associated with the abundance of aerial insectivore birds. Exurban areas had, on average, more large trees. Exurbanization therefore appears to change both bird communities, macroinvertebrate communities and vegetation structure, but to a lesser extent than other habitat changes such as forest fragmentation or more intensive urbanization.

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DEVELOPING A SPATIAL MODEL OF YELLOW-BILLED CUCKOO BREEDING HABITAT

We are assisting the Lower Colorado River Multi-Species Conservation Program develop a spatial model of Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) breeding habitat. Specifically, we are identifying landscape and riparian features that constitute high quality breeding habitat with logistic regression, presence/absence survey data, Landsat imagery and a digital elevation model. Currently, our best candidate model contains four

variables and achieves 74% overall accuracy. The most influential predictor variable characterizes the amount of densest riparian vegetation (NDVI > 0.41) inside a 480-m radius (i.e., 72-ha neighborhood). The odds ratio indicates that the likelihood of a cuckoo occurrence goes up ~90% for each 10% increase in the amount of densest vegetation found within the surrounding neighborhood. Three other significant variables include distance to water, size of floodplain, and heterogeneity in vegetation density. We are exploring whether fragmentation metrics, such as the number of patches, amount of edges, or landscape connectivity, improve the model's fit. The spatial model identifies cuckoo breeding habitat remotely and could be used to assess the effectiveness of habitat restoration or enhancement projects.

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**EVIDENCE FOR THE SPECIES STATUS OF THE BAHAMA
 YELLOW-THROATED WARBLER (*DENDROICA*)**

The Bahama subspecies of the Yellow-throated Warbler (*Dendroica dominica flavescens*) was originally described as a species, but was later reclassified as a subspecies in part because the trinomial was considered useful for demonstrating relationships. We investigated the taxonomic status of *flavescens* by examining morphological, plumage, song, and genetic data. Morphologically, *flavescens* and continental *dominica* differed significantly in bill, tarsus, wing chord, and tail lengths, resulting in 100% discrimination using discriminant function analysis. The yellow belly of all *flavescens* specimens contrasted with the white belly of all *dominica*. Contrary to earlier accounts, the ascending song of *flavescens* was diagnosable from the descending song of *dominica*. Mitochondrial control region sequence data revealed fixed differences and 1.0% divergence between *flavescens* and *dominica*. Phylogenetic analysis indicated that *flavescens* samples form a monophyletic group and that *dominica* is paraphyletic with respect to *flavescens*. This is consistent with a scenario of peripatric speciation: complete lineage sorting in the *flavescens* population but incomplete lineage sorting in the much larger continental *dominica* population. We conclude that *flavescens* satisfies the requirements of both the Biological and Phylogenetic Species Concepts.

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**AT-SEA HABITAT USE AND PATTERNS IN SPATIAL
 DISTRIBUTION OF MARBLED MURRELETS IN PORT
 SNETTISHAM, SE ALASKA**

We examined habitat use and spatial distribution of Marbled Murrelets (*Brachyramphus marmoratus*) during summer 2007 in Port Snettisham, AK. We modeled murrelet distribution at fine- (100-1600 m) and meso- (14.4 km) scales using CART analyses. At almost all fine-scales, distance to flyways was the most important variable. At the meso-scale, low prey availability was associated with lower densities of murrelets. When prey availability was low, murrelets were more abundant in Port Snettisham during nest incubation and chick rearing compared with other times. We used Ripley's K to examine spatial clustering by murrelets relative to each other (univariate) and their prey (bivariate). Murrelets showed significant univariate spatial clustering on all transects (patch length range: 0.3-9.0 km). Patch length increased significantly at the end of the breeding season. When murrelet mean group size was relatively high (>2.33 murrelets.group-1), murrelets tracked prey at significantly finer scales and had significantly lower patch lengths, suggesting that larger groups are more closely associated with fish and other groups of murrelets. We found murrelets tracked prey over a broader range of scales at medium prey relative abundances.

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**EFFECTS OF VEGETATION ON THE DISPERSAL OF BLACK
 FRANCOLIN FRANCOLINUS FRANCOLINUS BOGDANOVI IN TWO
 FOREST AND FARMING HABITATS IN EASTERN SISTAN, IRAN**

In this paper, effect of plant coverage on (*Francolinus francolinus bogdanovi*), during March-September 2008 in monthly manner in their habitats studied in two areas of Niatak and Doost Muhammad Khan. The route selected for recording observations based on line transects and the number of observed specimens. By following the determined route, wherever black francolins were found a 2x2 m² plot were sampled in connection with vegetation study, plant species, the height of each species and the crown cover were recorded. Totally (N= 82) plots in localities, were studied. The dominant plant species in spring was (*Phragmites australis*) in Niatak and Stuvvie sp. in Doost Muhammad Khan; however (*Alhaji camelorum*) was the dominant species in summer and overall in both areas. In Niatak, crown cover of 30-40 % and height of 50-60 cm had more birds observed and in Doost Muhammad Khan crown cover of 20-30 % and height of 20-30 cm. According to the results, habitat preference of the Black Francolin is in connection with crown cover and the height of vegetation

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**SPRING LOON MIGRATION PHENOLOGY OFF CENTRAL
 CALIFORNIA, 1994 THROUGH 1996**

Three species of loons, Red-throated, Common, and Pacific, undergo a spring migration along the Pacific coast from their wintering areas to breeding grounds. In 1994-1996, migrants were observed daily from 18 March through 02 June at Piedras Blancas and the numbers of birds recorded. The numbers of Red-throated Loons increased each year; the rate of Pacific Loons observed increased in 1995 and then decreased in 1996, but not as low as observed in 1994 rate; the rate of Common Loons observed decreased during the study period to a rate lower than initially observed in 1994. In addition to the number of birds migrating north, we obtained information about the migration span and peak period for each species and differences in the timing of migration among the years. The source of the flights was predicted using the observed peak migration hours. Our study detected variability in loon migration by species and the hour of migration may provide insight flight sources. This time series may be of value for monitoring climate change and its effects.

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**A LONG-TERM STUDY OF PRESCRIBED FIRE EFFECTS ON
 HENSLOW'S SPARROW IN ILLINOIS**

We studied the response of Henslow's Sparrows (*Ammodramus henslowii*) to 11 prescribed fires conducted over a 16 year period (1991-2006) at Goose Lake Prairie State Natural Area in northeastern Illinois. We used an information-theoretic approach to evaluate factors influencing Henslow's sparrow abundance within burn units at the site. Potential factors included year, time of season, and a series of variables describing various short- and long-term responses to prescribed fires. The "best" model included four terms and explained 24% of the variance in abundance among burn units. Terms included in the best model included a year effect (overall abundance increased during the study), a time of season effect (abundance was higher late in the breeding season) and both short- and long-term burn effects. Abundance was reduced in the first growing season following the fires then peaked before gradually declining in subsequent years. Our results confirm previous studies that have shown this species to be sensitive to prescribed fires, but also show that partial recovery can occur within the burn-year and that abundance may decline with long intervals between fires.

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REEVALUATING THE EXISTENCE OF THE BASILINNA GENUS USING MITOCHONDRIAL AND NUCLEAR DNA SEQUENCES

The hummingbird genus *Hylocharis* includes eight species, and some recent studies indicate that the genus is paraphyletic (McGuire et al. 2007). Even more, Ridgway (1911) suggested that the White eared hummingbird (*Hylocharis leucotis*) and the Xantus hummingbird (*Hylocharis xantusii*) must be consider under the *Basilinna* genus, as was proposed before by Boie in 1831, and more recently by Schuchmann (1999) and Howell and Webb (1995), that resurrected this proposal based on the external morphology that suggest a closer relationship to the *Lampornis* genus. We sequenced mitochondrial and nuclear genes (partial sequences of ND2, C-mos and AK5) for seven of the eight species of the genus, and conducted phylogenetic analysis, obtaining maximum parsimony (MP), maximum likelihood (ML) and Bayesian Inference (BI) trees, using combined sequences (c-mos+AK5+ND2) and separated genes (c-mos, AK5, ND2) data sets. Our result clearly indicate the existence of a monophyletic *Basilinna* genus including *H. leucotis* and *H. xantusii* with high support of the branches in all the analyses.

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DOES SUCCESSFUL RE-NESTING BY ARCTIC-BREEDING DUNLIN (*CALIDRIS ALPINA ARCTICOLA*) RESULT IN ADDED PRODUCTIVITY?

Lack of information on re-nesting propensity, brood survival, and juvenile survival present the greatest impediments to estimating arctic shorebird productivity and population trends. We evaluate the second of these, brood survival, while accounting for the first, re-nesting following experimental removal of initial nests from Arctic-breeding Dunlin (*Calidris alpina arctica*). We monitored a total of 66 broods by systematically following adult males and their broods using radio telemetry. We considered broods with at least one chick surviving to fledge (15 days) successful. Ten of 19, and 15 of 20 initial broods successfully fledged young in 2008 and 2009, respectively. In contrast, only 2 of 19, and 3 of 8 replacement broods fledged young in 2008 and 2009, respectively. We examine the relationship of brood survival in initial versus replacement clutches, environmental factors, hatch date, and insect abundance using daily survival rate models in program MARK. We discuss the impact of brood survival rates from initial and replacement clutches on estimates of productivity and the subsequent implications for shorebird management.

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THE EFFECTS OF WEST NILE VIRUS ON THE REPRODUCTIVE SUCCESS AND OVERWINTER SURVIVAL OF EASTERN BLUEBIRDS IN ALABAMA

We tested for negative effects of West Nile Virus (WNV) on a breeding population of eastern bluebirds in Alabama by comparing fecundity and reproductive success in years before and after the arrival of WNV and by comparing fecundity, reproductive success, and overwinter survival of seropositive and seronegative individuals within the same population in the same years. We found that female bluebirds were more likely to be seropositive

than male bluebirds. Age and individual condition did not affect likelihood of being seropositive. Being seropositive for WNV was not associated with any negative effects on reproduction or survival. However, female fecundity was higher in years after WNV compared to years before the arrival of WNV. The reproductive success of males who tested positive for WNV exposure was higher than that of males that were seronegative. Overall, we found no negative effects on reproduction or survival following exposure to WNV.

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LIFE AFTER ICE: POST-PLEISTOCENE CHICKADEE DISPERSAL IN NORTH AMERICA

Post-glacial avian recolonization of North America was influenced by several factors including the source refugia (number and size), patterns of glacial retreat and physical barriers such as mountain ranges and large river systems. By comparing the levels of genetic variation in previously glaciated vs. unglaciated regions of North America, we can infer patterns of recolonization and the roles of physical and non-physical barriers to species dispersal. Using a 680 base pair sequence of mitochondrial DNA (control region) from a common, year-round resident songbird, the black-capped chickadee (*Parus atricapillus*; n=360), we found genetic differentiation among potential Pleistocene refugia (Alaska, Newfoundland and southern Alberta/northwest U.S.) and previously glaciated populations (e.g., mainland Canada; P<0.001). High levels of allelic variation were found between eastern and western populations, and the northwest U.S. population was significantly different from all other populations (P<0.001 for all populations). Based on sequence similarities, the data suggests at least four distinct lineages, three that correspond to past refugia (e.g. northwest U.S., Alaska and Newfoundland) and a fourth widespread group.

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USING AN INDIVIDUAL-BASED MODEL TO PREDICT ANNUAL FECUNDITY IN ACADIAN FLYCATCHER

Midwest forest fragments are perceived as population sinks for migratory forest birds. Some Missouri birds have long breeding seasons, and can make up for increased rates of nest failure, by breeding through August. In 2007-2009 we followed 122 female Acadian Flycatchers (*Empidonax virens*) finding 255 fledged young. Each female fledged an average of 2.09 young/female, for a lambda (population growth rate) of 1.02. Traditional models underestimate fecundity by 29 % and lambda by 7%. We developed an individual-based model (IBM) to estimate annual fecundity. The model predicted the actual annual fecundity within 1-2%. Accounting for late season nests, and multiple renests we get a better picture of the population status of migratory birds. Late-season nests must be accounted for to prevent underestimating productivity of Acadian Flycatchers and potentially other birds that breed late in the season. An IBM is a useful tool to predict fecundity for Acadian Flycatchers and possibly other species as well. Accounting for late-season nests is critical in accurately assessing population status of some species.

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ISOTOPIC EVIDENCE FOR A HISTORICAL SHIFT IN THE BREEDING DISTRIBUTION AND MIGRATORY DIVIDE AMONG RUSTY BLACKBIRDS

Causes for the dramatic decline in Rusty Blackbird (*Euphagus carolinus*) numbers are unknown. We used δD values of feathers from Rusty Blackbirds collected in Mississippi Alluvial Valley (n=255) and South Atlantic Coastal Plain (n=281), 2005-2009, to estimate origins of birds wintering west and

east of the Appalachians, respectively. We also measured feather δD values from available museum collections, 1879-1990, for these same regions ($n = 190$). These isotopic values support the existence of a migratory divide in this species. Populations in the west-central boreal migrate through a central or Mississippi flyway; those in the eastern boreal migrate to sites east of the Appalachians. We detected little change in origins of modern and historical populations wintering east and west of the Appalachians but found high spatial and temporal variability in origins of birds wintering in South Atlantic Coastal Plain. The migratory divide suggests that effective management will distinguish at least eastern and western sub-populations both on the breeding and wintering grounds. Our approach can be applied to a broad range of migratory species in North America and elsewhere.

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LIVE TO MIGRATE ANOTHER DAY? RECONCILING RISKY BEHAVIOURS WITH LIFE-HISTORY DECISIONS

In a world where everything survives by eating something else, avoiding becoming dinner for a predator is of paramount concern to most small birds, shaping both behaviour and life-history. Within this context, I explore how short-term migratory stopover behaviours relate to long-term life-history decisions. During migration, Western Sandpipers (*Calidris mauri*) must trade-off current predation risk from local predators against future predation risk during moult when capacity for flight is inhibited. Western Sandpipers can decrease predation risk during moult by arriving on their moulting quarters earlier than their primary predator the Peregrine Falcon (*Falco peregrinus*) and by moulting at more southern latitudes. At stopover sites, earlier arrival and maintaining a lower wing-loading (a measure of escape performance) can reduce predation risk. I used migratory timing and wing-loading to assess short-term risk-taking behaviour by migrating Western Sandpipers, and stable isotope analysis to reveal levels of risk aversion at the life-history scale through identification of moulting latitude. I found that over the short-term, as the threat of predation became more imminent Western Sandpipers increased their exposure to predation risk.

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STATUS OF THE LEAST BELL'S VIREO IN THE SANTA ANA RIVER WATERSHED IN SOUTHERN CALIFORNIA-RECOVERY IN PROGRESS

The Least Bell's Vireo, *Vireo belli pusillus*, is an endangered bird of riparian habitats in California and Mexico. Its decline is due to habitat loss and brood parasitism by Brown-headed Cowbirds, *Molothrus ater*. A low count of 19 pairs was documented in Prado Basin in 1986 by U.S. Fish & Wildlife (USFWS) biologists. A management program consisting of habitat restoration and cowbird trapping was initiated in a cooperative effort among the Orange County Water District (OCWD), the Santa Ana Watershed Association (SAWA), the Army Corps of Engineers, and the USFWS. SAWA and OCWD have initiated major habitat restoration for the vireo with the removal of approximately 3,800 acres of giant reed, *Arundo donax*, and associated invasive species from the watershed since 1997. Over 100,000 Brown-headed Cowbirds have been removed from the watershed since 1986. The Least Bell's Vireo population in the watershed has increased from 19 territories in 1986 to 1,013 in 2008. Annual data have been collected on the vireos' reproductive success, parasitism rates, depredation rates and nest site characteristics.

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IMPLEMENTING BIRD CONSERVATION ON PRIVATE LANDS

Private lands are critically important to bird conservation. The objectives of our paper are to (1) increase awareness of the importance of private lands for bird conservation, (2) improve audience understanding of opportunities and challenges to implementing bird conservation on private lands, and (3) showcase examples of efforts that have successfully advanced bird conservation. Achievement of conservation goals on private lands requires a detailed knowledge of farming and ranching practices, conservation programs, and effective partnerships between land users and conservation interests based on mutual trust. Lessons learned from our experiences implementing bird conservation on private lands are (1) economic considerations are the primary drivers of land-use decisions, so precise valuing of ecosystem services rendered under various management scenarios is essential; (2) bird conservation plans need to be fully integrated and linked to broader societal needs; (3) population and habitat goals need to be defined and evaluated in an adaptive management framework; (4) conservation programs/actions should be targeted and applications/incentives ranked with respect to these goals; and (5) effective communication with community leaders will improve adoption of bird friendly practices.

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BODY MASS MAY NOT ALWAYS REVEAL IMPORTANT VARIATION IN ENERGETIC CONDITION DURING THE ONSET OF BREEDING IN THE ATLANTIC PUFFIN, (*FRATERCULA ARCTICA*).

We captured adult Atlantic puffins breeding at Machias Seal Island to survey energetic condition and breeding status during breeding onset. Puffins were captured 13-15 May, 2009, by either treadle-style box trapping along the rocky intertidal area ($n = 20$) or by gently removing birds from nearby burrows ($n = 20$). All birds were sampled for corticosterone (CORT), triglycerides (TRIG), and glycerol (GLYC) within 2-4 min of initial disturbance (dropping into the trap or first contact in the burrow). The two groups did not differ in body size or mass and neither showed indications of fattening or egg yolk deposition (both had low TRIG). However, box-trapped birds had higher CORT ($p = 0.033$) and GLYC ($p = 0.0001$), indicating that they were more likely to be losing energy reserves at the time of capture than those already with eggs in burrows. These results suggest that, independent of mass, birds can vary significantly in energetic status. Birds captured away from burrows during this stage could represent a behaviorally and physiologically different cohort, with potentially different breeding success than those already in burrows.

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ANTIMICROBIAL PROPERTIES OF SWIFT (APODIDAE) SALIVA: AN ASEPTIC APPROACH?

Microbial infection is a major mortality source in birds that can occur through trans-shell pathogenic micro-organism contamination. This resulted in a suite of adaptations against microbes (e.g., incubation, using aromatic plants as insecticides or antipathogenic agents, and egg shell antimicrobial matrix). Another potential mechanism completely unexplored is saliva. Most (~75%) swift (Apodidae) species use a salivary nest glue to construct nests. Despite this unique behavior, swift saliva function as an antimicrobial agent remains unexplored. Our objectives were 1) to document, isolate, and identify antimicrobial proteins from chimney swift nests, and 2) test these extracts

against microbes. Preliminary data indicate the presence of an ovotransferrin homologue, a known antimicrobial protein. Disc diffusion tests suggest that crude extracts inhibit the growth of some bacteria. This is the first study to investigate the antimicrobial properties of swift saliva. Besides functioning as an adhesive, nest glue may function to sanitize a nest. We plan to extend our studies to investigate how saliva functions in solid form. This contributes to our growing knowledge of vertebrate-microbe interactions, and may serve to inspire new biomimetic antimicrobial adhesives.

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A COMPARISON OF MASS CHANGE BY MIGRANTS DURING STOPOVER USING THREE DIFFERENT METHODS

Stopover sites provide Nearctic-Neotropical migrating passerines an opportunity to build and/or restore fat stores needed for extended flight. Common methods of estimating migrant use of stopover habitat involve calculating mass change of individuals recaptured on subsequent days or estimating mass change using regression models. We compared estimates of mass gain from these two standard techniques and from same day recaptures. Using banding data collected during spring and fall migration from 1990-2007 on Appledore Island, Maine, we examined the mass changes of the five most common species recaptured on the same day. Over the 18 years of banding, 18,917 birds were banded of these five species, with 11.5 % of birds recaptured at least a day after initial capture and 3.2% of birds recaptured on same day. All five species experienced mass increases during fall migration using all three methods of analysis. During spring migration Red-eyed Vireos lost mass (all three methods), American Redstarts and Northern Waterthrushes gained mass (all three methods), and Yellow-bellied Flycatchers and Black-and-white Warblers showed mixed results from the different methods.

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PHYLOGENY OF THE KNIPOLEGUS BLACK TYRANTS

We present a phylogeny of the Knipolegus tyrants and black-tyrants inferred from DNA sequences of three coding mitochondrial genes and three noncoding nuclear introns. Bayesian and maximum likelihood trees support Knipolegus monophyly and a sister relationship with Lessonia. Analyses recover two major clades within Knipolegus, a "tropical" clade consisting of the two resident Amazonian and one Tepui/Andean foothill species, and a second clade containing all other species. Our results support three independent colonization events into the Andes, and three independent losses of seasonal migration. Reduction of sexual dimorphism is correlated with lack of seasonal migration, but male breeding flight displays and modified outer primary morphology show complex patterns, which are difficult to interpret. Results also support known differences in plumage and distribution in elevating two taxa, *K. cabanisi* and *K. franscanus* to species status. The widespread *K. poecilurus* has little genetic variation throughout its range, even between geographically isolated Tepui and the Andean populations where there are marked plumage differences.

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NESTING AND POSTFLEDGING SURVIVAL OF A SPECIES OF GREATEST CONSERVATION NEED IN SOUTHERN IOWA GRASSLANDS MANAGED WITH FIRE AND GRAZING

Patch-burn grazing (PBG) is a management practice intended to benefit grassland-dependent wildlife. This practice relies on a fire-grazing interaction to create a habitat mosaic that is heterogeneous in terms of structure and composition, mimicking historic conditions. To assess effects of this, we studied nesting and postfledging survival of Grasshopper Sparrows (*Ammodramus saviannarum*), in pastures under two treatments: PBG (grazed, 1/3 burned annually) or graze-only (grazed, entire pasture burned every third year). The study was conducted in Ringgold County, Iowa, on public and private lands. We found 327 Grasshopper Sparrow nests in 2008 and 2009. In 2009

we attached 50 transmitters to randomly selected nestlings one day prior to fledging. We found that nests in graze-only pastures had a daily survival rate (DSR) of 0.90 (SE± 0.01), and nests found in PBG pastures had a DSR of 0.92 (SE± 0.007). Postfledging survival across treatments was low, with 4 chicks surviving >20 days. Mortality rates were highest within two days of fledging (>48%). We would caution against assessing management with nest survival alone due to high rates of mortality during the postfledging stage.

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THE CHALLENGE OF CONSERVATION PRACTICE IN A CHANGING CLIMATE: APPLICATIONS OF SPECIES DISTRIBUTION MODELS ON PUBLIC LANDS

Although the need to adapt bird conservation strategies to a changing climate is well recognized, specific recommendations are lacking. We used species distribution modeling coupled with regional climate models to predict the probability of species occurrence in 2070 for 60 focal species. We then evaluated how projected changes in species richness varied among private and public landowners. Average species richness is projected to increase within some ownership categories (especially Forest Service lands) and decrease within others (especially Department of Defense lands). Our results have implications for prioritizing areas for conservation, but they also illustrate the challenges of making specific recommendations from distribution models. At what scale(s) can the results be applied? How should one prioritize among areas projected to gain or lose species richness? How should we deal with model uncertainty? There is a pressing need to develop science that will convert information about the projected effects of climate change into conservation actions that can be applied on the ground.

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MIGRATORY FLIGHT PATTERNS AND MOVEMENT RATES OF BIRDS AND BATS IN RELATION TO OBSERVED MORTALITY AT WIND ENERGY FACILITIES IN THE MONTEZUMA HILLS, CALIFORNIA

Many studies have documented bird and bat mortality around wind turbines using carcass surveys, while others have examined migratory movements using radar and/or night vision devices. We present year one of a unique two year study examining the relationship between migratory movements and mortalities of birds and bats near turbines, using concurrent radar, night vision, acoustic monitoring, and mortality surveys. To quantify this relationship we selected $n = 48$ 1.5 and 1.8 megawatt turbines at two sites near Fairfield, CA. We sampled using a marine radar and night-vision optics ($n = 40$ nights), and acoustic monitoring stations equipped with Avisoft software ($n = 8$ stations). We conducted mortality surveys ($n = 38$) the morning after each radar survey. During year one, the number of migrating birds detected by radar and acoustic monitoring was orders of magnitude greater than the small number of migratory bird ($n = 7$) and bat ($n = 12$) carcasses found. This study provides a framework for estimating the number of birds and bats killed as a function of overall migration passage rate through wind energy facilities.

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SKEWED SEX RATIO AND BREEDING SYSTEM SHIFT IN A CALIFORNIA POPULATION OF SOUTHWESTERN WILLOW FLYCATCHERS (*EMPIDONAX TRILLII EXTIMUS*)

The endangered southwestern willow flycatcher in California is restricted primarily to three populations, two of which have declined steeply in recent years. We collected lifetime data for color-banded flycatchers from 2000-2009 at Marine Corps Base Camp Pendleton, where flycatchers have declined from 25 territories in 2004 to 12 territories in 2009. We observed a shift in the breeding system from primarily monogamous to polygynous, associated with an unequal annual mortality rate between sexes and lower male recruitment. Annual male mortality averaged 56% from 2002-2004, compared to 29% for females. Additionally, fewer males than females entered the breeding population. These factors combined created a female-biased sex ratio favoring polygyny. The percent of paired males that were polygynous increased from 14% in 2001 to 75% in 2005. After 2005, female mortality increased compared to males, culminating in an equal sex ratio by 2008, and a return to a primarily monogamous system by 2009. The flexibility of flycatchers to alter their breeding system in response to a changing sex ratio may have allowed this declining population to persist during years with fewer males.

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PHYLOGEOGRAPHY OF THE EURASIAN NUTHATCH – A MULTILOCUS TEST OF MTDNA PATTERNS

In the Palearctic, Pleistocene environmental changes led to a variety of avian population structures. Advances in the analysis of genetic data make it possible to unravel these historical processes. Despite the widespread application of mitochondrial DNA (mtDNA) to phylogeography, its single-locus inheritance prohibits it from representing all aspects of a history and precisely quantifying population parameters. Multilocus data are suggested as being essential for solving this problem. However, the performance of multilocus data has not been tested by taking into account the cost in time and money. Eurasian nuthatches (*Sitta europaea*) form three mtDNA lineages in the Palearctic involving Caucasus, and western and eastern Eurasia, but the relationships among them are unresolved. We used 13 nuclear genes to re-examine the population structure and estimate demographic parameters associated with the origin of the three lineages. The results show the multilocus data, which cost five times more than do mtDNA data, do not improve the phylogenetic reconstruction but are essential for estimating demographic parameters. This study also suggests the three lineages might be separated from one another during the same geographical event.

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WINTER DISTRIBUTION OF THE SEX AND AGE CLASSES OF THE YELLOW-RUMPED WARBLER

To investigate the possibility of differential migration in the Yellow-rumped Warbler (*Dendroica coronata*), museum specimens collected between the months of November and March were assigned to age/sex classes and 5° blocks of latitude and longitude. In the "Myrtle" race (*D. c. coronata*), the percentage of males increased with latitude, with males predominating in the northeastern United States. Females predominated in Florida, the West Indies, and Central America. A month by month analysis suggested a net southerly movement of females between December and February. With respect to age, adults wintered in middle latitudes and immatures in northern and southern latitudes. Overall, the distribution of age/sex classes from north to south was as follows: immature males, adult males, adult females, and immature females. Data for the "Audubon's" subspecies (*D. c. auduboni*) show a similar pattern for sex but not for age. These results document the phenomenon of differential migration over a much larger area than has previously been shown for a migrant passerine. They also have implications for population dynamics, given the widely different winter environments experienced by different sex/age classes.

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MIGRATORY CONNECTIVITY RESULTS IN INTERCONTINENTAL EXCHANGE OF GENES AND VIRUSES IN NORTHERN PINTAIL DUCKS.

To determine if contact between Asian and North American populations of Northern Pintail ducks (*Anas acuta*) resulted in pintail gene flow between continents or intercontinental exchange of low pathogenic avian influenza (LPAI) viruses, we studied movements of pintails between continents, genetic similarities of pintails on Japanese and California wintering areas, and phylogenetic associations LPAI viruses from pintails in Alaska. Breeding season recoveries of pintails banded on wintering areas in Japan and North America, and movements of 129 pintails marked with satellite transmitters in Japan indicated that birds from Asian and North American wintering populations were sympatric in eastern Russia during summer, and that dispersal of individuals between continental wintering areas occasionally occurred. We found no genetic differences between pintails that wintered on different continents. Among 38 LPAI virus isolates obtained from Alaskan pintails, 45% had at least one Asian-origin gene segment. These data support the hypothesis that intercontinental migrants such as Northern Pintails may be capable of transmitting highly pathogenic avian influenza viruses between continents.

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POPULATION DIFFERENCES IN REPRODUCTIVE BIOLOGY OF FREE-LIVING CASSIN'S SPARROWS, *AIMOPHILLA CASSINII*
Seasonally breeding birds use various proximate cues to regulate reproductive cycle. In relatively stable seasonal environments, the primary cue used often is day length. In less predictable environments, supplementary factors associated with weather (e.g., precipitation) may also play an important role. Little is known regarding the specific mechanisms by which these factors are integrated to regulate reproductive activity. To begin addressing this question, we compared seasonal changes in reproductive morphology (testis size and cloacal protuberance: CP) and molt in Cassin's Sparrows, belonging to two geographically separate populations (Arizona and Colorado) that employ temporally different breeding strategies: Colorado birds breed in spring whereas Arizona birds initiate breeding in response to summer monsoon. These populations were found to exhibit quantitatively similar time courses of seasonal changes in testis and CP sizes as well as molt, but exhibited a temporal shift in breeding activity so dramatic that Colorado birds were in the first stages of molt when Arizona birds were just becoming reproductively active. We are currently conducting additional experiments aimed at determining the neuroendocrine basis of these intraspecific population shifts in reproductive timing.

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SEX DIFFERENCES IN SONG AND GROUP KIN STRUCTURE SUGGEST STRONG INFLUENCE OF COMPETITION AMONG FEMALES AND COOPERATION AMONG MALES IN A NEOTROPICAL SONGBIRD

Determining function and contextual usage of elaborate traits leads to significant insight on selective pressures that act on animals. In songbirds, previous work on males has concluded that mate attraction and territory-defense functions of song suggest strong selection on males to acquire matings. However, less is known about selective pressures in species where both sexes sing. Stripe-headed sparrows (*Aimophila ruficauda*) provide a unique opportunity to investigate song in a species where females are very strong singers. I recently discovered that many aspects of female song are more pronounced and more elaborate than the corresponding traits in males. Females sing more frequently and have larger repertoires than do males. While females engage in matched countersinging with solo female opponents, males are more likely to sing in unison with group members during chaotic

group interactions. The sex-differences in song-type matching are mirrored by sex differences in song sharing. These sex differences in song may be greatly influenced by dispersal strategies. In stripe-headed sparrows, female song appears to be greatly influenced by intrasexual competition, while male song show more signs of kin selection.

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THREATS TO SECONDARY LARGE CAVITY-USERS IN THE EASTERN CANADIAN BOREAL FOREST: ARE WE OVERESTIMATING THE NEGATIVE EFFECTS OF FORESTRY?

In boreal forests, forestry is known to reduce the long-term availability of large trees, especially snags. Declines in population trends of cavity-nesting birds in areas with a long history of forest management can largely be attributed to changes induced by forestry. Although long-term forest bird monitoring data are not currently available in the eastern Canadian boreal forest, waterfowl aerial surveys show stable or increasing trends for cavity-nesting ducks. Using pre and post clear-cutting data on 37 survey plots, we recently found no short-term effects of forestry on cavity-nesting ducks. For at least one species, changes related to human presence along lakes and to beaver populations possibly have greater importance on future long-term trends than forestry. Although all primary excavators selected trees with larger diameter than those available in our area, forest openings created by clear-cutting increased the occurrence of the Northern Flicker, a keystone excavator. As ongoing studies also show that the availability of cavities may not affect as much as expected habitat selection of some cavity-using mammalian species, we conclude that the relative importance of forestry as a threat to cavity users might need to be reconsidered.

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POSTFLEDGING SURVIVAL OF EASTERN BLUEBIRDS (*SIALIA SIALIS*) IN DEVELOPED LANDSCAPES: LATER FLEDGING PREDICTS HIGHER SURVIVAL

Golf courses ostensibly offer green space in urbanized areas, but it is unknown how these human-modified habitats affect fledging survival. In 2008 and 2009, we estimated postfledging survival of eastern bluebirds (*Sialia sialis*, n=156) through radio telemetry on golf courses and reference sites in Williamsburg, Virginia. We used information theory to evaluate support for biological covariates on survival estimates using cox proportional hazard models. Covariates included golf/non-golf habitat, size-corrected pre-fledging mass, fledge date, and forest cover. A model containing fledge date was the most supported, having the lowest AICc score, and three times the weight of the second-best model. Three additional models containing fledge date were also supported ($\Delta AICc < 2$). Model-averaged parameter estimates indicated that a one day increase in fledge date was associated with a 1.7% decrease in the hazard of death (95% confidence interval: -0.033 to -0.001), while the golf covariate was not biologically important (95%CI: -0.654 to 0.553). While all fledglings may be affected by early-season hawk predation, fledglings on golf courses did no worse than those in structurally similar habitats that lacked intensive use of pesticides.

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NO EVIDENCE OF NUCLEAR INTROGRESSION ACROSS THE BALTIMORE/BULLOCK'S ORIOLE HYBRID ZONE

A well-studied stable hybrid zone exists between the eastern Baltimore Oriole and western Bullock's Oriole across the Great Plains. MtDNA confirmed that these two orioles have been separated for millions of years. Yet, they share

a great proportion of their nuclear genome. Our goal was to use coalescent methods to test two possible causes of allele sharing: 1) gene introgression and 2) retained ancestral alleles. Allele networks revealed extensive allele sharing at seven unlinked intron loci. But, in contrast to studies on other avian hybrid zones, we found little evidence of genes introgressing beyond the hybrid zone. In fact, hierarchical model testing revealed that a reduced model assuming zero migration was not a significantly worse fit to our data. The large breeding ranges of these two species have likely contributed to slowing the rate of lineage sorting, such that both populations still share the signature of their common ancestor millions of years after splitting. Hence, this study highlights the need to consider shared history as well as current demographic processes when considering shared alleles and paralogy between closely related species.

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COMPARATIVE OSTEOLOGY OF *TALPANAS LIPPA*, A NEW FOSSIL SPECIES OF WATERFOWL FROM KAUA'I WITH NEUROLOGICAL SIMILARITIES TO PLATYPUS AND KIWI

Talpanas lippa is a new genus and species of fossil Anatidae from Makauwahi Cave on Kaua'i, described based on a nearly complete neurocranium and other bones (*Zootaxa*, in press). The skull is oddly transformed compared with other Anatidae. The bird had an extremely small orbit and its nasal cavity was expanded caudally to abut the braincase. By inference from the apertures of cranial foramina in proportion to body size, the trigeminal nerve was enlarged by an order of magnitude compared with other Anatidae and the orbital nerve was markedly reduced in size. We infer that *Talpanas* had very poor eyesight, was nocturnal and flightless, and had developed a more extreme somatosensory specialization in the bill than any other bird. Postcranial bones of *Talpanas*, including newly identified vertebrae, provide evidence of locomotory mode and evolutionary relationships. Although the heightened somatosensory function and inferred bill form in *Talpanas* are reminiscent of platypuses, the bird was apparently terrestrial and graviportal rather than swimming and diving like a platypus. In terms of foraging behavior, kiwis may be a more apt ecological analog for *Talpanas*.

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SQUEEZED AT THE TOP: INTERSPECIFIC AGGRESSION CONSTRAINS ELEVATIONAL RANGES IN TROPICAL BIRDS

Many tropical montane birds exhibit narrow elevational distributions and are "replaced" by closely related species along elevational gradients. A historically popular hypothesis for such replacements is that interspecific competition constrains range boundaries and maintains segregated distributions of these species. Here we test this hypothesis in two genera of tropical passerines in which species have non-overlapping elevational distributions. Using heterospecific playback experiments, we found that, at species' replacement zones, individuals show aggressive territorial behavior in response to songs of congeners. Additionally, aggressive responses in two species pairs were asymmetric, indicating interspecific dominance. These results provide the first experimental evidence for a strong role of interspecific competition, mediated through aggression, in maintaining elevational ranges of Neotropical birds. Our results also underline the importance of considering biotic processes, such as competition, when predicting range shifts in response to climate change. Asymmetric interspecific aggression, in particular, could have serious consequences for subordinate species. If warming temperatures in montane landscapes allow upslope range expansion by dominant competitors, then high-elevation subordinate species would be forced into progressively smaller ranges on mountaintops, jeopardizing viability of their populations.

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WEST NILE VIRUS EXPOSURE OF BIRDS ACROSS NORTH AMERICA

West Nile (WNV) was introduced to North America in 1999 and spread across the continent in four years. Over 300 species of birds have been found infected with the virus, but drivers of WNV exposure are poorly understood. We integrated data from 14 studies of >100 species from across North America and examined the influence of body size, nest height, nest type, migratory status, and aspects related to taxonomic group on WNV exposure. We used seroprevalence data, mosquito feeding patterns, and WNV mortality in the laboratory to estimate WNV exposure. We found strong influences of taxonomy and weaker effects of other factors. These results have important implications for the impact of WNV on bird populations and for the transmission of this pathogen.

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VARIATION IN THE IMMUNE FUNCTION OF LARKS FROM MESSIC AND ARID ENVIRONMENTS.

Lark species (Alaudidae) from arid habitats live at a slower pace-of-life, and seem to invest more in adult survival and less in current reproduction than their mesic relatives. The immune system plays an important role in an individual's survival, and there are costs in terms of nutrients and energy associated with the development, maintenance and use of its different parts. We hypothesized that lark species with different life-history strategies might also differ in their investment in innate immune defenses. We assessed the innate immunity of two species from the temperate Netherlands and five species from the Saudi Arabian desert, using a bacteria killing assay and an hemagglutination/hemolysis assay. In the bacteria killing assay, the mesic larks were better at eliminating the pathogenic bacteria *C. albicans* from their blood, and their blood lysed exogenous red blood cells significantly better than their desert relatives in the hemagglutination/hemolysis assay. These results possibly reflect differences in the investment that these birds put into the use of these parts their innate immunity, or they simply reflect differences in pathogen prevalence in these 2 environments.

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IDENTIFYING MIGRATORY PATTERNS OF RED-TAILED HAWKS IN CALIFORNIA USING GENETIC, STABLE ISOTOPE AND HAEMOPARASITE DATA

This study combines hydrogen isotope data with previously published genetic analyses to estimate origins and delineate populations of 138 hatch-year Red-tailed Hawks moving through the Marin Headlands, California during the fall 2004 season. These results were compared with results from haemoparasite screening to examine whether host population structure matches the geographic distribution of their parasites and to investigate whether parasitic infection affects raptor migration timing. A correlation was observed between population of origin assignments determined by genetic analysis and hydrogen isotope ratios in juvenile hawk breast feathers. These data support the hypothesis that early arrivals to the study site (August 15-September 30) are primarily non-migrant juveniles dispersing from Central California while later arrivals (October 1-December 30) are both California dispersals and migratory individuals from desert regions of the Intermountain West. Phylogenetic analysis revealed that a high diversity of closely related *Leucocytozoon* lineages infected the hawk populations sampled. No significant effect of parasitic infection on migration timing was observed. However, some geographic structuring of parasite lineages was documented, as one lineage was significantly more prevalent within the Central California population.

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JUVENILE SWAINSON'S THRUSH HABITAT SELECTION AND MOVEMENT THROUGH FORESTED LANDSCAPES IN THE OREGON COAST RANGE.

Swainson's Thrush (*Catharus ustulatus*) are abundant, riparian associates and it is unclear why they have exhibited population declines in the Pacific Northwest over the past 40 years. Existing studies have focused primarily on the breeding season. Whether juveniles exhibit similar habitat preferences during the post-fledging season is largely unknown. Survival is lower during the juvenile life stage, therefore, juvenile habitat is likely crucial to population stability. We tracked juveniles (N=36) daily or every other day using radio telemetry during two post-fledging seasons in headwater areas of the Oregon Coast Range. We compared site characteristics at juvenile locations to what is locally available. Juveniles appear to select areas with a high percent of deciduous cover between 1.5m-20m in the vertical strata near small streams. These data emphasize the importance of headwater riparian habitat and provide quantitative data on forest structural features used by juvenile Swainson's Thrush that may aid in stabilizing population declines.

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ROOSTING BEHAVIOR OF MIGRANT BIRDS ON COFFEE FARMS: IMPLICATIONS FOR ECOSYSTEM SERVICES

Documenting ecosystem services provided by native organisms in agricultural habitats can provide powerful incentives for conservation. Recent evidence indicates that insectivorous birds in shade coffee farms provide economically significant ecosystem services by reducing insect pests. However, the provisioning of this service may be dependent on landscape composition and movement patterns of these mobile consumers. We explored roosting behavior in black-throated blue warblers (*Dendroica caerulescens*) on two Jamaican coffee farms using radio telemetry. Nocturnal tracking revealed most birds moved outside diurnal foraging ranges in coffee farms to roost in forested habitat patches, sometimes up to 1km away. Our findings suggest that black-throated blue warblers with diurnal foraging ranges located within coffee farms commute to roosts in the forest. Daily commuting between nocturnal roosting habitat and diurnal foraging habitat reflects the ecological connectivity between coffee habitats and the adjacent landscape. In this case of pest-eating birds in coffee, these connections could cause the provisioning of pest reduction to be at least partly dependent on a farm's proximity to forest patches, demonstrating the value of intact habitats to farmers.

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INDIVIDUAL RECOGNITION OF CONTACT CALLS BY MONK PARAKEETS (*MYIOPSITTA MONACHUS*)

Social structure, and an individual's place within it, can have a strong effect on an individual's fitness. Social relationships may play a crucial role in the survival of individuals in newly established groups, such as during species introductions. We simulated the establishment of novel groups to study social structure formation in the early stages of a species invasion with captive groups of Monk Parakeets (*Myiopsitta monachus*). We observed social association patterns, and then performed playback trials to test whether individuals responded preferentially to close social associates. A significant relationship was found between association strength (proportion of time spent as nearest neighbors) and latency of response to playback stimuli, suggesting that monk parakeets can identify group members by call and respond differently based on the type of social relationship.

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INFLUENCE OF HABITAT STRUCTURE ON AVIAN BIODIVERSITY AND REPRODUCTIVE SUCCESS IN WESTERN ASPEN FORESTS

Habitat structure greatly influences biodiversity and reproductive success in wildlife communities. Habitat types such as aspen forests contain a high diversity of birds, and aspen forests are declining throughout western United States. The presence of conifers is a major cause of aspen decline, and conifers in aspen forests may affect avian nest success by housing primary nest predators (i.e., red squirrels). However, the effects of conifers on aspen forest structure and how variation in structure affects diversity and nest success across different spatial scales is unclear. At microhabitat scales, nest predation frequently decreases with increased understory density or canopy cover. At larger spatial scales (i.e. patch or landscape) nest predation may vary with spatial distribution of different vegetation types, such as the proximity of conifers to aspen stands. We studied nest success and diversity of songbirds in aspen forests of Montana to test the questions: which habitat features reduce nest predation at different spatial scales? Does landscape context of an aspen stand affect avian nest success and diversity? And does the presence of conifers affect avian nest success and diversity?

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DEMOGRAPHIC STRUCTURING OF NEOTROPICAL FOREST FRAGMENTS: WHY UNDERSTANDING MOLT SEQUENCES IS IMPORTANT

Forest fragmentation decreases biodiversity, but a suitable matrix can rescue fragmented populations through immigration. Because dispersal in birds mainly occurs after fledging, we predicted that age structures in fragments and continuous forest would differ based on dispersal patterns. We first developed aging criteria by identifying molt patterns in 21 species. We then categorized birds into six guilds, analyzed capture rates of adults and immatures, and estimated transience in fragments and continuous forest using mark-recapture models. The results showed distinct responses to fragmentation in some guilds including dramatic differences between adult and immature capture rates. In some guilds, adults were area sensitive and had low transience, while immatures were less area sensitive, sometimes dispersing to small fragments. Specifically, transience in immature frugivores, ant-followers, gap specialists, and flock dropouts was moderate or high, facilitating occupancy in fragments, but area sensitivity in ant-followers prevented persistence. In flock obligates and other insectivores, immature dispersal was low and area sensitivity of adults and immatures was high. These results reveal the utility of understanding molt sequences in providing a demographic explanation for extinction and recolonization dynamics.

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SPATIAL ECOLOGY OF ECOSYSTEM SERVICES PROVIDED BY BIRDS

As agents of ecosystem services, especially regulating (e.g., seed dispersal and pest control) and supporting (e.g., nutrient deposition) services, birds are notably mobile and capable of utilizing multiple habitats. Therefore, the delivery of ecosystem services by birds in some cases will depend strongly on habitat configuration and landscape composition. Several models are available for projecting ecosystem services over a changing landscape (e.g., InVEST, MABES, individual-based-models). We applied these ideas to previous and ongoing work on birds in coffee farms in Jamaica, West Indies. Previous research documented that insectivorous birds reduce pests of Jamaican coffee, yielding an economic benefit. Radio telemetry studies showed that a principal pest predator, the black-throated blue warbler (*Dendroica caerulescens*),

commutes to/from foraging territories within coffee habitat to nocturnal roosting sites in forests, and selects territories near farm edges. Using a spatially explicit model, we simulated how a changing landscape composition could affect the delivery of pest control services. This approach could be useful for conservation planners by providing estimates of the economic value of forested habitats within agricultural landscapes.

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YELLOW-BILLED CUCKOO HABITAT USE AT TWO VEGETATION SCALES AND ITS IMPLICATIONS FOR RIPARIAN CONSERVATION

Key challenges in conservation of the Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*) involve the management of the riparian areas on which the cuckoo depends. Riparian habitats are dynamic; ecological processes that affect them operate at multiple temporal and spatial scales. We examined cuckoo habitat use along the Lower Colorado River at two spatial scales, within-patch and at the landscape scale, during the breeding season. Both within-patch vegetation characteristics and landscape-level habitat characteristics appear to affect habitat use by Yellow-billed Cuckoos. Riparian areas occupied by Yellow-billed Cuckoos generally had higher canopies, denser cover in the upper layers of the canopy, and sparse shrub layers when compared to unoccupied sites. Landscape features that appear to influence cuckoo distribution and abundance include the amount of cottonwood-willow-dominated vegetation cover in the landscape, and riparian width. We will discuss the patch level characteristics and landscape features associated with cuckoo habitat use, and discuss factors to consider when planning and implementing habitat conservation and restoration for cuckoos.

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CHARACTERIZING RESISTANCE AND TOLERANCE OF THREE PASSERINE BIRDS IN RESPONSE TO TWO ZOONOTIC PATHOGENS: BORRELIA BURGDORFERI AND WEST NILE VIRUS

Birds are reservoirs and dispersal agents for many zoonotic pathogens. Upon infection, a bird may eliminate the pathogen (resistance), allow amplification and transmission without experiencing disease (tolerance) or succumb to disease (susceptibility). Currently, little is known about the mechanisms underlying these responses. I will compare the resistant and tolerant abilities of the American robin (*Turdus migratorius*), gray catbird (*Dumetella carolinensis*), and northern cardinal (*Cardinalis cardinalis*) using two zoonotic pathogens: *Borrelia burgdorferi* and West Nile virus. My research objectives are to 1) compare in-vitro bacterial killing ability of avian serum, 2) compare reservoir competence in-vivo, 3) assess resistance (inverse of viremia) and tolerance (slope of the regression of host fitness against infection intensity) using two pathogens in-vivo, 4) determine the role of fever using an antipyretic drug and 5) characterize a tolerant and resistant avian immune response in terms of viral and antibody titer and duration, antimicrobial peptides composition and cytokine expression. I predict robins will have the lowest resistance and highest tolerance, catbirds will have the highest resistance and cardinals will be intermediate in both resistance and tolerance.

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TRENDS IN GOLDEN EAGLE FLIGHT BEHAVIOURS AT A WIND FARM UNDER CONSTRUCTION IN NORTHERN BRITISH COLUMBIA, CANADA.

Concerns for raptors that utilise the Rocky Mountains as a migration corridor have surfaced with the quick rise in wind energy prospecting in BC's north-eastern Peace Valley Region. Collision risk models ideally seek to incorporate

some measure of avoidance, which is known to be species- and often site-specific. Here we compare pre- and mid-construction golden eagle flight tracks at a planned wind energy installation in northeast BC, to look for indications of turbine avoidance behaviour. We found that the proportion of golden eagles approaching to within 500m of, and the proportion crossing the ridge-top itself did not differ significantly between years. An analysis of ridge-crossing events by topography type showed that ridge ends and peaks were more frequently traversed than flat sections or saddles. These results suggest that idle turbines alone do not provoke coarse scale changes in golden eagle flight behaviour, although results of a "height-at-crossing" analysis are pending. This work provides some initial information on the flight response of golden eagles to idle turbines and serves as a baseline from which to evaluate future golden eagle flight patterns.

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FIRST DOCUMENTATION OF A FIELD X CLAY-COLORED SPARROW

We document the first well characterized hybrid between Field (*Spizella pusilla*) and Clay-colored (*S. pallida*) sparrows. This hybrid combination has previously been suggested in the field in New York and Vermont, but each of those observations either involved pair-bonding between the two species with no young documented or a putative hybrid that was never caught and measured. Our bird was first seen in June 2008 in Charlemont Reservation, Lorain County, Ohio, during surveys for the Ohio Breeding Bird Atlas II. The bird was a territorial male, singing a buzzy but accelerating trilled song with characteristics of both parental songs. It responded vigorously to song playback from both Field and Clay-colored sparrows. Once netted, the bird showed plumage patterns with characteristics of both parental species as well as intermediate measurements. Like the hybridization events suggested in New York and Vermont, this bird was found on the eastern margin of the breeding range of Clay-colored Sparrow, suggesting that this hybrid combination may be expected elsewhere in New England and the Upper Midwest when these species are syntopic.

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CLIMATE CHANGE IMPACTS TO SENSITIVE SPECIES WITHIN CALIFORNIA'S IMPORTANT BIRD AREAS

California's 145 Important Bird Areas occupy roughly 10% of California's total land and water areas. While conferring no regulatory authority, designation of an Important Bird Area is a powerful tool that can increase opportunities for land acquisition, restoration, conservation planning, public outreach, citizen science, and advocacy. In March 2009, we released GIS maps of Important Bird Areas in California. GIS layers have allowed us to analyze IBAs for landownership, wildlife habitat types, and other parameters. We also recently modeled avian responses to future climate change scenarios in California based on bird distribution data from the Audubon Christmas Bird Count and North America Breeding Bird Survey. Our analysis suggests that of 310 native California bird species, 110 species will disappear from at least 25 percent of their current ranges by the end of the 21st century. Under future climate change scenarios, we present an analysis of whether Important Bird Areas will continue to provide critical habitat for key sensitive bird species which triggered their designation and how mapping may be adjusted to account for future conservation efforts.

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Cox, J. A., Tall Timbers Research Station, Tallahassee, USA, jim@ttrs.org SURVIVAL AND MOVEMENT CHARACTERISTICS OF A MARKED POPULATION OF BACHMAN'S SPARROW

Bachman's Sparrow (*Aimophila aestivalis*) is a disturbance-dependent species whose demographics are little understood. We monitored a large marked population (N = 186) for 5 years in an area dominated by longleaf pine (*Pinus palustris*) and maintained with biennial prescribed fires. Marked individuals were re-sighted within a 250-ha core study area, and additional surveys were performed ≤ 1 km outside the core area in an attempt to document wide-ranging movements. Estimated annual survival was 0.649 (SD = 0.06) for males and 0.442 (SD = 0.10) for females. Median and maximum within-year movements were 147 m and 1304 m for males and 147 m and 1246 m for females. Median and maximum between-year movements were 220 m and 2290 m for males and 336 m and 1048 m for females. The estimated proportion of females moving >1 km between years was higher than the proportion of males moving >1 km (31% vs. 16%). Estimates of female survival are likely affected by these wide-ranging movements because they decrease detection. Studies based on "guesstimates" of annual survival in Bachman's Sparrow need to be re-evaluated.

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A POTENTIAL NEW METHOD FOR RAPID NON-INVASIVE DETECTION AND QUANTIFICATION OF CAROTENOID PIGMENTS IN AVIAN PLUMAGE AND INTEGUMENTARY TISSUE

Carotenoid-based coloration serves important functions in mate attraction for many bird species and has also been linked to immune system health. Currently in avian research, carotenoids levels are assessed with blood serum or plasma high-performance liquid chromatography measurements. However, such methods can be invasive, expensive, and impractical for research on large scales. Recently, a non-invasive and rapid method for assessing carotenoid levels in external tissues has been developed based on Raman spectroscopy. This method has shown that skin carotenoid levels correlate with blood levels, as well as with overall antioxidant health in humans, and may show similar results in avian plumage and integumentary tissue. However, further study and collaboration is needed to establish the link between carotenoid-based coloration in avian tissues and blood carotenoid levels to validate this method for avian research.

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Searcy, W. A., University of Miami, Coral Gables, USA, wsearcy@miami.edu MHC AND MATE CHOICE IN THE GREAT FRIGATEBIRD (FREGATA MINOR)

The major histocompatibility complex (MHC) is a highly polymorphic multi-gene family associated with immune defense and has also been proposed to play a role in mate choice. One hypothesis is that females choose mates that differ genetically from their own MHC genotypes, thereby avoiding inbreeding and enhancing immunocompetence of their offspring. We tested the prediction of disassortative mating based on MHC genotypes in a population of great frigatebirds (*Fregata minor*), by sequencing the second exon of the MHC class II β gene. We compared MHC amino acid differences of 46 mated pairs to that of 10,000 simulations of 46 random pairings using the same individuals. In addition, we repeated this analysis using a similarity index of a set of neutral markers (12 microsatellite loci) to distinguish between MHC-based mate choice and mate choice based on overall genetic similarity. Analysis showed significant disassortative mating amongst mated pairs based on MHC genotypes, but not for microsatellites. This result suggests a role for MHC genes in mate choice, and in particular supports the hypothesis that females choose mates that differ genetically from themselves at MHC loci.

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CLIMATE SENSITIVITY OF PARENTAL BEHAVIORS AND THEIR FITNESS CONSEQUENCES

Research over the past decade indicates that climate change should have the greatest influence on the optimal breeding performance of species living under extreme conditions. Recent work in New Hampshire, however, suggests that climate warming may have larger effects per °C on the breeding performance of individuals in medium-quality habitat relative to high or low quality habitat. To test this hypothesis, we investigated variation in parental behaviors of Black-throated Blue Warblers (*Dendroica caerulescens*) and the concomitant effects on nestling condition along a 600-m elevation gradient in NH from 1995-2009. Study sites encompassed a 2.3°C temperature gradient and an increase in prey abundance from low to high elevations. We found that parents delivered the highest prey biomass to nestlings under intermediate conditions at mid-elevation sites. Differences in parental behavior were manifested in reduced nestling mass at low and high elevations and greater mass under intermediate conditions. This finding demonstrates a nonlinear relationship between temperature and optimal parental investment, and emphasizes the importance of understanding the climate sensitivity of behavior for predicting the effects of global change on avian breeding performance.

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EFFECTS OF WIND TURBINE PROXIMITY AND OTHER VARIABLES ON THE REPRODUCTIVE SUCCESS OF SHRUB-NESTING PASSERINES

Wind energy is increasing at an incredible pace. While boasting many benefits, its continued growth has the potential to negatively impact bird populations. We evaluated the nesting success of five passerines at a wind energy facility in north-central Texas. We addressed the impact of wind turbines on nesting success using two approaches: 1) we calculated the daily survival rate (DSR) using the J-statistic and compared DSR among nests found in different distance-interval classes from wind turbines, and 2) we determined the relative impact of nest timing, nest distance to forest edge, nest site substrate, Brown-headed Cowbird parasitism, fecundity, and nest distance to nearest wind turbine on nesting success using an information-theoretic approach. For the latter, we constructed models in all possible additive combinations of explanatory variables, analyzed them using Mayfield logistic regression, compared the relative explanatory power of all models (hypotheses), and determined the relative strength of each individual variable.

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MONITORING PAINTED BUNTING POPULATION TRENDS IN SOUTHEASTERN NORTH CAROLINA, 2006-2009

The Painted Bunting is a migratory songbird found in two distinct locations in the U.S. Our study focuses on the Atlantic Coastal population—specifically that of Southeastern North Carolina—which is of conservation importance as the population is thought to be in decline. However, our preliminary data analyses show an overall increasing trend in population for Southeastern North Carolina between 2006 and 2009. Our study presently focuses on captured males, females, and hatch year birds to determine

population trends. We found a significant positive trend in both males and females captured by testing mean number of bird captured per site per year with an ANOVA (Males: $F = 4.554$, $df = 3$, $P = 0.0054$; Females: $F = 3.185$, $df = 3$, $P = 0.0284$). In addition, we did not find a significant decrease in the hatch-year birds as the population remained relatively constant. These data were collected as part of the internship program of the Painted Bunting Observer Team.

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DOES LIVESTOCK GRAZING INTENSITY AFFECT PASSERINE EGG SIZE?

Cattle grazing is the major land use in North American grassland habitat and has been shown to influence bird populations and communities in these areas. We hypothesized that intense grazing causes songbirds to lay smaller eggs, potentially due to reductions in arthropod prey availability caused by reduced vegetation cover. To test this hypothesis, we implemented a randomized complete block design with four treatment levels (no grazing, light grazing, moderate grazing, intense grazing) and four blocks in a grassland habitat dominated by native plants on the Nature Conservancy's Zumwalt Prairie Preserve in north-eastern Oregon. We measured eggs in the nests of Vesper Sparrows ($n = 24$), and Savannah Sparrows ($n = 26$) but we failed to detect a relationship between egg volume and grazing intensity for either focal species. Thus, if grazing influences eggs size, the effects were either too weak to detect or manifest themselves differently.

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DOES PRIOR EXPERIENCE INFLUENCE NEST-SITE SELECTION OF SONGBIRDS WITHIN A SINGLE SEASON?

Nest predation is one of the major determinants of nest success in songbirds. Consequently, a bird's choice of nest location is expected to reflect previous experience with predators (i.e., previous nest success or failures), but relatively little is known about how birds may incorporate these experiences when re-nesting during the same season and within the same territory. We compared nest placement of two breeding forest songbirds, Northern Cardinals (*Cardinalis cardinalis*) and Acadian Flycatchers (*Empidonax vireescens*) in central Ohio riparian forest fragments. We identified nest substrates and measured nest placement attributes for both species (flycatcher nests, $N = 43$; cardinal nests, $N = 87$). Birds that experienced a nest depredation event did not appear to modify nest placement in subsequent re-nests. The failure to change nest placement in response to depredation may result from our observation that nest fate was not generally linked to vegetation characteristics surrounding nests. Collectively, our data suggest that other factors, such as the composition of the predator community and/or parental behaviors, may play more important roles in nest fate.

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TEMPORAL AND SPATIAL PATTERNS OF SPRING MIGRATION AND PLANT PHENOLOGY ACROSS LARGE ELEVATIONAL GRADIENTS IN THE ARID SOUTHWESTERN UNITED STATES

Migration phenology and habitat use across large ecological and elevational gradients are poorly understood for Neotropical birds, particularly in the arid southwestern United States. Migration patterns are intimately linked with temporospatial factors like plant phenology and vegetation community mosaics, factors highly responsive to climate change. The Madrean Archipelago in southeast Arizona provides vital "stepping stones" that link migration corridors of Mexico's Sierra Madre Occidental with mountains of the western US. We examined 1) temporal and spatial distribution of migratory birds and 2) plant phenology during spring migration (1 March - 15 May, 2009) across 3 mountains in southeast Arizona, stratified by 5

vegetation communities: montane conifer, pine-oak, oak, mesquite, and lowland riparian. Temporal abundance patterns were correlated with tree and shrub phenology. Bird species exhibited a range of habitat specificity; the narrowest species-habitat associations occurred in lowland riparian or high elevation forests; examples include *Dendroica petechia* and *D. occidentalis* respectively. Continued degradation and loss of montane and riparian habitats threaten the potential migration success of obligate species that may lack behavioral plasticity to alter stopover habitat use.

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PLASTIC BEHAVIORAL AND PHYSIOLOGICAL RESPONSES OF A NEOTROPICAL PASSERINE TO ADULT AND OFFSPRING PREDATION RISK

Plastic responses to proximate changes in adult and offspring predation risk remain unknown for lowland tropical rainforest birds, despite their elevated nest predation rates. We manipulated predation risk of Check-throated Antwrens (*Epinecrophylla fulviventris*) using models of adult and offspring predators presented at nests during the nestling period. We found a significant effect of predator type on latency to return to the nest, feeding rate, and corticosterone levels of adults and nestlings. Adults reduced nestling feeding rates (compared to control model) when confronted with an offspring predator. Responding to an adult predator, adult antwrens never visited the nest, returning hours after model removal. Adults and offspring mounted high corticosterone responses after exposure to the adult predator but also showed slightly increased stress response after exposure to an offspring predator (compared to control). Corticosterone levels of nestlings tracked adult levels, which is likely mediated by changes in food delivery or response to adult alarming rather than direct effects of predator presence. These data provide the first evidence that adult lowland tropical birds can perceive and respond to changes in age-specific predation risk.

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ECOSYSTEM SERVICES WITH A DEPLETED AVIFAUNA: BIRD POLLINATION AND DISPERSAL IN NEW ZEALAND

Worldwide declines in bird numbers have renewed interest in how well bird-plant mutualisms are functioning. In New Zealand, this is a particular concern because of extensive recent bird losses. In temperate countries generally, avian fruit-dispersal is thought to be important, while bird pollination is uncommon. Here we show that in New Zealand, bird pollination is unexpectedly widespread, because birds also visit many non-ornithophilous flowers. Birds visit the flowers of 5% of the seed-plant flora and 30% of the trees, whereas 12% and 59% of species respectively have fleshy fruits. A larger fraction of forest basal area nationally has bird-visited flowers (37%) than fleshy fruits (31%). Additionally, pollination is frequently failing while dispersal is not. Although dispersal of the largest fruits is now dependent on a single pigeon, only three tree species are affected, and there is little evidence of dispersal failure. In contrast, 8 of 10 ornithophilous-flowered species are strongly pollen limited, showing widespread pollination failure from a shortage of birds. These findings were not obvious in New Zealand prior to detailed study, and may apply elsewhere.

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DIFFERENTIAL REPRODUCTIVE SUCCESS IN A HETEROGENEOUS ENVIRONMENT: A 12-YR STUDY IN A VEERY POPULATION

Selecting a habitat is a critical decision organisms make due to its direct effect on reproductive success. If heterogeneity among habitat options exists, then individuals would benefit by settling in habitats of high quality. We investigated differences in reproductive success among a veery population (*Catharus fuscescens*) in a deciduous forest within the Hudson Valley of New York. We examined a twelve-year dataset at two different scales (small and medium), and looked for spatial and temporal patterns to determine if spatial heterogeneity or temporal correlation in occupancy and reproductive success exists at either scale. Neither scale produced results suggesting temporal trends in reproductive success exist at any sites. In contrast, patterns indicating spatial differences in reproductive success exist at both scales. Spatial heterogeneity implies that it is crucial for organisms to assess habitat quality and determine where high fitness can be attained. These results are discussed in terms of two theories: (1) site-dependent regulation, where sites differ predictably in reproductive success, and (2) public information, where information collected during the post-breeding season is used to select future sites.

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INCREASING THE HABITAT VALUE OF CALIFORNIA'S
RICELANDS FOR WETLAND BIRDS: PARTNERSHIPS,
EXPERIMENTS, AND POLICY

Rice is an essential habitat for migrating and wintering wetland birds in California's Central Valley, providing surrogate habitat in place of natural wetlands; 95% of which have been lost. Over 205,000 hectares in California are used to produce rice – more than twice the available wetland habitat. Considerable evidence supports the value of post-harvest flooded rice fields as habitat for wetland birds, but very little experimental work has been done to test the relative value of specific practices on rice farms. As part of two workshops held in partnership with the rice industry, we identified several alternative post-harvest field management practices that may benefit wetland birds. We are using large-scale experiments on working farms to evaluate bird response to these practices within the constraints of successful rice production. Our work is identifying beneficial practices that farmers can perform over large spatial scales and estimating the impacts of implementation on wetland bird populations. Results of this work will be used to influence or create programs that provide financial or other incentives to implement these practices, and thus contribute to wetland bird conservation.

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SHOREBIRD DISTRIBUTION, ABUNDANCE AND HABITAT USE AT COASTAL STAGING SITES IN THE ARCTIC NATIONAL WILDLIFE REFUGE, ALASKA

Several species of shorebirds aggregate in coastal habitats of the Arctic National Wildlife Refuge (Arctic Refuge) after the breeding season. This staging is believed to be critical for building energy reserves necessary for migration, but the relative importance of staging sites is unknown. These coastal areas are vulnerable to potential effects of oil development and climate change. Abundance, distribution, timing, and species composition of shorebirds

staging on coastal areas was assessed by surveying staging shorebirds on every major river delta on the Arctic Refuge coastline in July and August from 2006 to 2009. Shorebird use was highly variable both spatially and annually with no one delta appearing singularly important. Rather shorebirds may rely on the aggregate of these coastal habitats, moving among sites depending on environmental conditions and food availability. Seasonal patterns and habitat use were also investigated at several deltas. Seasonal timing varied across species and most shorebirds remained at a staging area for < 5 days. Studies of mechanisms underlying habitat use have been initiated.

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ECTOPARASITE ABUNDANCE AND INDIVIDUAL COLOR VARIATION IN THREE CARDUELIN FINCH SPECIES

Elaborate and/or colorful bird plumages have often been hypothesized to evolve via sexual selection for increased ornamentation. Differences in coloration among individuals can be influenced by a number of variables, including diet, hormones, and disease resistance. Specifically, Hamilton and Zuk (1982) hypothesized a link between an individual's parasite resistance and more colorful plumage signals, as a mechanism for individuals to advertise their 'quality'. While much data has accumulated documenting the nutritional and hormonal regulation of various types of plumage coloration, relatively little data exists reporting the effects of parasite load on individual plumage colors (i.e. melanin and carotenoid pigmented feathers). We collected ectoparasites and plumage color data from 24 purple finches (*Carpodacus purpureus*), 11 pine siskins (*Carduelis pinus*), and 21 American goldfinches (*Carduelis tristis*). We found substantial individual variation in both total parasite load and quantified measures of feather coloration, and we report on the association between these variables among individuals within each species.

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FIRE IN NORTH AMERICAN DRY FORESTS: A META-ANALYSIS OF AVIAN RESPONSES TO SEVERITY, TIME SINCE FIRE, AND FIRE SURROGATE TREATMENTS.

We meta-analyzed the scientific literature on avian demographic responses to burn severity (low/moderate, high), time since fire (0-4, 5-9 and >10 yrs) and fire surrogates (e.g. forest thinning) in the most extensively studied fire-prone, forested biome (dry forests of the United States). We found 52 studies of 124 bird species which examined responses to thinning as a fire surrogate, prescribed low-severity fire, thinning + prescribed fire, and high-severity fire (all high severity fire data were from wildland fires. Data were stand scale (< 50 ha), precluding analysis of mixed-severity fire and response at coarser spatial scales. Our results indicate forest thinning appears to act as a surrogate for prescribed fire with similar proportions of species responding positively and negatively. Combined thinning + prescribed fire produced a higher proportion of positive and negative responses of taxa. Response patterns between low- and high-severity fire were distinct, suggesting low-severity fire was not a substitute for high-severity fire. Contrary to the paradigm that high-severity fire produces primarily negative responses, many avian taxa responded positively to high-severity fire at all three time scales considered.

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TERRITORY-SCALE MOVEMENTS, HABITAT SELECTION, AND A TEST OF A RED-COCKADED WOODPECKER HABITAT SUITABILITY MODEL

We studied territory-scale movements of foraging Red-cockaded Woodpeckers (*Picoides borealis*) on Eglin Air Force Base in Florida. Group locations were recorded each minute as birds moved across the landscape during the first one to two hours after sunrise (N=441 morning foraging paths on 113

territories). We used a GIS to derive stand-level vegetation characteristics of the movement paths, which were compared to unselected resource sets with discrete choice methods. Results indicated that the birds actively chose stands with lower hardwood tree abundance and density, and that pine-dominated areas were generally suitable. Similar analyses were conducted to test a spatially explicit habitat suitability model that is used for Red-cockaded Woodpecker management on Eglin Air Force Base. Results indicated that birds selected foraging areas that were predicted to be higher quality, and thus validated the model's utility. No differences were found in woodpecker movement characteristics among seasons, or between large and small groups.

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LONG-DISTANCE MIGRATION IN THE ASIAN GREAT BUSTARD

Though populations of the Asian subspecies of Great Bustard (*Otis tarda dybowskii*) are under threat, their migratory routes and habitat-use patterns are poorly understood. Our team uses GPS/satellite telemetry to monitor the movements of Great Bustards captured at breeding sites in northern Mongolia. The migratory routes we have recorded are 2000 km each way - more than twice as long as has previously been reported for this species. These Great Bustards use multiple stopovers, at some of which they remain for extended periods of time, for a total one-way journey of approximately two months. We have observed considerable differences in the migratory behavior of males and females, consistent with the large sexual size dimorphism of Great Bustards. Stopover and wintering locations for these populations are located primarily in agricultural habitat, sometimes adjacent to large cities. We have recorded high mortality at stopovers, due mainly to poaching. These data indicate that regional-level efforts will be necessary for the successful conservation of this subspecies.

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EXPERIMENTAL PREDATOR EXPOSURE ALTERS CORTICOSTERONE AND BEHAVIOR IN EUROPEAN STARLINGS (*STURNUS VULGARIS*) AND BOBOLINKS (*DOLICHONYX ORYZIVORUS*)

We examined corticosterone and behavioral responses of captive European Starlings to 30 minute exposure to four treatments – 1. Human plus model hawk, 2. Human alone, 3. Model hawk alone, 4. novel object control – and took additional corticosterone samples after a 30 minute capture-restraint protocol. We measured flight initiation distance of free-living Bobolinks in response to treatments 1 and 2. Corticosterone levels were highest in treatments 1 and 2 and lowest in 3 and 4. Corticosterone levels after restraint did not significantly increase in treatment 1, showed a strong positive trend in 2, and significantly increased in 3 and 4. There was a trend towards reduced corticosterone response following restraint in birds exposed to 1 and 3. We did not observe a behavioral difference between any treatments but did see increased activity compared to a control. Bobolinks did not respond differently to treatments when approached singly, but responded sooner to treatment 1 when in groups. The data suggest that the hawk model only altered corticosterone release when paired with a human.

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HIDDEN IMPACTS OF WEST NILE VIRUS ON SMALL SONGBIRDS

West Nile virus (WNV) transmission occurs each year in many bird communities throughout North and South America. Several correlational analyses have shown population declines coincident with the arrival of West Nile virus, and for corvids, these were supported by lab studies on susceptibility and by finding large numbers of infected dead birds. However, evidence demonstrating susceptibility in smaller passerines has been mostly lacking, and an absence of dead birds could result from poor detectability. We examined the susceptibility and infectiousness of Tufted titmice (*Baeolophus bicolor*), and Carolina wrens (*Thryothorus ludovicianus*) to WNV by experimental infection. We found titmice were highly susceptible to WNV infection, with all birds dying within one week after infection. Mortality in wrens was lower, but not insubstantial. Both species were highly infectious for WNV and could play roles in WNV amplification. We interpret these findings in light of field data on mosquito feeding patterns and observational patterns of population trajectories. Our findings demonstrate the value of experimental evidence for disease susceptibility in species conservation, and confirm that WNV is impacting many smaller bodied birds.

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FACTORS EFFECTING BREEDING ECOLOGY OF BROWN-HEADED COWBIRDS IN CENTRAL NEBRASKA

I investigated factors effecting Brown-headed Cowbird (*Molothrus ater*) density, female home range, and parasitism levels for grassland birds breeding in the Platte River Valley from 2005 - 2008. I hypothesized cowbird density, home range, and parasitism levels would correlate with host density. Cowbird home-range decreased with host density as predicted, however, homerange displayed a stronger relationship to habitat structure. Cowbird parasitism levels varied by host species, Grasshopper Sparrows (*Ammodramus saviannarum*) displayed only 41% parasitism levels compared to Dickcissels (*Spiza americana*) with 75% parasitism levels. The best fit models for parasitism level included both distance to cattle and host density. Cowbird parasitism had minor impacts to host nest, however cowbird parasitism decreased productivity, measured as number of young fledged/nests, an average 1 fledgeling/nest for both Bobolinks (*Dolichonyx oryzivorus*) and Dickcissels, and over 2 fledgelings/nest for Grasshopper Sparrows and Westserrn Meadowlark (*Sturnella neglecta*). Cowbird productivity ranged from 0.21 - 0.52 cowbirds fledged/parasitized nest, with Grasshopper Sparrows fledging the fewest cowbirds per parasitized nest and Dickcissels producing the most cowbirds per parasitized nest.

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EVOLUTION OF BARRIERS TO RECOMBINATION IN AVIAN SEX CHROMOSOMES

Non-recombining sex chromosomes arose from recombining autosomes, and they retain pseudoautosomal (recombining) regions. In many organisms with sex chromosomes, the pseudoautosomal regions gradually reduced in size such that most loci do not undergo recombination. Paleognath birds have sex chromosomes that are homomorphic and appear to recombine like autosomes, though neognaths have evolved barriers to recombination

along at least part of their sex chromosomes. Previous analysis of the ATP5A1 locus on the sex chromosomes suggest that this locus ceased recombining independently in the ancestor to the Galloanserae and in the Laridae. We collected additional ATP5A1 Z and W sequences for 20 diverse species of birds to better understand the number of barriers to recombination at this locus. In some taxa, the two alleles were virtually identical, suggesting this locus was still within the pseudoautosomal region and undergoing recombination, while in others the large differences between the Z and W copies suggest the alleles suggest recombination ceased a long time ago. The cessation of recombination, when it had occurred, appears to have occurred independently in most of the taxa examined.

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LIFE HISTORY VARIATION IN COMMON TERNS OF THE GULF OF MAINE: FORAGING INPUTS AND THERMAL EXPENDITURES

Life history variation between Common Tern (*Sterna hirundo*) colonies in the Gulf of Maine includes clutch size, juvenile growth rate, and asymptotic mass. Tern life history characteristics vary among colonies as they increase in latitude, but also with longitude as colonies are located farther from the coast. To determine if energy inputs are driving this life history phenomenon, Common Tern foraging success was monitored from 2005 to 2007 on National Audubon Society Seabird Restoration Program islands. Foraging success was determined by observations of adult prey deliveries to chicks as well as carbon and nitrogen stable isotope analyses of chick down and fledging feathers. To determine possible energy expenditures between islands, copper thermal models were used during 2009 to measure tern chick operative temperatures. Isotopic signatures roughly match observational results indicating that islands farther from the mainland were receiving lower quality food items in 2005 relative to 2006 and 2007. However additional energy expenditure for thermoregulation could be a larger factor driving this life history phenomenon between colonies as seen with Arctic Tern (*Sterna paradisaea*) colonies.

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THE TIMING OF HUMORAL IMMUNOLOGIC INDEPENDENCE IN NESTLING HOUSE SPARROWS (PASSER DOMESTICUS)

Little is known about the development of the adaptive immune system in passerines. For this study we generated a profile that details the timing of humoral independence in nestling house sparrows (*Passer domesticus*). Seven breeding pairs of wild-caught sparrows were housed in an outdoor aviary. Prior to the onset of the breeding season, female sparrows (N=20) were immunized against dinitrophenyl keyhole limpet hemocyanin (DNP-KLH), a novel and non-pathogenic antigen. Female serum, second laid eggs, and nestling serum (age 0, 3, 6, 9, 12, and 15) were sampled and analyzed via enzyme-linked immunosorbent assays to detect the presence of specific antibodies built against DNP-KLH in conjunction with total immunoglobulin levels. In doing so we were able to determine the half-life of maternal antibodies in nestling plasma, the onset of de novo antibody synthesis by nestlings themselves, and the timing of immunologic independence, where nestling are entirely dependent on their own antibodies for immunologic protection.

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SPATIALLY EXPLICIT ANALYSIS OF THE GENETIC STRUCTURE WITHIN A HYBRID ZONE: TOWHEES IN MEXICO

We analyzed two stable regions of hybridization in Mexico between *Pipilo maculatus* (spotted towhee) and *P. ocai* (collared towhee) (historically delineated using morphological characters and isozyme loci). The two main

hybrid gradients are perpendicular; where these two gradients intersect, the two parental towhee forms live sympatrically without hybridizing. Unraveling the architecture of this hybrid complex on a genomic level can offer insight into the broader implications of interspecies gene flow. Specimens of *P. maculatus*, *P. ocai*, and their hybrids have been collected along the Teziutlán (~1200km, 11 locations, 167 total specimens) and Transvolcanic (~700km, 10 sites, 295 total specimens) gradients. The AFLP assay (genome survey) was run on the genomic DNA and individuals were sequenced at mtDNA and nuclear loci. Multi-locus analyses reveal bi-directional introgression, geographic differentiation among parental types, and divergence of populations within the areas of hybridization. Spatially explicit models suggest that some portion of loci in the genome may be free to cross porous species boundaries while other loci may be restricted by selective pressure and linkage disequilibrium.

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PHYLOGENETIC RELATIONSHIPS OF THE EXTINCT CAROLINA PARAKEET (*CONUROPSIS CAROLINENSIS*) INFERRED FROM ANCIENT-DNA SEQUENCES

We obtained the first DNA sequences from the extinct Carolina Parakeet (*Conuropsis carolinensis*) and used these data to infer the phylogenetic relationships of this iconic North American parrot. We compared our sequences of the mitochondrial CO1 gene obtained from two *C. carolinensis* museum specimens to homologous sequences from individuals representing 44 species in 25 genera of Neotropical parrots (Tribe Arini), and four outgroups from Old World tribes of Psittacines. Maximum likelihood and Bayesian analyses place *C. conuropsis* on a long branch, sister to a well-supported clade of Aratinga parakeets that includes the most northern extant species of Neotropical parrots and species endemic to Cuba, Hispaniola, and Socorro Island. Our data do not support a close relationship with the Monk Parakeet (*Myiopsitta monachus*) with which *C. conuropsis* shares fully feathered cere, a putative adaptation for cold tolerance. Based on the high level of sequence divergence from all sampled species (uncorrected $P > 5.6\%$), we recommend continued recognition of the monotypic genus *Conuropsis*. Taxonomic revision of the highly polyphyletic genus *Aratinga* is needed.

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MIGRATING AND BREEDING SONGBIRD USE OF INTERIOR AND EDGE FLOODPLAIN FOREST SITES ALONG THE UPPER MISSISSIPPI RIVER, USA.

Floodplain forests in the Midwestern USA are naturally fragmented by waterways and other habitats, yet managers often speak of managing these forests to benefit "interior" forest bird species. I surveyed birds and habitat in Upper Mississippi River floodplain forest during spring migration and the breeding season to determine if assemblages and occupancy of Cerulean and Prothonotary Warblers differed in relation to interior forest patches, associated edges, and randomly chosen areas of forest not associated with an interior patch. Estimated habitat characteristics did not differ among interior, edge and random sites. Bird assemblages did not differ among site types during migration but assemblages in random sites differed from those in interior and edge sites during the breeding season. Diversity measures of bird assemblages suggested that random sites differed from interior and edge sites during migration, but not during the breeding season. Occupancy of Cerulean and Prothonotary Warblers did not differ among site types. Hence, bird assemblages may respond more to forest width because areas with random points were not wide enough to have an "interior" area.

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TERRITORY DYNAMICS OF MEXICAN ANTHRUSH (*FORMICARIUS MONILIGER*) REVEALED BY THEIR SONGS

Birds sing as they move through their territories to signal to rivals that their territory is occupied. Typically it is males that sing to defend their territory, but female birds in some species also sing, particularly in the tropics. Researchers have traditionally followed spatiotemporal territory dynamics by tagging birds and mapping their territories using sight records. Such methods require substantial field effort and may not be suitable for species that are difficult to observe. We tested whether individual Mexican anthrush (*Formicarius moniliger*) could be monitored over time using their songs. We used Canonical Discriminant Analysis to identify 38 individual males and females by their songs over a 4-year period. We found that songs varied little from year to year and that individuals' songs could be recognized with accuracies above 80%. We found that shapes and sizes of territories can vary over time when individuals are replaced and territory dynamics varied between males and females. Finally, we found substantial variation in territory size in (*Formicarius*) between our population in Mexico and those reported in studies based in Central and South America.

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EFFECTS OF HABITAT DISTURBANCE ON MIXED-SPECIES FORAGING FLOCKS IN THE TUMBESIAN REGION OF ECUADOR

I examined the effects of habitat degradation on mixed-species foraging flocks in the highly threatened Tumbesian region of Ecuador. Species interactions are often neglected but can be important in species' persistence. In the tropics one of the most ubiquitous interspecific interactions occurs in mixed-species flocks. Thus, understanding how habitat change influences flocks can be crucial to conserving flocking species. From February to May of 2008 and 2009 I compared flock species composition and abundance, species' roles, flocking propensities and foraging behavior and efficiency in arid scrub and tropical dry forest vegetation under two disturbance levels each. While flock species composition did vary by vegetation type, the number of species and individuals per flock did not change significantly by month or vegetation type. However, species' roles in the flock, flocking propensities and foraging behavior and efficiency all varied significantly by both month and vegetation type. Most species showed higher flocking propensities and greater feeding efficiencies in the less disturbed vegetation types. These results suggest that habitat disturbance does disrupt flocking behavior and feeding efficiency for many species in the Tumbesian region.

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EFFECTS OF FIRE AND GRAZING BY BISON AND CATTLE ON PRAIRIE BIRDS AND THEIR RESOURCES: BASELINE RESULTS FROM AN ADAPTIVE MANAGEMENT EXPERIMENT IN SASKATCHEWAN

Grazing by cattle may restore ecosystem processes associated with bison and fire, but its effectiveness in doing so is unclear. In 2006, we initiated an adaptive management experiment to determine effects of cattle grazing intensity on prairies, using a Beyond BACI design. Here, we use baseline results to evaluate effects of cattle on prairie birds and their resources, and to compare effects of cattle grazing with effects of bison and wildfire. Cattle grazing had variable influences on vegetation heterogeneity. Songbird

responses to heterogeneity suggest that management for songbird diversity might threaten some species at risk. Grazing influenced invertebrates, but as songbirds did not select habitats based on prey resources, it is unlikely that prey mediate effects of disturbance on songbirds. Fire interacted with grazing in its effects on avian diversity, whereas fire and grazing had additive effects on individual species. Western Meadowlarks and Savannah Sparrows responded differently to bison than to cattle grazing intensity, whereas Baird's Sparrows, Chestnut-collared Longspurs, and Sprague's Pipits did not. Grazing by cattle is not a surrogate for natural disturbances, but is often better than no disturbance.

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WHAT LIMITS THE ACCURACY OF AN ACOUSTIC LOCATION SYSTEM?

Microphone arrays allow researchers to localize the position of vocalizing animals. In spite of their growing use, there have been relatively few studies examining how physical factors such as microphone arrangement influence acoustic location system (ALS) accuracy. We use speaker playbacks of multiple calls from known locations along with sub-sampling of channels within a large (24-mic) array to examine empirically the determinants of localization accuracy. The biggest determinant of accuracy in all simulations was the distance of the speaker outside the array. The number and spatial arrangement of microphones influenced ALS accuracy, although, with the exception of the poor performance of linear microphone arrangements we caution against generalizing these results given the insensitivity of this particular ALS algorithm to selectively use the best channels. Simulations examining error in measurements of mic locations and air temperature highlight the importance of obtaining accurate sensor positions, while speed-of-sound estimation was less important unless extremely precise locations are needed. Future simulations should examine these factors in conjunction with more adaptive ALS algorithms.

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CROSSING THE ISTHMUS: OVERLAND SPRING MIGRATION OF COMMON LOONS (GAVIA IMMER) ON THE FLORIDA PENINSULA

Spring migratory routes of the Common Loons (*Gavia immer*) wintering on the Gulf Coast of peninsular Florida were investigated at a survey site at the center of the peninsula (Alachua Co.). I documented that these loons use a unique and concentrated migration route to cross from the Gulf Coast to the Atlantic Ocean. The numbers recorded (more than 500/year) were greater than the total sum recorded during Christmas Bird Counts on peninsular Florida's Gulf Coast (ca. 21 counts), indicating that a substantial portion of this population uses this route. Using known flight speed of loons and their trajectories at my site, the loons depart from the Gulf Coast near daybreak, fly northeast and reach my observation point 50 min. later, and reach the Atlantic Ocean 110 min. after sunrise. This route minimizes overland travel while maintaining northward movement. Data were collected from 2003-2009 (excepting 2007-8). A total of 1219 loons was recorded. The median migration date was 29/30 March. The greatest single day was 193 loons on 5 April 2006. Potential alternative routes are discussed.

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GEOGRAPHIC VARIATION IN HOST RESPONSIVENESS TO BROOD PARASITISM IS EXPLAINED BY EVOLUTIONARY DIFFERENCES AND NOT PHENOTYPIC PLASTICITY

Brood parasitism reduces host fitness and favors the evolution of host defenses such as the recognition and rejection of foreign eggs from nests. Egg recognition can be completely retained for thousands of years by hosts living apart from brood parasites, but is sometimes found to decline significantly in such populations. Differences in rejection rates between host populations could reflect genetic differences, but may instead be due to phenotypic plasticity if exposure to adult parasites increases the rejection response.

American Robins and Gray Catbirds breeding in sympatry with brood parasitic Brown-headed Cowbirds in North America nearly always ejected dummy cowbird eggs experimentally placed in their nests. Rejection rates of conspecifics breeding in long-term isolation from cowbirds were significantly lower (robins) or slower (catbirds). These differences do not appear to be due to phenotypic plasticity because rejection responses of conspecifics breeding within the range of cowbirds, but where cowbirds are exceedingly rare, were nearly identical to their counterparts breeding in the presence of cowbirds. Our results provide evidence for the evolutionary decline of rejection behavior when selection for the trait is relaxed.

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INFLUENCE OF CLIMATE ON TIMING OF NEST INITIATION IN LEAST BELL'S VIREOS

Anticipating response to changing climate is a high priority need in endangered species management. I examined relationships between date of nest initiation in Least Bell's Vireos, which influences seasonal productivity, and five climate variables shown to influence migration timing in other species: Southern Oscillation Index (SOI), Multivariate ENSO Index (MEI), North Atlantic Oscillation Index (NAOI), local temperature, and local precipitation, averaged over three months (Jan-Mar) preceding vireo arrival on their breeding grounds. Precipitation and temperature were stronger than the global climate indices as predictors of annual (1) median and (2) earliest lay date of first egg for vireos in San Diego county, CA, from 1987-2009. Temperature, particularly in March, influenced both median and earliest lay dates, explaining 42% and 54% of their inter-annual variability. Total precipitation in January and February predicted earliest, but not median, lay date. No significant trends in temperature, precipitation, median or earliest lay date of vireos were detected during the study period; however, the relationships between timing of nest initiation and local climate variables provide a tool for predicting and tracking response of Least Bell's Vireos to future climate change.

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AVIAN RESPONSE TO ROAD CONSTRUCTION NOISE WITH EMPHASIS ON THE ENDANGERED GOLDEN-CHEEKED WARBLER

Noise pollution can mask or distort bird songs; which may inhibit mating success, predator detection, and parental response to begging calls. Road noise can cause lowered density and reproductive success in songbirds. I examined the impact of construction noise on reproductive success and territory selection of golden-cheeked warblers (*Dendroica chrysoparia*) at 3 sites: adjacent to road construction, adjacent to road-noise only, and a control with no noise or activity. I also examined golden-cheeked warblers' responses to experimental playback of construction noise. In 2007, productivity was 90% at the construction site and 72% at the control; 62% at both sites in 2008, and 72% at the construction site and 71% at the control in 2009. From 2007-2009, productivity was 92%, 93%, and 88% at the road-noise only site. There was no significant difference in productive territory locations based on distance from road. Six birds responded to construction noise playback; all birds that responded were located ≥ 150 m from the road. Results suggest that construction noise does not appear to affect behavior or reproductive success of golden-cheeked warblers.

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CLIMATE CHANGE AND THE PATHOGEN LANDSCAPE

Over the past decade, many scientists have warned about the negative consequences of climate change. A key prediction is a loss in global biodiversity. This may occur because the climate suitability for organisms will shift to higher latitudes and altitudes, and some species will not be able to keep up with the shift. A second key prediction is an increase in infectious diseases. This may occur because many pathogens thrive in tropical regions. As the world warms, climates in higher altitudes and latitudes will be increasingly tropical-like and more suitable for tropical diseases. The hypothesis for an increase in disease differs substantially (and is at odds) with the mechanisms that may reduce biodiversity. An alternative hypothesis is that

pathogens and parasites are components of biodiversity and, in some cases, the most sensitive elements. In this context, we might expect the climate suitability for parasites to shift with climate change, increasing in some areas, and decreasing in others. A net decrease in the diversity and distribution of parasites (along with free-living species) is, therefore, a possible logical outcome of climate change. Birds are a good study system for investigating these questions, with applications that apply to human health and beyond.

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HOW DO DISPERSAL BARRIERS AFFECT THE POPULATION STRUCTURE OF BOREAL CHICKADEES?

During the last glacial period much of North America was covered by large ice sheets. Throughout this time, both fauna and flora survived in ice-free regions known as refugia. Two large refugia existed in North America – one south of the ice sheets, and one in the west in Beringia. A number of smaller, disputed refugia were present on both the east and west coasts of Canada. Many studies have looked at how physical barriers such as the Isthmus of Panama, mountain ranges and large bodies of water can act as barriers to gene flow in many species. Obstacles such as these may have impacted the recolonization following the melting of the ice sheets. The boreal chickadee (*Poecile hudsonicus*) is a small passerine which resides in the boreal forests of Canada and the northern United States. In order to study their postglacial expansion, and how physical barriers affected their population makeup, we evaluated mitochondrial sequences from field and museum samples (N=165), covering all of the chickadees' range. Early results indicate a starburst pattern of genetic variation.

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EFFECTS OF GLOBAL CLIMATIC CYCLES ON INTERANNUAL SURVIVAL OF A MIGRATORY SONGBIRD

We examined 17 years of Swainson's Thrush (*Catharus ustulatus*) mark/recapture data (N=1188) from 41 banding stations in northern California to model survival parameters in relation to two global climatic cycles: El Niño Southern Oscillation (ENSO) and North Atlantic Oscillation (NAO). The western subspecies (*Catharus ustulatus ustulatus*) breeds from northern California to SE Alaska and winters in Central America. Based on model selection results, there was a 95.3% likelihood that models incorporating averaged winter indices of ENSO and NAO explained variation in annual survival. Annual survival, which ranged from 30-60%, was negatively correlated with both climatic indices, and ENSO had a significantly negative effect on annual survival. Central American climate analyses showed increased drought and plant stress during positive years of ENSO and NAO, which we hypothesize is a possible mechanism for the observed negative effect of ENSO and NAO on Swainson's Thrush survival. Understanding this effect, as well as the effect of ENSO and NAO on other species, is crucial considering both ENSO and NAO are projected to trend more positive in coming years due to human-induced Global Climate Change.

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**ARCTIC SHOREBIRD DEMOGRAPHIC NETWORK:
 UNDERSTANDING THE MECHANISMS BEHIND SHOREBIRD
 DECLINES**

There is growing evidence that many shorebird populations may be declining in North America. Reasons for these declines are unknown. Demographic studies on the breeding grounds provide an opportunity to measure a variety of parameters that influence population growth (e.g., reproductive effort and performance, age of first breeding, adult survival). Here we introduce a new initiative called the "Arctic Shorebird Demographic Network" (ASDN) whose goal is to gather information on potential mechanisms behind shorebird declines that can be measured on the breeding grounds. This approach

complements the Arctic PRISM that estimates population size and trends of shorebirds. To better understand patterns in shorebird demographics, we plan to collect data on other environmental variables such as alternative prey, invertebrate abundance, predators and weather. At the time of writing, we have identified 4 sites in Alaska and 3 sites in Canada to conduct this work. The ASDN also will allow the collection of samples from a large number of birds (or eggs) across a large geographic area, enabling assessments of contaminants, genetic subdivision, migratory connectivity, and other areas of interest.

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EVIDENCE OF FEMALE-BIASED PRIMARY SEX RATIOS IN RUFFS

Recent theory and data suggest that female-biased population sex ratios are stable in strongly sexually selected species. In Ruffs (*Philomachus pugnax*), a lekking species, several sources of information suggest that primary sex ratios are strategically female-biased by laying females: (1) non-breeding population sex ratios have long been thought to be strongly female biased; (2) sex ratios of several thousand juvenile migrants from five sites captured over ca. 15 years are ca. 40:60 male:female biased; (3) a 40:60 male:female bias occurred in over 600 chicks raised in captivity; (4) a published field study found a condition-dependent female biases in hatching eggs, albeit with limited samples sizes; and (5) estimates of effective population size based on levels of variation in nuclear DNA (males and female genomes) versus mitochondrial DNA (females only), are consistent with an evolutionary history of female-biased ratios, although the discrepancy is so large that substantial skew in male mating success, which also occurs, must also be a contributing factor.

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SOCIALITY AND PARENTAL CARE IN THE BLACK CATBIRD IN QUINTANA ROO, MEXICO

Understanding how social systems (e.g., cooperative breeding) evolve represents an important area of behavioral ecology, but insufficient sampling of breeding behavior across taxa can impede attempts to infer patterns. In 2008 and 2009, we studied nest-provisioning behavior in the Black Catbird, *Melanoptila glabrirostris*, a poorly known mimid endemic to the Yucatán Peninsula and adjacent islands, to characterize its social breeding system and contribute to an understanding of the evolution of sociality in the Mimidae. On mainland México (Quintana Roo) and on Isla Cozumel, breeding occurred from April through August in both years. Clutch size averaged 2.31 eggs (N = 62), and in 2009, a greater percentage of nests fledged young on Cozumel (-75%, N = 16) compared with the mainland (-13%, N = 48), with losses mainly attributable to predation. On the mainland, we observed groups of up to 7 catbirds cooperatively mobbing predators. Despite having the greatest breeding density of any mimid (≥ 48.6 adults/ha, mainland site), we recorded no instances of cooperative breeding. This clustering may represent a formerly undocumented level of social organization for the Mimidae.

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REVISITING THE NESTING ECOLOGY OF WESTERN GREBES AFTER 40 YEARS OF CHANGES AT DELTA MARSH, MANITOBA

As one of the largest marshes on the Canadian prairies, Delta Marsh is a major nesting area for western grebes (*Aechmophorus occidentalis*) in

Manitoba. Since the 1970s, artificially stabilized hydrology, increased presence of common carp, and invasion by a highly competitive cattail hybrid have significantly impacted Delta Marsh and may have impacted its western grebe population. To evaluate the impact of stressors within Delta Marsh on western grebes, and to facilitate comparisons across time, in 2009 we repeated surveys originally conducted by Nuechterlein (1975) on the nesting ecology of western grebes in 1973 and 1974. Chick-to-adult ratio in 2009 was 0.55, compared to 0.88 in the corresponding high-water year of 1974. Increases in the proportion of nests destroyed by waves, and significant structural changes in marsh vegetation used for nesting, suggest that the breeding success of western grebes at Delta Marsh may have been negatively impacted by stressors within the marsh. These data will help identify and prioritize actions to improve the management and conservation of western grebes at Delta Marsh and similar coastal marshes.

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THE ROLE OF PARENTS IN SHAPING PATTERNS OF AVIAN NEST
PREDATION RISK

Because nest predation limits avian fitness and strongly shapes avian biology, ornithologists are interested in understanding how and why predation occurs. We examined the mechanisms underlying observed spatial and temporal variation in nest predation risk for a population of Yellow Warblers (*Dendroica petechia*). Specifically, we examined the effect of parents on observed predation risk patterns by comparing natural patterns to those recorded by experimental nests (nests without parents). We found a negative correlation between bird density and natural predation rates, and relatively low mid-seasonal predation rates on natural nests. By contrast, experimental nests recorded relatively constant predation rates with respect to these factors. Natural egg predation patterns were similar to those recorded over the entire nest cycle despite relatively constant predation pressure attributable to two major egg predators identified from clay egg bites. Having accounted for all differences between natural versus experimental nests except for the presence of parents, we concluded that parents influence natural predation patterns. Variation in nest defense caused by differential food availability for parents is a likely factor causing variation in nest predation rates.

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HABITAT PREFERENCES OF PAINTED BUNTINGS (*PASSERINA
CIRIS*) ON A BARRIER ISLAND

Population size of Painted Buntings (*Passerina ciris*) declined over 2.58% annually from 1966-2002. We used radio telemetry and vegetation sampling techniques to: 1) determine habitat preferences, 2) identify territory size, and 3) determine nesting habitat requirements. Our study site was Kiawah Island, a barrier island in South Carolina. We caught 52 birds (M-21, F-20, SY-7, HY-3, Unk-1) at feeders, representing both sexes and three age classes. We fitted each individual with a radio transmitter using a figure-eight harness, and followed them daily for up to six weeks. We used standard BBIRD methodology, gathering information on degree and composition of herbaceous ground cover, mid-story shrubs and trees, and canopy closure. Both sexes and all age classes showed significant preferences for edge between maritime shrub-scrub forest and marsh or meadow. Males sang from canopy trees, and females, young males, and HY buntings utilized mid-story shrub/tree species. Nests were predominantly found in the mid-story, either in shrubs or Spanish moss (*Tillandsia usneoides*; n=15; mean nest height = 2.67m). Our data suggest that restoration of developed homestead should focus on increasing mid-story habitats.

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TESTING INFERENCES IN THE NEW TECHNIQUE OF
MEASURING CORTICOSTERONE IN BIRD FEATHERS

The newly described technique of extracting corticosterone (CORT) from bird feathers shows promise as a less invasive, more integrated measure of a bird's stress response, but requires further validation. We explored assay dynamics by measuring CORT concentrations in a standard pool of homogenized feathers and found that sample mass affects measured feather CORT concentration, suggesting that sample mass should be standardized. We established a more direct link between plasma and feather CORT concentrations by experimentally increasing plasma CORT concentrations using implants, and determining if a corresponding rise in CORT could be detected in feathers grown during implantation. We detected higher CORT levels in the feathers of birds whose plasma CORT levels were experimentally increased, and found that CORT levels in two feathers grown at the same time from the same bird were very consistent. However, different portions of a growing feather did not reflect changes in plasma CORT at the time different parts of the feather were forming. These data indicate that important technical constraints must be considered before using a feather assay as an indicator of plasma CORT levels.

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HERMIT THRUSH (*CATHARUS GUTTATUS*) AND VEERY
(*C. FUSCESCENS*) BREEDING HABITAT ASSOCIATIONS IN
SOUTHERN APPALACHIAN SPRUCE-FIR FORESTS

The Hermit Thrush is a relatively recent breeding bird in the high-elevation forests of the Southern Appalachians, having expanded its range southward over the last four decades. Here it overlaps with the breeding territory of the Veery, a congeneric, well-established breeding resident. The aim of this study was twofold: 1) to compare breeding habitat associations between the two species, and 2) to gather information on the local breeding habitat preferences of the Hermit Thrush. Thirty-six topographic and habitat variables were measured in Hermit Thrush (n=30) and Veery (n=24) territories, ten of which showed significant differences between the species preferences. In general, Hermit Thrush territories had more leaf-litter ground cover, a more open understory, and higher basal area and canopy closure. Veery territories had a much thicker shrub layer and a less developed canopy. The Southern Appalachian Spruce-Fir forest is one of the most endangered forest types in North America, due to past logging, acid deposition, and aphid infestation. It is important to document bird-habitat relationships here to better understand how birds may be affected in the future.

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RIPARIAN BIRD MONITORING AND POPULATION SIZE
ESTIMATES FOR THE LOWER COLORADO RIVER, 2007 - 2009

The Lower Colorado River is a major center of bird diversity of the American Southwest, and significant efforts are currently underway through the Lower Colorado River Multi-Species Conservation Plan toward recovery of native riparian habitats. We conducted area searches on randomly selected grid sites from Lake Mead to the Southerly International Boundary and two tributaries and in established habitat creation sites in the historic floodplain of the Colorado River's mainstem from April - June, 2007 - 2009. Using double sampling, we calculated population size estimates based on all three years, and using field habitat assessments, we created habitat models for four targeted species. In three years, 192 bird species were detected. The habitat analyses indicated that a patchy mosaic of different riparian habitat types that vary at a 2-5 ha scale supports the largest number of targeted species and in greatest abundance. The majority of the species covered under the Plan were also significantly associated with native vegetation cover, although Yellow Warbler (*Dendroica petechia*) had some of its highest breeding densities in the exotic salt cedar (*Tamarix* spp.).

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THE WHITE-BREASTED WOOD-WREN (HENICORHINA LEUCOSTICTA) SHOWS HIGH LEVELS OF PHYLOGEOGRAPHIC STRUCTURE THROUGHOUT THE NEOTROPICS

The White-breasted Wood-Wren (*Henicorhina leucosticta*) is a common lowland resident of Middle and northern South America. Using mitochondrial and nuclear genes, we reconstructed phylogenetic relationships of the *Henicorhina* wood-wren complex. Sequence variation from across the species' range showed four principal clades, two Middle American (Middle America and Volcan Baru) and two South American (Choco and Amazon-Darien). These four clades were well supported and highly divergent (9.1-13.1%) in mtDNA. The Choco clade, representing samples from the Choco region of northwestern Ecuador, was sister to the Bar-winged Wood-wren (*H. leucoptera*). The Amazon-Darien clade exhibited a relatively deep split (4.4%) between Amazonian and eastern Panamanian specimens, with specimens occurring east of the Andes showing relatively shallow genetic splits (1-2%). In all phylogenetic reconstructions, the Middle American clades showed high levels of geographic structure. In general, Middle American *H. leucosticta* populations are characterized by large phylogenetic splits (2.5-13.1%) between geographically proximate populations. The largest phylogenetic break in Middle America (13.1%) occurred within two populations of a single subspecies from the Pacific and Caribbean slopes of Panama.

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THE COST OF SAVING HAWAII'S REMAINING BIRDS

At least 60% of the known Hawaiian avifauna is extinct. Thirty-one of the remaining 42 endemic birds are federally listed, many continue to decline, and almost all are threatened by habitat degradation due to non-native ungulates, predation by non-native mammals and owls, and introduced diseases. Climate change will exacerbate these threats, especially disease. Current conservation measures are necessary, but insufficient, to prevent additional extinctions. Required management actions are expensive, and funding for Hawaii's birds is less than would be predicted based on need. To highlight this disparity, I estimate the funds needed to prevent further extinctions. This estimate considers threat abatement projects across all USFWS designated recovery or critical habitats. The estimate accounts for efforts needed to ameliorate the effects of climate change and the fact that efforts must be continued in perpetuity. Minimizing threats will require constructing 100s of miles of ungulate or predator-proof fence and eradicating or controlling non-native species over 100s of thousands of acres. These actions will require 100s of millions of dollars; far more than the funds now available to protect Hawaii's unique species.

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DO PRAIRIE BIRDS SELECT MANMADE GRASSLANDS WITH MORE FOOD?

Transmission lines could be managed to support species of native prairie organisms, whose original habitat has been severely reduced. We hypothesized that prairie birds would settle along manmade grasslands with more arthropod prey. In southern Manitoba in 2007-2009, we surveyed birds, arthropods (pitfall traps, sweep-netting), and vegetation at sites (n = 52) along transmission lines that varied in management (mowing, haying) and with surrounding land use. Based on avian diets, we identified arthropods that were available as prey for each bird species, along with vegetation and landscape-level metrics that best predicted bird densities and available prey at each site. As an example in 2007-2008, Savannah sparrows *Passerculus*

sandwicensis were most abundant at sites with more prey (hayed sites), after accounting for year and forest within 400 m of transects (-). Arthropod prey may be a cue for prairie birds settling in remnant grassland habitats, even though studies have not found such a relationship in unfragmented prairie landscapes. Furthermore, urban prairie habitat managers ought to manage for both prairie birds and their arthropod prey in manmade grasslands.

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DISTRIBUTION AND ABUNDANCE OF SAGEBRUSH BIRD SPECIES IN THE WYOMING BASINS: IS IT LAND-USE, FRAGMENTATION, OR HABITAT LOSS?

The relative contribution of anthropogenic land-use, and/or habitat loss and fragmentation to the decline of sagebrush associated birds is poorly understood. Based on fieldwork in the Wyoming Basins (321 point-count stations), we evaluated the occurrence/density of sagebrush obligate species based on habitat (land cover), land-use (anthropogenic footprint), and abiotic conditions across six spatial scales (0.27 – 18 km) using logistic or count-based regression models. Preliminary analyses indicate that anthropogenic factors had less influence on species occurrence/density than habitat or abiotic conditions. For sagebrush obligate species, amount of sagebrush habitat (scale-dependent) was positively associated with species occurrence/density, while mixed shrub habitat was negatively associated with species occurrence/density. Although relationships between anthropogenic variables and occurrence of birds were evident for a few species, the consistent relationship with habitat factors suggests that habitat loss due to human disturbance is the most important factor affecting sagebrush obligate bird communities. We used our models to identify key areas of conservation priority in the Wyoming Basins.

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THE CALM AFTER THE STORM: HURRICANES HELP LEAST TERNS

Hurricanes often negatively impact breeding waterbirds by direct mortality and habitat destruction. For an island nesting species that prefers open beach habitat, hurricanes may improve nesting conditions in the short term by removing vegetation and nest predators. We monitored nests of Least Terns on Trinity Island, Isles Dernieres Barrier Island Refuge, Louisiana, in 2008 and 2009. During the fall of 2008, two major hurricanes impacted the island. The breeding season following these storms saw a marked increase in Least Tern nesting colonies on Trinity Island and in their nest success. Nesting was observed in six distinct colonies in 2009, in contrast to only one in 2008. Logistic exposure model estimated nest success increased from 19.6% in 2008 to 52.7% in 2009. We examine the likely causes of this improvement and conclude that increased open habitat and declines in predator activity were important factors. As with most disturbance effects, there are winners and losers in both the short and long term. The hurricanes decreased the size of the island, and all species ultimately lose if the islands are lost.

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THE FEATHERY TRIBE: TOWARD A HISTORY OF MODERN ORNITHOLOGY

A broad literature exists on the history of ornithology. However, there have been virtually no studies that explicitly analyze the issue of just what constituted a professional or an amateur, nor when the study of birds became a true profession. I argue that the history of modern ornithology as a recognizable profession came into existence considerably later than usually implied, during a key quarter-century between 1875 and 1800 after Darwin's

theory of evolution had become widely accepted. A key trio of traits provided evidence of professionalization, and also were a foil for skirmishes between professionals and amateurs as ornithology became a full-blown science: 1) the use of study skin collections to illustrate intergradation of species and other elements; 2) the role of publications as a form of institutional authority and prestige; and 3) the role of nomenclature in efforts to create an agreed-upon vocabulary and set of linguistic conventions for describing birds and what this meant for systematics. Robert Ridgway, the Smithsonian's first Curator of Birds, played a key role in these three realms, and serves as a locus for investigation of this topic.

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MAPPING THE BYCATCH SEASCAPE: SPATIAL APPROACHES TO REDUCING SEABIRD BYCATCH

Fisheries bycatch of seabirds is a worldwide conservation issue. Despite a growing awareness of seabird bycatch in particular ocean regions, spatial analyses of bycatch have been hampered by inherent data limitations and the need for novel applications of geospatial and telemetry-based approaches. Here, I present how a range of spatial applications, including hierarchical Bayesian models, point and area pattern statistics and telemetry-based habitat models, informs and improves our ability to reduce fisheries bycatch of seabirds.

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NEST-DISMANTLING BEHAVIOR OF THE HAIR-CRESTED DRONGOS IN CENTRAL CHINA: A FURTHER STUDY

We reported a unique nest-dismantling behavior in Hair-crested Drongos (*Dicrurus hottentottus*) that adults dismantled their nests after fledgling and hypothesized that this was an adaptive behavior for increasing fitness by reducing predation risk of young birds or nest site competition of adults in the following breeding season. To test these hypotheses, we further investigated this behavior in 2008 and 2009. Of the nest sites used in previous years, 12 (80%) and 24 (67%) nest sites (or territories) were reused in 2008 and 2009, respectively. Moreover, 6 of 11 adult drongos banded in 2008 were recaptured or resighted in the same territories in 2009. Using radio-tracking technique in 2009, we confirmed that adult drongos dismantled their nests after juveniles fledged and became less fidelity to their nest locations, but before they became independent. The nest-dismantling process was not started immediately after fledging and usually took several days. These observations were consistent with "nest-site-competition hypothesis" that predicted drongos should reuse the nest sites in following breeding season and inconsistent with "predation-risk hypothesis" that predicted nest-dismantling should occur immediately after young birds fledged and do so quickly.

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FEEDING SEXY SONS SOMETIMES: FEEDING DECISIONS OF EASTERN BLUEBIRDS ARE SITUATIONALLY INFLUENCED BY FLEDGLING PLUMAGE COLOR

The relative amount of resources that avian parents provide to individual offspring within a brood represents a strategy that can have large effects on reproductive success. We tested whether parental feeding decisions of eastern bluebirds *Sialia sialis* are influenced by offspring plumage color by presenting pairs of differently colored fledglings side by side and observing how they were provisioned by parents. After a control period, we manipulated blue plumage color so that one sibling in each trial became relatively dark and one became relatively bright. During neither the control nor the experimental periods did either parent consistently feed naturally brighter or experimentally brightened sons more than drab sons. Under specific circumstances, however, both parents directed a higher proportion of their feeding attempts to more brightly colored sons. These results suggest that equal provisioning of offspring is the strategy most commonly adopted by eastern bluebirds, but more brightly colored offspring will be fed preferentially when resources for offspring are limited.

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POPULATION DYNAMICS OF THREE SPECIES OF PASSERINES IN SOUTHEAST ASIA: THE IMPACT OF PAST CLIMATIC AND GEOGRAPHIC CHANGES.

Although Quaternary glacial cycles are known to be important in shaping the evolution of biota in the temperate zone, their impact on tropical systems is less well studied. We assessed the influence of glaciation-associated climate and habitat changes on the population dynamics of three Southeast Asian passerine species (*Arachnothera longirostra*, *Malacocincla malaccensis*, and *Orthotomus sericeus*). Through paleo-environmental reconstructions, it has been shown that lowland forests in insular Southeast Asia shrank during the Last Glacial Maximum (LGM). Our specific objectives are to determine: (1) the extant and direction of gene flow between populations in Borneo and mainland Asia; (2) rate, directionality, and center of origins of spatial population expansions on Borneo; and (3) distribution of genetic diversity across different regions of Borneo. We found that the three species responded differently to the presence of land connections between Borneo and mainland Asia during the LGM, possibly indicating differences in their abilities to cross putative habitat barriers (e.g., savanna) on the exposed shelf. Distribution of genetic diversity was uneven across Borneo, suggesting the presence of forest refugia.

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DIFFERENT HABITAT CHARACTERS ATTRACT DIFFERENT STATUSES OF FOREST BIRDS IN FRAGMENTED LANDSCAPE IN TAIWAN

Habitat fragmentation has been considered as threat to biodiversity and maintaining large forest patches is often considered the key in preserving biodiversity in fragmented landscape. However, the effects of habitat fragmentation are not universal to all bird species. We mapped the locations of all observed bird individuals in a 50 hectares farm by territory mappings during the breeding seasons from 2005 to 2007. We classified habitat types by aerial photograph and measured vegetation structure of each patch. Almost 90% of the registration spots were located in forest patches. Forward variable selection of logistic regression suggested the distributions of different statuses of species in forest patches were affected by different habitat characters. Family richness of sub-canopy plants was the most important factor to dominant residents; and canopy foliage volume was to non-dominant residents. Wintering species mainly affected by habitat types. We conclude that, habitat type is a strong effect to habitat selection of birds, even in a very small patch. The habitat with highly diverse characters is a key factor to attract different statuses of forest birds.

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STRESS AND SOCIAL STATUS IN A COOPERATIVELY BREEDING BIRD, THE RED-BACKED FAIRY-WREN

Androgens are involved in regulating alternative reproductive tactics and appear to maintain signal honesty of condition dependent traits. The function of androgens may be mediated by glucocorticoid stress hormones. We tested the hypothesis that corticosterone levels influence the development and maintenance of alternative reproductive tactics in a cooperatively breeding passerine, the Red-backed Fairy-wren (*Malarus melanocephalus*). First year males demonstrate one of three breeding phenotypes: 1) red/black breeding males with high body condition and androgen levels, 2) brown breeding males with intermediate androgens and condition, or 3) low condition, low androgen, brown non-breeding auxiliaries. First, we assessed whether breeding male phenotype reflects differences in corticosterone levels and found that contrary to our predictions, both subordinate auxiliary males and dominant red/black breeding males had equally high levels of corticosterone while brown breeding males had the lowest levels. However, corticosterone during molt is correlated with body condition and testosterone, and may

therefore mediate breeding phenotype. These results highlight the need for further studies on the intermediary effects of stress hormones in regulating the production of seemingly androgen dependent traits.

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NEST HABITAT CHARACTERISTICS OF FLAMMULATED OWLS IN COLORADO

As part of a long-term investigation of habitat and demography in Flammulated Owls (*Otus flammeolus*) in Colorado, we assessed nesting habitat of owls in undisturbed mixed-conifer forests from 1981 to present. Flammulated Owls, which are secondary-cavity nesters, nested most frequently (91 of 114 nests) in quaking aspen (*Populus tremuloides*) trees but not disproportionately based on availability. Among characteristics of nest trees that differed from available but unused cavity trees, the most important were nest cavity height (nests were 25% higher; 6.7 m vs 5.2 m), and tree height (nest trees were 27% taller; 16.8 m vs 12.2 m). Other factors, including number of cavities/tree, cavity orientation, and tree and shrub density in the nest area did not differ from available but unused areas. The importance of nest cavity height likely is tied to risk of nest predation by red squirrels (*Tamiasciurus hudsonicus*), the most important predator of owl nests in our study sites. Compared to nest cavities that were depredated by red squirrels, height of nest cavities where no predation occurred was significantly greater (7.6±0.7 m vs 5.8±0.5 m).

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FEMALE REPRODUCTIVE SUCCESS IN RELATION TO MALE ORNAMENTATION AND GENETIC COMPATIBILITY OF PAIRS

We measure the benefits to females of pairing with highly-ornamented males versus males that are more genetically compatible in eastern bluebirds (*Sialia sialis*). We found that females mated to brighter males fledged more offspring annually and that both male coloration and genetic compatibility of pairs predicted offspring quality. The relative importance of genetic compatibility versus mate ornamentation on nestling quality, however, varied with season. For first clutches, early in the breeding season, genetically more-compatible pairs produced heavier nestlings. On the other hand, for second clutches, later in the season, brighter males produced offspring that were heavier and had longer wings at fledging. We found no relationships, however, between male heterozygosity and either coloration or reproductive success. Our data suggest that females receive benefits both from mating with genetically more-compatible males and mates that are more colorful, however, environmental circumstances influence the relative benefits of mate selection for ornamentation versus genetic compatibility.

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AN ESTIMATE OF AVIAN MORTALITY AT COMMUNICATION TOWERS IN NORTH AMERICA BY SPECIES AND REGION

Neotropical migrants are attracted to lights on communication towers and are killed in the millions annually in collisions with the structures. Using a meta-analysis of existing data, we produced a new estimate of avian mortality at towers that explicitly assigns estimated mortality both to species and to regions in North America. Our method integrated tower characteristics and distribution in the U.S. and Canada, estimates of annual avian mortality by tower calculated by tower height, lighting, and presence of guy wires, and profiles of species killed derived from available records for aggregated Bird Conservation Regions. Neotropical migrants suffer the greatest mortality; 95% of birds killed are passerines, mostly warblers (Parulidae, 57%) and vireos (Vireonidae, 11%). We estimate that >100,000 individuals are killed annually of Red-eyed Vireo, Ovenbird, Common Yellowthroat, Swainson's Thrush, Tennessee Warbler, American Redstart, and Magnolia Warbler. Many birds of conservation concern are estimated to suffer annual mortality at towers of 1–5% of total population size. Our geographically explicit approach supports the conclusion that tower mortality has a significant biological impact as defined within the federal regulatory structure.

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CACHE SITE SELECTION IN CLARK'S NUTCRACKER

Clark's nutcrackers (*Nucifraga columbiana*) are effective seed dispersers for pines in western North America because of their scatterhoarding behavior. Some species, including the declining whitebark pine (*Pinus albicaulis*), rely on nutcrackers for seed dispersal. One restoration method for whitebark pine uses mechanical thinning and prescribed fire to create forest openings that are believed to be preferred by nutcrackers for caching. However there have been no published studies of nutcracker caching preferences to date. We examined nutcracker cache site selection at three scales. On a landscape scale, nutcrackers cached seeds centrally within their home range even though this required them to transport seeds up to 32 km. Once within the home range, nutcrackers avoided burns and selected cliffs and low elevation forests for caching. On a microsite scale they placed 58 percent of all caches above ground in trees. For ground caches, they selected sites with greater understory cover and closer to tree stems compared to random sites. Overall, nutcrackers selected sites that increased individual fitness and only 37 percent of whitebark pine seeds were placed in sites favorable for germination.

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DOES THE WORM GET THE EARLY BIRD? IMPACTS OF INVASIVE EUROPEAN EARTHWORMS ON GROUND-NESTING SONGBIRDS IN NORTHERN HARDWOOD FORESTS

Non-native earthworms are invading previously earthworm-free hardwood forests of the northern U.S., dramatically altering soil composition, vegetation structure, and plant diversity. Whether these changes impact the songbirds

using these habitats remains unknown. Earthworm-mediated changes to understory plant communities may increase susceptibility of ground-nesters to predation while reduction of invertebrate abundance may cause food shortages for ground-foragers. We conducted avian surveys and nest searching at sites representing a progression of earthworm invasion in the Chequamegon-Nicolet National Forest, Wisconsin. Results indicate that Ovenbirds and Hermit Thrushes, common ground-nesters in the region, may indeed be negatively impacted by earthworm invasions. Densities of these species were significantly lower in invaded forests compared to earthworm-free stands during both years of the study. Furthermore, nesting density of Ovenbirds was significantly greater in earthworm-free areas. Models of nest success provide strong evidence that Ovenbird nest survival rates are inversely-related to the mass of one particularly damaging earthworm species (*Lumbricus rubellus*). Further research will clarify the mechanisms for this apparent impact of earthworms to nest success and whether earthworm invasions pose a significant conservation threat to forest songbirds.

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PATTERNS OF HABITAT OCCUPANCY BY RUSTY BLACKBIRDS
WINTERING IN THE LOWER MISSISSIPPI ALLUVIAL VALLEY

To provide management recommendations for the sharply declining Rusty Blackbird (*Euphagus carolinus*), we evaluated habitat use by ≥ 1 and by flocks of ≥ 20 Rusty Blackbirds in the central Lower Mississippi Alluvial Valley (LMAV) by modeling occupancy rates with habitat type, tree density, canopy coverage, and ground water coverage from 8 detection/non-detection surveys at 89 sites in 2006, 10 surveys at 117 sites in 2007, and at 109 sites in 2008. Occupancy (SE) was 0.71 (0.05) during 2006, 0.44 (0.05) during 2007, and 0.38 (0.05) during 2008. Occupancy of flocks was 0.45 (0.06) in 2006, 0.17 (0.04) in 2007, and 0.10 (0.03) in 2008. Habitat effects on occupancy during 2006 and 2007 were weak. During 2008, occupancy increased from 0.29 (0.06) at 0 trees/ha to 0.85 (0.14) at 350 trees/ha. Also, occupancy was $\geq 70\%$ greater in wet bottomland hardwood forests versus agriculture. Flock occupancy was $\geq 61\%$ greater in wet, moist, and dry bottomland hardwood forests versus agriculture. Restoring bottomland hardwood forests in the central LMAV may increase resource use by Rusty Blackbirds during low occupancy years.

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AGING BELL'S VIREOS BY PRIMARY FEATHER LENGTH AND
SHAPE: A TEST

Accurately aging organisms in demographic studies is essential to determining survivorship and productivity by age cohort. Many passerines are difficult to age accurately once juvenile characteristics are absent. Pyle (1997) suggests that in Bell's Vireo, the length and shape of the tenth primary feather (p10) may be useful in distinguishing hatch-year and second-year birds from older individuals. To test this, we measured the extent of p10 beyond the tip of the longest primary covert (N = 76) and scored the tip as rounded or pointed (N = 68) on live Least Bell's Vireos of known age that were captured in the field. We also photographed p10s of 18 known-aged vireos and had nine observers independently score the shapes side-by-side. We found that length of p10 did not differ by age. Inter-observer variability was high in determining the shape of seven of the eighteen p10s in photos. However, when ≥ 8 observers agreed, we were able to accurately age vireos by p10 shape 91% of the time. With practice, the shape of p10, although subtle, can be useful in determining the age of Bell's Vireos.

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A PREDICTIVE MODEL FOR THE LOSS OF NEOTROPICAL
MIGRANTS AT COMMUNICATION TOWERS IN ARKANSAS

The loss of birds at communication towers has been documented throughout the eastern U.S. during the last half century and may pose a threat to populations of migratory birds more than any other group. Our investigation into the effects of communication towers on neotropical migrants in Arkansas shows that significantly more birds ($p=0.022$) are lost at tall (>150 m) towers

(mean = 0.27 ± 0.15 birds per night) than at short towers (mean = 0.06 ± 0.077). No significant differences among treatments of physiographic region and light color were detected when only tall towers were considered. Furthermore, no significant effects due to region, lights, nor the presence or absence of guy wires were found in analyses of data from short (61–150 m) towers. We incorporated recoveries of birds at towers, searcher efficiency results, and measures of scavenging and/or predation into a predictive model to estimate the annual loss of birds at specific communication towers structures. According to our analyses, the construction of shorter towers whenever possible provides the most effective means of reducing the loss of migrating birds.

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SEXING GREATER ROADRUNNERS (*GEOCOCCYX
CALIFORNIANUS*) USING MORPHOLOGY AND DISCRIMINANT
FUNCTIONS

The Greater Roadrunner (*Geococcyx californianus*) is a large New World ground-cuckoo found in the deserts and grasslands of the southwestern United States and in Mexico. Like most cuckoos, roadrunners are sexually dimorphic only in size and therefore cannot be easily sexed in the hand. We examined sexual size dimorphism in roadrunners and developed a discriminant function that allows for the determination of sex based on external morphological characters. We collected blood samples and morphological measurements from 113 roadrunners across four states during the 2008 and 2009 breeding seasons. Individuals were sexed using molecular genetic methods. Analysis of variance revealed that males were significantly larger than females in all characters measured. Using forward stepwise discriminant function analysis, we determined the best characters for sexing roadrunners. We then generated a linear discriminant function using the wing chord, culmen length, and tarsus length that was able to assign 85% of our samples to the correct sex. Our results show that these three morphological measurements can be used to determine a roadrunner's sex with a good degree of accuracy.

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TREND AND POWER ANALYSIS OF A LONG TERM BOREAL BIRD
STUDY IN NORTHERN CANADA.

An intact community of boreal forest songbirds in southwestern Northwest Territories, Canada has been monitored since 1998. Seven years of data have been collected within a core study design stratified by habitat type supplemented by counts collected randomly with respect to habitat (2807 counts). Power to detect linear trends was calculated for 21 species using the CV of existing data and projected to 20 years continuing current tri-annual sampling or intensifying to biannual. 15 of 21 species analyzed had power >0.80 ($\alpha = 0.10$) to detect 50% total linear decline continuing tri-annual sampling. There was no improvement with biannual sampling. Mixed-model regressions were used to calculate observed trends of 51 species for 1998-2008 accounting for the nested, repeated counts and two sampling designs. Eight are declining significantly, 23 have no discernable trend, and 4 have a positive linear trend. Sixteen species had a quadratic trend, many likely due to cyclical outbreaks of spruce budworm (*Choristoneura fumiferana*). Only 1% of the landscape has anthropogenic disturbance, implying that observed trends are not due to local disturbance.

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CHANGE IN MIGRATORY BEHAVIOR AS A POSSIBLE EXPLANATION FOR BURROWING OWL DISTRIBUTIONAL CHANGES IN NORTH AMERICA

While many avian distributions in North America are shifting northwards in response to climate change, the breeding distribution of the Western Burrowing Owl is shifting in the opposite direction. Burrowing owl populations near the northern edge of the species' breeding range in southern Canada and northern United States are declining or even disappearing. The species' breeding distribution has also expanded southwards into coastal Sonora and Sinaloa in northwestern Mexico, where recent agricultural development of desert thornscrub has created suitable breeding habitat in these otherwise wintering grounds. We hypothesize that migratory Burrowing Owls from northern declining populations are becoming resident breeders in the irrigated agricultural valleys of northwestern Mexico. We used microsatellite DNA markers and stable isotope analyses on feathers to determine the patterns of breeding dispersal among populations in North America. Microsatellite data does not support our hypothesis, suggesting high rates of emigration and immigration among all populations. Stable isotope signatures of C and N in feathers, however, suggest moderately high site fidelity among burrowing owl populations, with evidence of migratory Burrowing Owls from the north becoming breeders in northwestern Mexico.

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SPRING MIGRATION IN WOOD THRUSH (*HYLOCICHLA MUSTELINA*): CARRY-OVER EFFECTS INTO BREEDING SEASON

We used geolocators to determine spring migratory routes of wood thrushes (*Hylocichla mustelina*) breeding in northwestern Pennsylvania, USA (N=14). Most individuals in our population use a similar migration route, crossing the Gulf of Mexico and continuing up the Mississippi Valley. Departure date from the winter territory (Nicaragua/Honduras) varied from 17 March to 21 April and spring migration speed ranged from 100-318 km/d. Upon arrival to the breeding grounds in 2009, wood thrush were caught using mist-nets and corticosterone levels measured prior to nest-building (N=10). To determine the reproductive impact of carry-over effects from spring migratory departure date, route choice and speed of migration, these individuals were then radio-tagged and monitored to document their reproductive output over the entire breeding season. Corticosterone levels were used to assess a physiological response to differing migratory strategies as a potential mechanism for delaying early attempts at reproduction in wood thrush.

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ARE ALL MATERNAL EFFECTS RELEVANT WHEN ACTING SIMULTANEOUSLY? A TEST WITH COMMON GRACKLES

Mothers can influence the phenotypes of their offspring in diverse ways. Such maternal effects are of interest because mothers can potentially vary the effects facultatively to influence both offspring survival and their own reproductive success. Because multiple maternal effects usually operate simultaneously, the prevailing research paradigm has been to examine individual maternal effects in isolation, often by experimentally controlling other effects. We examined the relative importance to both offspring survival and maternal reproductive success of multiple maternal effects operating simultaneously in common grackles. Most of the maternal effects we assessed appeared to be irrelevant because both offspring and maternal success were largely determined by a single, albeit different, maternal effect. Offspring success decreased with hatching asynchrony, whereas female success increased with clutch size. Our results indicate that the importance of specific maternal effects should be assessed in the context of other maternal effects that operate simultaneously, and also the importance of quantifying both offspring and maternal success, because maternal effects that increase offspring performance do not necessarily increase maternal success.

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TERRITORIAL COMMON LOONS THAT SIGNAL POORER FIGHTING ABILITY SIGNAL GREATER AGGRESSIVE MOTIVATION

In addition to communicating individual identity and aggressive motivational state, male common loons (*Gavia immer*) can communicate condition-dependent fighting abilities through the dominant frequencies of vocalizations called yodels, where heavier birds produce lower-frequency yodels. Considering honest signaling theory and the behavioral mechanisms by which loons compete for breeding territories, we examined possible receiver-dependent factors that may prevent smaller individuals from producing lower-frequency yodels. Measuring both the frequency of, and extent to which territorial contests escalate to aggressive chases and/or fights, we found that birds that produced higher-frequency yodels were as likely as birds that produced lower-frequency yodels to experience territorial intrusions and intrusions that escalated into more aggressive interactions. Additionally, although males producing high-frequency yodels were as likely to yodel and yodeled as frequently as males producing low-frequency yodels to a simulated conspecific intrusion of low/moderate intensity, low-frequency males tended to produce yodels having more 2-syllable repeat phrases. This suggests that territory holders that produce higher-frequency yodels compensate for signaling low condition-dependent fighting ability by signaling a heightened willingness to escalate a contest, if necessary.

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VESPER SPARROWS AND WESTERN MEADOWLARKS SHOW A MIXED RESPONSE TO CATTLE GRAZING IN THE INTERMOUNTAIN REGION OF BRITISH COLUMBIA.

Livestock grazing in the Intermountain region of British Columbia is predicted to negatively impact grassland habitats and their bird communities. We tested whether grazed and ungrazed plots could be discriminated based on their vegetation, whether grazing predicted the plot-level abundance of Vesper Sparrows (*Poecetes gramineus*) and Western Meadowlarks (*Sturnella neglecta*), and whether vegetation characteristics found to be affected by grazing could be used to predict the abundance of the two bird species at a fine scale. Grazed plots were distinguished from ungrazed plots based on their vegetation characteristics, but grazing did not explain the plot-level abundance of the two bird species. At a finer scale, the abundance of both species was predicted by three of the vegetation variables that were found to be affected by grazing, but abundance was negatively associated with one variable and positively associated with two others. This indicates that the influence of grazing on Vesper Sparrows and Western Meadowlarks through vegetation is mixed and results in no net change in the broad-scale abundance of the two species.

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IMPORTANCE OF EMBRYONIC DEVELOPMENT FOR OFFSPRING AND ADULT IMMUNE FUNCTION

Why species differ in developmental rate and offspring quality is a central question in life history theory. Long developmental periods are thought to produce high quality offspring and high adult survival due to an intrinsic physiological trade-off between development rate and enhancement of intrinsic systems such as immune function. Studies of tropical birds appear to support the hypothesis: variation among species in embryonic period is positively related to adult survival probability and adult immune function. Yet, avian embryos are effectively ectothermic and their development rate depends on extrinsic temperatures which greatly fluctuate as incubating parents leave the nest to forage. Low egg temperatures cause extended embryonic periods and decreased hatchling size and thus may compromise offspring quality. Here we report the results of a comparative study of co-occurring passerine species of Arizona. We examined whether longer embryonic period, corrected for temperatures, has an effect on immunocompetence and parasite prevalence of nestling and adult birds.

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ECOLOGICAL SPECIATION BETWEEN KING AND CLAPPER RAILS

Ecological speciation can be defined as reproductive isolation caused by divergent selection due to adaptation to different environmental conditions between two or more populations. King and Clapper rails have parapatric breeding distributions along thousands of kilometers of coastline where salt, brackish, and freshwater marshes occur in close proximity. Clapper Rails only occur along the margin of the coast in saline marshes, while King Rails inhabit brackish and freshwater marshes. We collected a minimum of 10 locally breeding rails each from 8 different marshes in Louisiana with a range of salinities from near seawater to freshwater. We took several water samples from each site and measured salinity. For each bird we sequenced the mtDNA gene ND2, measured body weight, and extracted and measured wet weight of the salt glands. Average salinity of the marshes had a significant relationship with mtDNA haplotype frequency, body weight, and percent salt gland weight. This evidence supports the hypothesis that ecological factors, primarily salinity, play an important role in explaining morphological and genetic variation in this mosaic hybrid zone.

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PATTERNS OF TURNOVER IN BREEDING BIRD COMMUNITIES OF OAK-HICKORY FORESTS OF SOUTHERN INDIANA

For several decades, studies of avian community ecology have emphasized patterns in species richness and species diversity, while understanding of other aspects of community structure, such as beta diversity, have lagged behind. The Hardwood Ecosystem Experiment is a multi-taxon, long-term study of the impacts of active management practices in the mature forests of southern Indiana. As part of this study, we collected 3 years of baseline data on species distribution and abundance at 240 locations across nine 80-ha study regions which are up to 35 km apart. We recorded up to 6733 detections of 53-57 breeding species per year with an average of 13.4 species/location. Samples were dominated by common species of mature deciduous forest. For example, in 2008, five species [Red-eyed Vireo (*Vireo olivaceus*), Acadian Flycatcher (*Empidonax virens*), Ovenbird (*Seiurus aurocapilla*), Eastern Wood-Pewee (*Contopus virens*), and Tufted Titmouse (*Baeolophus bicolor*)] accounted for 39.5% of total detections. Our results include patterns of change in beta diversity (turnover) at two spatial scales: within each of the 80-ha study regions and across all of the regions.

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THE SPLIT SONG REPERTOIRE OF THE DUETTING STRIPE-BREADED WREN: CHARACTERISTICS AND FUNCTION

In some passerines, male song repertoires are split into two categories, with certain songs apparently adapted to attract females while others mostly function in territorial defense. Here we describe the striking split repertoire of the Central American stripe-breasted wren *Thryothorus thoracicus*. This species stands out because the two forms of male song are acoustically very distinct from one another and also because this species produces tightly coordinated male-female duets. The combination of these acoustic characteristics makes this species ideal for addressing questions relating both to the function of song repertoires and also of duets. In 2008 and 2009 we carried out playbacks of duets and solo song from both sexes to test responses of single males and pairs. We will show that structurally simple hoot songs mostly function intersexually, while complex songs are used by males in escalated agonistic interactions with rivals. We will also show how the male contribution to the duet varies sharply depending on the intended receiver of the signal, providing clear evidence that the duet can represent cooperation or conflict depending on present circumstances.

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MULTI-LOCUS PHYLOGEOGRAPHY OF THE BROWN CREEPER (CERTHIA AMERICANA)

Although considered one taxonomic unit, *Certhia americana* is variable throughout its range; it exhibits clinal coloration and size variation with a marked difference between northern and southern populations resulting in up to 13 recognized subspecies. MtDNA data suggest geographical structuring of regional Brown Creeper populations with the largest divergence between northern and Mexican populations. However, individual genes may have different histories due to coalescent stochasticity and may not accurately represent the true species tree. To better explore the history of speciation in the Brown Creeper, we sequenced 22 additional nuclear loci for 54 individuals from seven populations representing the regional mountain ranges across the range of *C. americana*. Initial results, using the genealogical sorting index and the program Structure, show significant population structuring of all populations and a lack of admixture between northern and southern individuals. These results are concordant with morphology and mtDNA data which may suggest at least one speciation event between northern and southern populations of *C. americana*. Further analyses will estimate parameters of population divergence as well as estimate a species tree using a coalescent model.

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HABITAT SELECTION BY THE RUFOUS-AND-WHITE WREN IN A COFFEE AGROFORESTRY LANDSCAPE AND THE CONSEQUENCES FOR REPRODUCTION

High abundances of many bird species are found in shade coffee agroecosystems, yet there are few studies on the productivity of birds living in these areas. I evaluated the consequences of habitat selection by the rufous-and-white wren (*Thryothorus rufalbus*) on reproductive success in a shade coffee agroecosystem in northern Nicaragua. Using compositional analysis, I measured habitat preference at two scales, the territory and the nest (n=151) from 2005-2007. The rufous-and-white wren exhibits strong preference for shade coffee within the territory and as a nesting site, and habitat composition of the territory influenced choice of nest sites. A high percentage of shade coffee in the territory was associated with low nest success. Shade coffee nest sites experienced high nest loss, nearly 90%. The main causes of nest loss were predation and brood parasitism by the striped cuckoo (*Tapera naevia excellens*) a threat almost unique to shade coffee nesting sites. This study suggests that shade coffee may be an ecological trap for the study species. High abundances of birds in shade coffee cannot be taken as a proxy for habitat quality.

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NBII INFORMATION RESOURCES FOR BIRD CONSERVATION

Conservation of migratory birds requires timely access to data and information across multiple geographic scales. Over the last decade, this information has increasingly been delivered via the Internet. The National Biological Information Infrastructure's (NBII) Bird Conservation Node provides access via its website to a variety of data and information resources that support bird conservation. Our Bird Conservation Information Resources web page provides links to online resources used to inform the conservation process, including datasets from bird population monitoring surveys, geospatial layers and maps, standards and methods for data sharing, and tools for data exploration developed and supported by NBII and partners. In addition, other sections of our website provide general information on why we conserve birds, which birds need to be conserved, what is done to conserve birds, who conserves birds, and conservation action plans for selected bird species. We invite you to explore these online information resources and provide us with feedback on the kind of data and information that will help support your bird conservation efforts.

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ORNITHOLOGISTS IN ACADEMIA AND GOVERNMENT:
PROGRESSING IN YOUR CAREER AND STAYING HAPPY!

Fledgling avian scientists spend much time preparing for and obtaining a job in Ornithology. After obtaining that great job, goals need to be adjusted to developing a career that can be maintained along with other life goals. However, the frenzy of juggling research, teaching, outreach and administration can lead to unplanned delays in some professional activities that can have long-term costs to career or personal life. Staying happy in your job requires strategic planning and a determined set of priorities that will vary with time. Dr. Kathy Martin is a Senior Research Scientist for Environment Canada and a Professor of Forest Sciences at the University of British Columbia. She runs two long-term research programs; one on the population ecology and life history variation of alpine and arctic grouse and songbirds, and a second program on applied and basic community ecology of cavity nesters and other forest landbirds. Kathy Martin will discuss her career in ornithology. A love of the outdoors gained from her rural farm upbringing and inspiration from her freshman biology professor led her to choose ornithology as a career. With persistence and luck, she landed her dream job. With the ample benefits of hindsight, Kathy will provide some guidelines for ornithological career contentment!

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EXTRALIMITAL BIRD POPULATIONS AT THE KAXIL KIUIC
BIOCULTURAL PRESERVE, YUCATAN, MEXICO

The Yucatan Peninsula harbors 267 species of resident landbirds. The distributional limits of many of these species coincide with changes in climate and vegetation. A group of 45 species nearly shares the same northern limits on the peninsula, stretching from the northeast to the southwest along the boundary between tropical deciduous dry forest and humid tropical evergreen forest. Part of this limit coincides very closely with the border between the states of Yucatan and Quintana Roo (we call this northern limit or distributional pattern the Y-Q line or Y-Q pattern, respectively). Recent surveys at the Kaxil Kiuc Biocultural Reserve in the state of Yucatan have found 33% of the species conforming to the Y-Q pattern also occur in this 1650 hectare reserve 50 km to the north of the Y-Q line. GIS analysis suggests that the northern limits are not only determined by climatic variables, but that deforestation is the proximal factor shaping these distributional limits. Habitat restoration of dry deciduous forest could allow for the northward movement of many species thought to be restricted to the humid southeast.

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HABITAT PRESERVATION AND LANDUSE CHANGES WITHIN THE
SOUTHERN CALIFORNIA RANGE OF THE CALIFORNIA CONDOR
Preservation of California condor habitat dates back to 1937. Several significant ownership and land status changes within the historic condor range have been made over the last 60 years, including the establishment of Condor Sanctuaries, Wilderness Areas, Wildlife Refuges, and Critical Habitat. However, concurrent land-use changes in the wider region, such as decreased livestock grazing, growing urban development, and increased wilderness fragmentation may have adverse effects on species recovery efforts as condors return to their former range. Recent condor GPS transmitter data illustrates a consistent expansion of their territorial range from 2005-2009 and shows the foraging, roosting, and nesting patterns in their currently used habitat. GIS models of current landscape conditions and predicted future development may help wildlife managers in considering the habitat needs of an expanding condor population.

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REGIONAL AND SPATIAL FACTORS INFLUENCING NEST
SURVIVAL IN MONTANE MEADOWS

Riparian ecosystems are distributed in a patchy and fragmented pattern across the landscape. Willow Flycatchers depend exclusively on riparian systems for breeding habitat. We monitored flycatcher nests from 1997-2008 in three regions in the north-central Sierra Nevada, CA We examined the influence of habitat variables at multiple spatial scales on nest survival of flycatchers. We used logistic-exposure to estimate survival rates and an information-theoretic modeling approach. Regional and meadow-size influences constrained the direction and magnitude of edge effects. In small meadows in the south and central region, edge effects were not apparent yet in the north survival increased with distance from edge. In large meadows, edge effects decreased with distance from the forest edge. The influence of nest concealment at the nest varied with the size of the meadow. Our results support the hypothesis that larger patches may concentrate predators. Conservation efforts often are focused on larger expanses of riparian habitat but our results highlight the importance of smaller meadows in the system.

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NESTING ECOLOGY OF RUSTY BLACKBIRDS IN ALASKA WITH
REFERENCE TO NEST RECORDS FROM CANADA

We examined the nesting ecology of declining Rusty Blackbirds (*Euphagus carolinus*) from 162 nests monitored for survival in Alaska and 252 records from Alaska and Canada to identify important nesting habitats and determine whether low nest success was contributing to declines. Across Canada and coastal Alaska, nests were primarily in conifers (85% of 212 nests) with the use of spruce, particularly black spruce, widespread. In Alaska, use of spruce was selective, nest survival increased with densities of small black spruce, and nest success was higher for nests in spruce (79%) than in deciduous vegetation (52%). Rusty Blackbirds nested near water (mean = 8–30 m) and small spruce near water appeared to be important over much of the range. However, most nests in interior Alaska were in willows (78%) which dominated the vegetation near water. Nest success averaged 56% in Alaska, similar to rates in New England, but higher than other blackbirds (30–39%). Studies are needed to verify whether nest survival is high in Canada and to understand how deficits in adult or juvenile survival are limiting populations.

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ASYNCHRONOUS CONVERGENCE OF PLUMAGE PATTERNS IN
NECTAR-STEALING TANAGERS (GENUS: *DIGLOSSA*)

Flowerpiercers are comprised of 18 recognized species distributed through the Neotropics at high elevations from Mexico through the Andes to Argentina and the tepuis of Venezuela. Historically, relationships among flowerpiercers were arranged into species-groups based on plumage morphology (discrete sexual dimorphism, blue plumage, and black/dark gray back and/or rufous undersides). However, the recent molecular phylogeny does not support these relationships. To understand how plumage patterns have evolved in flowerpiercers, I used parsimony and Bayesian ancestral reconstruction methods. The results of both analyses were largely congruent with convergent evolution of sexual dimorphism in two clades. The reconstruction of the common ancestor of all flowerpiercers plumage coloration was uncertain. Nonetheless, the evolution of rufous feathers were gained and lost independently within three different lineages. When the pattern of rufous plumage evolution is compared geographically between clades distributed through the Andes, a corresponding leapfrog pattern is evident. The leapfrog of morphologically convergent superspecies is nearly overlapping in distribution but not in divergence times (Pleistocene vs. Pliocene). Thus, a leapfrog pattern of plumage diversification has occurred at two temporally disjunct periods in flowerpiercers evolution.

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A NEW BREEDING SITE FOR YELLOW-BILLED CUCKOO IN
COASTAL NORTHERN CALIFORNIA?

In California, breeding by Yellow-billed Cuckoos is primarily limited to the South Fork Kern and upper Sacramento Rivers. Although small populations have occasionally been recorded at other locations in the state, all of these have been away from the immediate coast. In coastal Northern California (Del Norte, Humboldt and Mendocino counties) the species was considered "accidental", with only 4 historical records -- presumably strays-- noted as of 1991. More recently however, the frequency of observations, specifically in Humboldt County has increased. Many observations were from apparently suitable breeding habitats very near the coast along the lower Eel River, during the breeding season. To determine whether or not cuckoos breed at this location, we conducted annual broadcast surveys from the mouth of the Eel River to approximately 15 miles upstream, from 2005 through 2009. During 4 of the 5 annual surveys 1-3 cuckoos were detected and probable breeding was indicated during at least two of those years. Our results indicate the riparian habitats of the lower Eel River likely host low-density breeding by Yellow-billed Cuckoo, at least intermittently.

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RESPONSE OF AVIAN AND ARTHROPOD POPULATIONS TO
WOODLAND RESTORATION IN THE ARKANSAS OZARKS

In the Arkansas Ozarks, the USDA Forest Service is restoring oak woodlands by thinning and burning upland oak-hickory forests. Changes in forest structure from restoration have been linked with changes in breeding bird populations, however few studies focus on the link between restoration and food, for example leaf litter arthropod availability. We investigated the response of breeding bird and leaf litter arthropod populations to oak woodland restoration by comparing populations between units thinned and burned twice (2004 and 2007) and control areas not subjected to restoration treatments. Surveys were conducted May through June in 2009 using distance sampling methods. Bird and arthropod species richness values were similar between control and restored sites; however, species composition shifted. In recently restored areas, ground-foragers had lower densities or were absent, e.g. Ovenbirds (*Seiurus aurocapillus*). Hymenopterans decreased in abundance in restored sites, while Collembolans increased. Arthropod abundance was higher overall in control sites, likely because there was more leaf litter substrate. Results indicate that both habitat structure and food availability should be considered important factors influenced by woodland restoration.

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BREEDING BIRD DENSITIES AND HABITAT PREFERENCES OF
BIRDS ON THE EAST GULF COASTAL PLAIN

Many bird species are declining due to habitat loss and degradation prompting calls for research on avian habitat preferences and preservation of critical bird habitat. Knowledge of avian habitat preferences is critical to developing conservation plans for any given species. Although there is a large body of literature on the general habitat requirements of birds on the coastal plain, many past habitat studies have been modeled under the assumption of perfect detection. We conducted point counts at 338 locations in and around Tuskegee National Forest, AL. Habitat characteristics were derived from the Alabama GAP land cover and National Land Cover Database Percent Tree Canopy maps within a 100m buffer around each point. Data were analyzed using the Royle Biometrics function in program PRESENCE. Models were ranked and compared using Akaike's Information Criterion and multimodel inference. We present models of breeding bird abundances that incorporate the probability of detection for 60 bird species on the East Gulf Coastal Plain.

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DIVERSIFICATION OF *APHELOCOMA* JAYS AMID NORTH
AMERICAN MOUNTAIN UPLIFT: ESTIMATING DIVERGENCE
TIMES IN A MULTILOCUS SPECIES-TREE FRAMEWORK

In North America, mountain uplift and glacial cycles provide temporally disjunct biogeographic factors affecting the origin of living species. We undertook one of the first implementations of a recent method for estimating divergence times of species trees to test whether the timing of speciation in *Aphelocoma* jays coincided temporally with periods of mountain uplift or glacial cycles. We analyzed data from 2 mtDNA and 2 nuclear genes with the program *BEAST, calibrating the tree with prior information from a fossil Florida Scrub-Jay (*A. coerulescens*). We found that speciation began in the Miocene against a backdrop of mountain uplift and aridification. Glacial cycles likely played a role in later divergence events within these groups, although Mexican Jays contain one highly divergent lineage found in the Transvolcanic Belt of Mexico that likely diverged in the Miocene or Pliocene. We found no support for variable rates of speciation through time, suggesting that speciation in *Aphelocoma* is occurring through vicariance of widespread species, with little extinction or density-dependent effects.

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REPUTATION CASCADES, QUEUES AND COOPERATION IN THE
SOCIAL NETWORKS OF MANAKINS

Why do pairs of male manakins sing and dance together for females? Having ruled out indirect inclusive fitness and direct reciprocity, we must explain an upward-directed chain of cooperation (B helps A, C helps B, D helps C etc.). Existing theory does not really encompass such a system, but work on indirect reciprocity (B helps A, who then helps C) includes a kernel that may. Spatial models for indirect reciprocity have highlighted reputation effects as facilitating cooperation. In the Long-Tailed Manakin, reputation for performance determines female mate choice, but younger males can also monitor the efforts of those whom they might help. Thus, a cascade of reputation (acting on females as external enforcers of male cooperation, as well as on potential cooperators) explains why males queue patiently for years to attain alpha status. A constellation of ecological factors -- resource distribution, female spatial memory, long breeding seasons and long life spans -- provides the necessary conditions for this reputation cascade, and variation in these factors helps explain the spectrum of male-male cooperation in the 50 or so species of Neotropical manakins.

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EVOLUTIONARY DYNAMICS OF A SKY ISLAND CONTACT ZONE

Isolated populations of the Eastern Double-collared Sunbird species complex inhabit sky island montane forests across the Eastern Afromontane. The Udzungwa mountain block of south-central Tanzania host two morphologically similar sister species, *Nectarinia moreaui* and *N. fuelleborni*, which exclude one another from suitable habitat over a mosaic of forest patches. There is limited contact between the two species along a narrow parapatric boundary. This unique distribution raises several questions, including 1) how two ecologically similar forms came to inhabit a single sky island; 2) how each species perceives the other during interspecific interactions; and 3) whether there is hybridization. In this set of studies we examine the spatial distribution of morphological and vocal phenotypes in relation to the contact zone. Secondly, we examine aggressive responses to heterospecific songs and plumage near the contact zones. Thirdly, we investigate spatial distribution of mitochondrial haplotypes to explore the possibility of recent expansion of one form into the Udzungwas. Finally, we use microsatellite genotyping and mitochondrial DNA sequencing to test for hybridization and gene flow.

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 CAROTENOIDS AND OXIDATIVE STRESS ALONG AN URBAN/RURAL GRADIENT: A COMMON GARDEN EXPERIMENT IN MALE HOUSE FINCHES (*CARPUS MEXICANUS*)

We are studying carotenoid accumulation in male house finches (*Carpodacus mexicanus*) inhabiting both Sonoran desert in Arizona and areas of accelerating urbanization in the city of Phoenix. Like studies of some European birds (e.g. tits), we find that finches display more colorful (red) plumage in natural habitats (desert) compared to urban areas. Environmental factors may affect carotenoid intake/mobilization/allocation (due to differences in immune, oxidative, or pollution stress) in the finches, and possibly genetic divergence. In our short-term "common garden" lab experiment, we manipulate carotenoid intake and oxidative stress (using paraquat) in a 2x2 factorial design to test whether or not (a) birds from urban and rural areas conform to similar antioxidant/health status when housed under identical conditions for one month, or (b) finches from the two sites retain or express differences in carotenoid and oxidative-stress physiology when presented with a range of antioxidant and OS conditions. Measurements of tissue (e.g. retina, liver, adipose) carotenoid accumulation at the end of the study will yield insight into the allocation patterns and utilities of carotenoids as a function of ecological and physiological challenges.

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PHYLOGEOGRAPHY OF THE LIGHT-VENTED BULBUL COMPLEX (*PHYCNONOTUS SINENSIS/TAIWANUS*)

The Light-vented Bulbul (*P. sinensis*) is a common lowland bird species of East Asia. It is divided into three clearly differentiated subspecies: *P. s. sinensis* is widely distributed in Mainland China, *P. s. hainanus* is found mainly on Hainan Island, and *P. s. formosae* occupies western Taiwan. Its sister species, the Taiwan Bulbul (*P. taiwanus*), is endemic to eastern Taiwan. MtDNA sequences recover *taiwanus* and *formosae* as monophyletic groups but fail to distinguish between *sinensis* and *hainanus*, probably owing to incomplete lineage sorting. Multi-locus nuclear sequences confirm the mtDNA topology and suggest divergence between the two species occurred around Taiwan's formation approximately 5 Ma. Divergence between mainland and Taiwan subspecies occurred approximately 2.5 Ma and was accompanied by historical gene flow, possibly facilitated by periodic landbridges connecting Taiwan to mainland Asia. Mainland and Hainan subspecies likely diverged following the Last Glacial Maximum. We point out the implications for biogeography in the region as well as the importance of using morphology to identify lineages whose mtDNA has not sorted.

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EVALUATION OF BROWN-HEADED COWBIRD TRAP DESIGN

We evaluated two variations (flat-topped vs. funnel-shaped top) of the Australian crow trap to determine the efficacy of each in capturing a brood parasite, the Brown-headed Cowbird (*Molothrus ater*). Entrance slots of two different widths were also evaluated to determine if variation in size had any effect on capture rates of cowbirds or non-target species. We found cowbird capture rates of funnel-topped traps to be higher than flat-topped for each gender ($P < 0.001$) and for juveniles ($P = 0.048$). Funnel-topped traps also had a lower escape rate ($P = 0.029$) and captured more non-targets than did flat-topped traps ($P < 0.001$). Wider slots had a tendency to capture more cowbirds than narrower slots ($P = 0.07$), and this difference was significant for females ($P = 0.039$); there were no differences in escape rates or non-target capture rates. Results suggest that to maximize capture rates and decrease escape rates of cowbirds, traps should have funnel-shaped rather than flat tops. However, funnel-topped traps also captured significantly more non-target species than did the flat-topped traps, so traps should be checked often.

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YELLOW-BILLED CUCKOO TELEMETRY AT RIPARIAN RESTORATION SITES ON THE LOWER COLORADO RIVER, 2009.

Six yellow-billed cuckoos (*Coccyzus americanus*) captured and fitted with radio transmitters at five restoration sites on the lower Colorado River were followed from July 7 to August 24 2009, for a total of 60 observation days. One cuckoo was a recapture, banded as a nestling the previous year at a restoration site 35 km to the south. Four nests of radio-tracked birds were located within the restoration sites; two in Goodding's willows, one in a Fremont cottonwood and one in a salt cedar. Size of the restoration sites ranged from 40 to 67 hectares. Estimated home ranges were 5 to 32 hectares (mean=21.6) based on 95% kernel density estimates, and 4 to 50 hectares (mean=27.6) using minimum convex polygons. The smallest home range belonged to a nesting female followed for 6 days; the largest was for an unmated female followed for 13 days. Two birds dropped their transmitters at their capture site. Three left their capture site between July 29 and August 3 and were not found again. The sixth bird remained on site until August 24.

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 AN UNEXPECTED RELATIONSHIP BETWEEN AGGRESSION AND ORNAMENTATION IN ANNA'S HUMMINGBIRDS (*CALYPTA ANNA*)

Compared to other types of coloration, iridescent colors are surprisingly understudied as sexual or social signals. We examined whether the size and color of iridescent ornaments mediate competitions during the breeding season in male Anna's hummingbirds (*Calypte anna*) by conducting 3 studies in which pairs of unfamiliar birds competed in an experimental arena. We predicted that more ornamented birds (with high color or ornament size score) would win contests. However, we found that less ornamented males won significantly more contests; also, the degree of ornamentation in males who lost contests was positively correlated with chasing time by the winner. Experimentally reduced ornamentation of one opponent did not cause that opponent to win contests, but the duration of chasing by the winner was positively related to the experimental, and not natural, length of the loser's crown. Iridescent ornamentation is thus socially costly, and we suspect that increased aggression towards more colorful males could function as a best-of-a-bad-job strategy to drive ornamented males preferred by females away from neighboring territories.

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ANNUAL ABUNDANCE AND PRODUCTIVITY INDICES OF FIVE TEMPERATE MIGRANTS AT ROCKY POINT BIRD OBSERVATORY: A PACIFIC COASTAL MIGRATION MONITORING STATION

Rocky Point Bird Observatory, located on the southern tip of Vancouver Island, B.C. is the only Pacific coastal member of the Canadian Migration Monitoring Network and provides important information on coastal and western landbird populations. We selected five temperate migrant species: Fox Sparrow (*Passerella iliaca*), Golden-crowned Sparrow (*Zonotrichia atricapilla*), Lincoln's Sparrow (*Melospiza lincolni*), Savannah Sparrow (*Passerculus sandwichensis*), and Dark-eyed Junco (*Junco hyemalis*). Using simple linear models, we calculated trends and productivity estimates for each species from constant-effort mist-net data (2000-2009). All species except Savannah Sparrow (-11.5%, $P=0.048$) showed non-significant trends in abundance and productivity ($p>.05$). Breeding Bird Survey (BBS) coverage in the Northern Pacific Rainforest region is poor for these species, and results varied or were not available. Average annual productivity of Savannah Sparrow was 0.66, SE 0.04, and annual productivity declined throughout the study period. These data suggest that for four species, populations currently sampled by our fall efforts are not experiencing significant declines in overall abundance

or productivity. They also provide valuable information on Golden-crowned Sparrow, a species absent from BBS and Monitoring Avian Productivity and Survivorship analyses.

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PTILOCHRONOLOGY OF EASTERN BLUEBIRDS

Feather growth rates, measured as the width of feather growth bars, have been used in several studies as a measurement of individual condition at the time of molt. If plumage coloration is an honest signal of condition, then coloration should be correlated with the width of feather growth bars. We compared feather growth rates to plumage coloration in Eastern Bluebirds (*Sialia sialis*) near Auburn, Alabama by measuring growth bars on bluebird tail feathers (N = 141) removed during the early breeding season. We found that first-time breeders had narrower growth bars than older breeders. Males with brighter blue-ultraviolet coloration had broader growth bars, however brighter females had narrower growth bars.

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COMPOSITION AND DYNAMICS OF A MEGA-DIVERSE MIXED-SPECIES FLOCK IN A TROPICAL MONTANE FOREST

Mixed-species bird flocks are a common phenomenon throughout the world, reaching their highest diversity and size in the tropics, where flocks often defend permanent territories from neighboring flocks. I present notes on the composition of one particularly large and diverse mixed-species flock from a middle elevation site on the eastern slope of the Andes in Manu National Park, Peru. Through a combination of mist netting, color banding, resighting, behavioral observations, and point counts I thoroughly documented the composition of the flock. The primary nuclear species were 6 species of tanagers and bush-tanagers (*Tangara*, *Chlorochrysa*, *Chlorospingus*; at least 72 individuals). In addition, I classified another 52 species (311 individuals) as regular flock associates, 49 species (267 individuals) as occasional flock associates, and 5 species (9 individuals) as accidental flock associates. There was little distinction between canopy and understory components of the flock, and the entire flock operated under a dynamic fission-fusion process, with subflocks splitting and rejoining the main flock often. I deemed 17 species full or partial elevational migrants, including the two most abundant species, *Diglossa glauca* and *Mionectes striaticollis*.

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MITOCHONDRIAL DNA VARIATION IN THE BROWN-HEADED NUTHATCH (*Sitta pusilla*): EVIDENCE FOR A DISTINCT EVOLUTIONARY LINEAGE (*S. p. insularis*) ON GRAND BAHAMA ISLAND

The Brown-headed Nuthatch (*Sitta pusilla*) provides an outstanding example of the challenges of conserving cryptic sources of biodiversity. We examined two genetic markers (958-bp) from mitochondrial DNA in seven United States mainland populations (*S. p. pusilla*) and Grand Bahama Island (Bahamas Nuthatch; *S. p. insularis*). Phylogenetic and population genetic analyses show that the Bahamas Nuthatch comprises a genetically distinct evolutionary lineage. While geological and climatic evidence suggest that Grand Bahama Island has been colonized recently, mainland and island haplotypes diverged from a common ancestor several hundred thousand years ago with much of the genetic diversity separating these two populations lost. We suggest the best explanation for the pattern of genetic variation observed within and between the Bahamian and mainland populations is an indirect colonization route of the island, rather than a single, recent colonization event directly from the mainland. Due to the unique mitochondrial genetic makeup of *S. p. insularis*, its long-term isolation from the mainland, and its extremely small population size, we recommend that the Bahamas Nuthatch be considered an evolutionary significant unit and be given immediate conservation priority.

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PERSONALITY TRAITS CORRELATE WITH HEAD-COLOR AND AGE IN GOULDIAN FINCHES (*CHLOEBIA GOULDIAE*)

There is increasing evidence that animals show correlated behavioral traits across contexts (personality traits). However, little is known about the factors determining individual reactions. Gouldian finches occur in three morphs in the wild – red-, yellow- and black-headed. We tested personality traits in the two more widespread morphs, the red-headed and black-headed one in the lab. Birds were tested in pairs consisting of a red- and a black-headed bird matched for size. Birds ranged in age from one to five years. We assessed ease of capture, avoidance (neophobia) of a novel object beside the feeder and approach (neophilia) to a novel object on a perch in each pair. The black-headed and/or the older bird in a pair got captured first and also was the first approaching a novel object (neophilia). The older bird in a pair fed first near a novel object (neophobia). The results regarding age are surprising as usually younger birds are more neophilic and less neophobic than older ones. The influence of head-color may be related to the lower conspicuousness of black-headed birds as compared to red-headed ones.

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WINTER HABITAT USE OF THE RUSTY BLACKBIRD

Rusty blackbird (*Euphagus carolinus*) is a forested wetland specialist and as such an indicator species for this habitat type. It winters in bottomland hardwood forests in the Southeastern United States. This habitat has experienced considerable change and loss over the last 40 years. However, little information is available how rusty blackbird has responded to these changes. We have investigated the winter ecology of the species in its core wintering range in the Lower Mississippi Alluvial Valley. Birds were captured in three different habitats – bottomland hardwood forest, cultivated pecan orchards, and along watercourses with trees. Adult males predominated in pecan orchards, young males were preferentially found along watercourses and females in forests. Males were in better body condition than females indicating that the two anthropogenic habitats are of higher quality than the forest. Telemetry data in combination with habitat assessment revealed a close association of rusty blackbird with water (puddles, creeks) and medium dense understory. Preferred habitats included willow, water and Nuttall oak and pecan among others. Fruits of these trees form an important part of the winter diet beside invertebrates.

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EFFECTS OF WIND TURBINES ON BREEDING GRASSLAND BIRDS IN NORTH-CENTRAL TEXAS

Grassland birds, the most threatened group of North American birds, are rapidly declining with loss of suitable habitat as the leading cause. Although wind energy is rapidly expanding in the U.S., the effects of wind turbines on grassland species are unclear. During the 2009 breeding season, we estimated grassland bird density and diversity at three study sites: grazed grassland with turbines, grazed grassland without turbines, and managed grassland (no turbines) interspersed between forest fragments. The five most commonly observed species were Dickcissels (*Spiza americana*), Eastern Meadowlarks (*Sturnella magna*), Grasshopper Sparrows (*Ammodramus saviannarum*), Scissor-tailed Flycatchers (*Tyrannus forficatus*), and Lark Sparrows (*Chondestes grammacus*). Grassland bird diversity was highest at the managed site, which also had the greatest habitat complexity. Dickcissel and Eastern Meadowlark densities increased with distance from turbines; other species showed no discernable pattern. Dickcissel density was highest in grazed grasslands without turbines, while Eastern Meadowlark density was highest at the site with turbines. It appears some grassland birds avoid areas immediately surrounding wind turbines, but overall density at the three sites may be best explained by differences in habitat structure.

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 COMMUNITY-LEVEL CONSEQUENCES OF UNDERSTORY
 INSECTIVOROUS BIRD DECLINE IN NEOTROPICAL
 RAINFOREST

Avian tropical understory insectivores are experiencing severe declines in response to forest fragmentation, potentially releasing herbivorous insects, thereby triggering trophic cascades in absence of compensatory predation by other taxa. Recent studies demonstrate that insectivores provide vital ecosystem services by effectively controlling arthropods in natural and managed habitats, yet most have failed to distinguish bird from bat contributions, instead attributing all insectivory to birds. We investigated the relative roles of birds and bats in limiting arthropods and herbivory in two Central American rainforest reserves, La Selva Biological Station (bird declines) and Refugio Bartola (control—no declines). As predicted by consumer relative abundances, herbivorous arthropod density and leaf damage were significantly higher within bat exclosures at La Selva, and significantly within bat+bird exclosures than either bat or bird exclosures alone at Bartola. Arthropod density was 64% higher at La Selva, contrary to theory predicting correlations between bird and prey abundance. This research demonstrates the potential for trophic cascades even in low-productivity rainforest interior, and illustrates the importance of both bats and birds in controlling herbivorous arthropods.

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LANDSCAPE GENETICS AND CONSERVATION IN THE
 FLAMMULATED OWL

Population densities, habitat patch sizes, and patch arrangements have been studied ever since the dawn of the theory of island biogeography. Here, we investigated the contribution of size, isolation, and proximity of habitat patches to population responses in Flammulated Owls (*Otus flammeolus*) on two temporal scales. We used logistic regression to compare landscape data from ecological niche models to territory densities and genetic variation (obtained from mtDNA) among populations. After adjusting territory densities to seasonal declines of male call responses, we did not confirm positive or negative relationships between density estimates and either patch size or patch proximity. However, two genetic variables, nucleotide diversity and proportion of private haplotypes, were positively correlated with patch proximity and territory density. Considering the temporal scale covered in this study, our results highlight the importance of historic population and landscape traits on the current distribution and conservation of extant taxa.

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NESTING SUCCESS AND NEST-SITE SELECTION OF FLORIDA
 SCRUB-JAYS IN A SUBURBAN MATRIX

I studied nesting success and nest-site selection in the second largest population of threatened Florida Scrub-Jays (*Aphelocoma coerulescens*) in southwest Florida, which occurs primarily on privately owned suburban lands. Annual nesting success during 2004-2006 (N=336 nests) ranged from 26% (following passage of a major hurricane) to 45%. The most commonly used nest substrate was oak (*Quercus* spp.) shrub (31%), particularly sand live oak (*Q. geminata*), but scrub-jays also used >14 different species of non-native trees and ornamental shrubs. Habitat analyses at nest-site, nest-patch, and landscape scales indicated that lateral cover at the nest was the habitat variable with the strongest influence on nesting success. Nesting success and productivity were comparable to values recorded in other stable scrub-jay populations, although recruitment of young into the population was low. Results are interpreted in the context of mitigating the impacts of suburban growth and assessing the viability of suburban populations.

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IMPACTS OF REGIONAL COLD FRONT AND LOCALIZED
 WEATHER PHENOMENON ON AUTUMN MIGRATION OF
 RAPTORS AND LANDBIRDS IN SOUTHWEST IDAHO

The effect of weather on avian migration across diverse geographic regions remains to be determined. We evaluated the impact of regional cold fronts and localized weather phenomenon on the autumn migratory timing of multiple landbird and raptor species. The analysis focused on total landbirds plus the top ten individual species by volume along with total raptors plus the top five individual species. Using 11 years of data from the Idaho Bird Observatory (1997-2007), we determined significant migratory timing patterns which differ from the established literature with regards to the effect of regional cold fronts on autumn migration. Our data show a depression of migratory volumes of most species on the days immediately before, during, and after the passage of a cold front, with peak flights for most species occurring several days later. Multiple hypotheses may explain the unique impact of weather phenomenon on avian migration in the western United States; most notably that most avian species choose to migrate during calm winds and high pressure when the opportunity presents itself.

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TERRITORY STRUCTURE AND MOVEMENT PATTERNS OF
 AMAZONIAN UNDERSTORY MIXED SPECIES FLOCKS IN FOREST
 FRAGMENTS

Understory mixed-species flocks are an important feature of the avian community in lowland Amazonian forests. Despite their ubiquity, obligate flocking species are known to be sensitive to habitat disturbance. Flocks disintegrate in small forest fragments, but return after development of surrounding vegetation. I studied spatial ecology of obligate flocking species by assessing the distribution of flock home ranges and areas of preferential use in two 10-ha fragments and two 100-ha fragments. I followed 14 flocks during 167 hours, georeferencing their position at 30 second intervals with 15-meter accuracy. Flocks in forest fragments sometimes left the fragment to visit adjacent second growth. More commonly, however, borders served as flock territory boundaries, despite well-developed second growth adjacent to fragments. Within home ranges, some areas were visited more frequently than others, but movement rates were comparable to less frequently used areas. These preliminary results suggest that flocks remain sensitive to second growth interface and that spatial use within fragments is non-random.

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THE EFFECTS OF SUPPLEMENTARY FEEDING ON
 REPRODUCTIVE ACTIVITY IN THE PROTHONOTARY WARBLER

Global climate change has resulted in the advancement of spring arrival and breeding events for many migratory birds. A 22-year long-term study of prothonotary warblers (*Protonotaria citrea*) reveals that while arrival has advanced approximately three weeks, egg-laying dates have not changed. One explanation for this newly emerged delay between arrival and egg-laying is a lack of advancement of prey emergence that may limit resources needed for reproduction. Food supplements (wax worms, *Galleria mellonella*) were, therefore, provided to adult pairs after arrival but before nesting over two breeding seasons, simulating prey advancement. Female egg laying dates and male breeding physiology and behavior were then compared between fed and unfed control pairs. Food supplements had no effect on egg-laying dates or male testosterone levels and aggressive behaviors. These data suggest that a cue other than food availability fine-tunes breeding events in prothonotary warblers. The effects that an extended interval between arrival and breeding may have on aspects of biology such as survival and territory acquisition are unknown.

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DIFFERENT SHADES OF GREEN: HOW BIRDS HAVE CHANGED THE WIND-ENERGY INDUSTRY

I review how the concern over deaths of birds within wind-energy facilities has changed the way the industry operates, including a substantial increase in pre- and post-development studies of bird ecology, relocation of individual turbines and entire developments, and redesign of towers. For example, towers have been removed from high-risk locations, and moved away from steep slopes, to help avoid raptor fatalities. I review studies that have been funded to determine the ability of birds to see or hear turbines, with the goal of designing means of deterring birds from colliding with turbine blades. Industry and government agencies have funded studies including patterns of movement, foraging and perching behavior, and related aspects of bird ecology. Subtle differences in site topography, and prey distribution and abundance, have been related to the rate of bird fatality. I also discuss how certain activities that are designed to lower bird fatalities, such as broad-scale killing of prey, have caused much debate and concern within industry, government agencies, and the conservation community.

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HIGHER LEVEL PHYLOGENY OF THE CORE BABBLERS (TIMALIIDAE).

It has long been suspected that the babblers (Timaliidae) are not a natural group, but rather an amalgam of well-defined clades and aberrant taxa with uncertain affinities. Recent molecular work has confirmed these suspicions, identifying well-supported core clades of babblers, but also species and genera that do not belong in the babblers (e.g., *Pteruthius*, *Erpornis zantholeuca*) and entire families embedded within babbler genera (e.g., *Zosteropidae*). Here we present results from an ongoing effort to reconstruct relationships within some of the core babbler clades. We present phylogenetic hypotheses based on five molecular markers from over 100 species. These results further support the main subfamilies of babblers (*Leiothrichinae*, *Pellorneinae*, *Timaliinae*, and *Zosteropinae*), but also identify extensive paraphyly of genera based on current taxonomy and several misplaced species and genera. The phylogenetic framework highlights the need for increased taxonomic sampling across the entire family and identifies some evolutionary and biogeographic trends.

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FEMALE AMERICAN GOLDFINCHES USE CAROTENOID-BASED BILL COLORATION TO SIGNAL STATUS

Interest in female ornamentation has burgeoned recently, yet few studies have tested whether females signal status with coloration. We conducted a series of aviary experiments to examine the signaling role of bill color in female American goldfinches (*Spinus tristis*). We tested for status signaling by examining whether caged females and males avoided feeding adjacent to female taxidermic models as a function of the model's bill color, which was experimentally augmented or dulled. We tested for a mate signaling function by giving captive males a choice between 2 live females with experimentally altered bill colors. Females avoided feeding near model females with colorful bills, but males showed neither avoidance of nor preference for females with more colorful bills. These results indicate that the female's carotenoid-based bill coloration signals status during competitive interactions and suggest that female bill color does not function as a mate-choice signal. This represents some of the first experimental evidence that female carotenoid-based coloration functions to mediate contest competition.

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THE EVOLUTION OF SEASONAL VARIATION IN CLUTCH SIZE.
The size of the clutches of many bird species declines during the breeding season. A variety of hypotheses has been proposed to explain this decline,

many having to do with a deteriorating environment or condition of the female. We propose that a smaller clutch size later in the breeding season increases the probability of success in rearing fledglings during the current year. There is no benefit to a female of having a larger clutch size, if the clutch has a lower probability of surviving. A smaller clutch shortens the time between the laying of the first egg and first fledging, which reduces the time of exposure of the nest's contents to predators and inclement weather, and, thus, increases the probability of success. We illustrate these relationships with data on the Yellow Warbler in Minnesota. Although the first clutch is the largest and produces the greatest number of fledglings from successful clutches, the probability of success increases from first to last clutch. As a result, later clutches produce more fledglings on average than early clutches.

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MORPHOLOGY AND GENETICS SUPPORT RECENT SPECIATION WITHIN THE WIDESPREAD AND POLYTYPIC NEOTROPICAL ORIOLE *ICTERUS CAYANENSIS*

We examined population-level relationships in the Epaulet Oriole (*Icterus cayanensis*) using mitochondrial and nuclear sequence data as well as morphology (plumage scores and bill shape). This oriole is distributed in a broad array of lowland habitats across South America east of the Andes, with populations exhibiting significant morphological variation across its range. We collected genetic information from two loci, the mitochondrial gene cytochrome *b* and the 10th intron of the nuclear gene ACO1. Additionally, we scored four variable plumage characters and measured bill curvature using a combination of digital photography and polynomial curve-fitting. Despite the sharing of haplotypes among populations, coalescent analyses indicate that the distinctive yellow-crowned subspecies, *I. c. chrysocephalus*, has ceased interbreeding and deserves full species status. Within the remainder of *I. cayanensis*, morphology correlates strongly with both geography and genetics, suggesting a model of isolation by distance. However, more intensive sampling is required to elucidate relationships, and the current extent of gene flow, among these other forms.

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SURVIVAL OF PRINCE OF WALES SPRUCE GROUSE IN SOUTHEAST ALASKA

Prince of Wales spruce grouse (*Falcapennis canadensis isleibi*) are of conservation concern in Southeast Alaska for several reasons: limited information is available for spruce grouse that inhabit temperate rainforest, large-scale landscape alteration due to timber harvest has occurred, and a recent subspecies classification. During 2007-2008, we radio-marked 40 birds to investigate survival and examine how season, sex, breeding status, and level of harvest (unharvested, harvested, and edge) affect survival probability. The greatest source of variation in survival probability was attributed to breeding status. The annual survival of non-breeding birds was ($S \pm SE$) 0.72 ± 0.082 while for breeding birds it was 0.08 ± 0.099 . Winter-spring had the highest survival for non-breeding birds, 0.93 ± 0.089 , compared to equivalent rates during summer and fall, 0.88 ± 0.058 . Consequences of breeding lasted throughout the year, with non-breeding birds being twice as likely to survive each season as breeding birds. Harvest was not as important in predicting survival as breeding status. Our results show that the time when birds are breeding is the most critical period of survival and this investment in reproduction can have long-term implications.

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LINKING DIET WITH PHYSIOLOGICAL CONDITION IN RUSTY BLACKBIRDS (*EUPHAGUS CAROLINUS*)

The Rusty Blackbird is the fastest declining songbird in North America and has experienced an 85-95% overall decline continent-wide with accelerated

rates of population decline since the 1970s. The reason for the decline remains unclear but loss and modification of winter wetland habitats and associated carry-over effects to the breeding ground is one plausible theory since winter systems have been disappearing most quickly. Rusty Blackbird habitats are composed of sources of tree mast and invertebrates for foraging. We propose that tree mast helps birds endure extreme winter temperatures and birds with more evidence of winter tree mast-eating are in better condition during winter and consequently on the breeding ground. We used newly developed techniques for determining physiological condition and diet composition to evaluate the role tree mast plays in the physiological condition of Rusty Blackbirds. The blood plasma metabolites triglycerides and B-OH-butyrate were used as indicators of physiological condition and diet composition was determined using novel methods of nitrogen, carbon, and sulfur stable isotope analysis.

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NON-IDEAL FREE DISTRIBUTION IN BLACK BRANT GEESE

Ideal free distribution theory predicts that individuals distribute themselves across the landscape resulting in equal mean fitness. Individual female brant typically use the same brood rearing areas across years despite fitness of offspring varied consistently among these areas. Consequently, some females consistently reared their broods on areas that produced offspring with low fitness. We evaluate all components of adult fitness to assess the hypothesis that individuals distribute themselves among distinct brood rearing areas in such a way that trade-offs among different life history traits results in equal fitness among areas. We use the sum of brood-rearing-area-specific per capita recruitment and apparent adult survival to calculate year by brood rearing area specific estimates of lambda. We use the approach of Coulson et al. (2006) using the "de-lifing" approach to provide estimates of individual (brood rearing area by year combinations) contributions to Lambda, a surrogate of fitness. Because we found variation in λ among brood-rearing areas and years, adult female black brant do not distribute themselves in an ideal free manner, resulting in heterogeneity in fitness among females using these areas.

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MATE LOSS IN BLACK BRANT: EFFECTS ON BREEDING PROPENSITY, SURVIVAL, CLUTCH SIZE, AND NEST INITIATION DATE

We examined 19 years of recapture/resighting and nesting data from 2338 marked pairs of black brant nesting in southwest Alaska to assess fitness effects on females of loss of the male member of the pair. Survival rates decreased from 0.847 ± 0.004 for birds who did not lose their mates to 0.690 ± 0.072 for birds who lost mates. Reporting rate for females that lost their mates were 2 times higher than those which did not lose mates, 0.12 ± 0.086 and 0.06 ± 0.006 respectively. We found little support for effects of mate loss on fidelity. Females that formed new pair bonds and bred following loss of a mate enhanced their clutch size by approximately 0.83 eggs. Relative nest initiation dates were approximately 0.45 days earlier for individuals that lost their mates and repaired. Our results indicate substantial fitness costs to females associated with mate loss, but that females who survived and formed new pair bonds may have been higher quality than the average female in the population.

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VARIATION IN PARENTAL CARE AND NESTLING BEGGING CALLS IN SUBURBAN AND WILDLAND FLORIDA SCRUB-JAYS.

Human modifications of habitats can drastically affect reproductive success by creating "evolutionary traps" that mimic natural cues and cause maladaptive behaviors. Differences in food and predator abundance in urban areas relative

to wildlands could cause miscues that could potentially lead to alterations in levels of parental care and a decrease in reproductive success. If suburban Florida Scrub-Jays perceive greater risk of predation and less food appropriate for raising nestlings, we predict that will reduce parental care by reducing brooding and provisioning. This, in turn, should increase nestling begging calls potentially increasing the vulnerability of suburban nests to predators. Preliminary results suggest patterns opposite of our predictions; suburban jays spent more time brooding and have higher provisioning rates, although they did not differ in the amount of food provided, and begging rate was positively related to the amount of food delivered. Because anthropogenic foods are more predictable than natural foods, females may be able to increase brooding by reducing foraging time and males might increase provisioning rates because they provide more low-quality anthropogenic foods, which, in turn, might increase nestling begging.

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DISTRIBUTIONAL CHANGES IN THE CENTER OF ABUNDANCE OF NORTH AMERICAN BIRDS IN RELATION TO CLIMATE CHANGE.

Climate change is predicted to influence the distribution and abundance of birds. We present evidence based on Christmas Bird Count data suggesting that the latitudinal centers of abundance of over 55% of the relatively widespread and common bird species spending early winter in North America have significantly shifted north over a recent 40 year period. This coincides with significant shifts inland from the nearest coast. These patterns of change correlate with changes in temperature during the same time period. Because all species are not expected to respond in the same manner, we evaluated the predicted responses of distributional change in various guilds of birds. Species vary regionally and by habitat in response to climate change, as did groups of species with increasing or decreasing population trends. Finally, we use information from a vulnerability assessment of impacts of climate change on birds to determine whether the observed recent distributional changes in wintering birds are associated with predicted vulnerability.

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DOCUMENTATION OF CAPTURE MYOPATHY IN PILEATED WOODPECKERS IN ARKANSAS AND ITS RESEARCH IMPLICATIONS?

In 2006, we began a 4-year project studying the ecology of Pileated Woodpeckers (*Dryocopus pileatus*; PIWO) in bottomland hardwood habitats after the reported re-discovery of the Ivory-billed Woodpecker (*Campephilus principalis*). Our primary objective was to use the PIWO as a surrogate species to understand large woodpecker ecology in bottomland habitats. Overall, we captured and radio-marked 46 PIWOs, of which at least 13 died (28.3%). We adaptively adjusted our radio-attachment techniques and reduced handling times in an effort to minimize stress to woodpeckers. Of the 13 mortalities, three intact carcasses were recovered for diagnostic evaluation. Gross and histologic postmortem findings in these three individuals were consistent with capture myopathy as either the primary cause of death or a likely contributing factor. In 2009, after a reduction of handling time (from ca. 1 hour to 30 min), all 13 captured and radio-marked birds survived (100%) the entire field season. These data support that large woodpeckers, specifically PIWOs, are susceptible to capture myopathy. Any work pertaining to this species or other large woodpeckers should strive to minimize capture and handling stress.

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NATAL PHILOPATRY AND APPARENT SURVIVAL OF JUVENILE SEMIPALMATED PLOVERS

Natal philopatry is rare in long-distance migrant shorebirds and requires long-term population studies to detect. We report on the rate of natal philopatry from a 18-year study of Semipalmated Plovers (*Charadrius semipalmatus*) marked as hatchlings to an arctic breeding site near Churchill, Manitoba. About 2% (27/1271) of banded hatchlings returned to the Churchill area to breed. There was no sex bias in rates of philopatry: 17 male and 10 female hatchlings recruited into the local breeding population. The annual rate of recruitment of hatchlings varied between 0 and 10.7%. Age of first encounter on the breeding grounds ranged from 1 to 8 years (median age 4) suggesting either unusually delayed age at first breeding, or low detection rates for philopatric hatchlings. The maximum age of a recruited (known-aged) hatchling was 9 years. Natal dispersal distances did not differ between males and females and averaged 5 km between hatching and breeding locations. We used a time-since-marking mark-recapture model to calculate apparent survival of hatchlings. Apparent survival in the interval after first capture was $\phi_1 = 0.0475$ (95% CI: 0.030-0.075), whereas apparent survival (ϕ_2) of birds during subsequent intervals was 0.866 (95% CI: 0.764-0.927). Low rates of natal philopatry suggest little advantage to site familiarity for juveniles, and agree with theoretical predictions for migratory species with widespread habitat availability.

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DEMOGRAPHIC AND SEASONAL PATTERNS OF WEST NILE VIRUS SEROPOSITIVITY IN HOUSE FINCHES

Following the appearance of West Nile virus (WNV) encephalitis in New York state in 1999, intensive research has focused on the impacts of the disease on humans. Studies of WNV relative to wildlife species have been dominated by reports of its host range, and on population-level impacts. We studied a local population of House Finches (*Carpodacus mexicanus*), using basket traps to capture finches at steadily-maintained feeding stations scattered across the study site in Charleston, SC, USA. Our data include samples (n=245) from both sexes and three age classes. We ELISA-based assays to determine prior exposure to WNV. We found a significant relationship between age and likelihood of exposure, but not between sex and likelihood of exposure. We also found a distinct seasonal pattern to our ability to detect antibodies produced in response to WNV exposure, with samples in the late summer being significantly more likely to show anti-WNV antibodies. We conclude that WNV strikes immunologically naïve finches stressed by the demanding period of molt that immediately follows their independence from their parents.

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QUANTIFYING DETECTABILITY OF MIGRATING RAPTORS: A PRACTICAL DOUBLE-OBSERVER METHOD

Annual counts of migrating raptors are used as indices of population size. To ascertain accurate trends from index counts over time, the proportion of the population being counted must remain constant. As such, sources of variation in the proportion counted should be identified and either corrected or eliminated. Detectability, the probability of a visible bird being recorded, is one source of error. We used a double-observer method to quantify the detectability of raptors at the annual fall raptor migration count at Lucky Peak, Idaho. Our methods were easy to implement and effective and could be readily applied at many other hawk counts. We examined the effects of observer, species, distance, and weather on detectability. Our results imply detectability is a potentially important source of error. Adjustment of raptor migration counts to account for detectability could result in more accurate trend assessments, thereby better informing timely management decisions.

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NICHE EXPANSION AND OVERLAP OF CAVITY-NESTING BIRDS IN RESPONSE TO FOREST INSECT OUTBREAKS IN INTERIOR FORESTS OF BRITISH COLUMBIA, CANADA

Forest insect outbreaks represent a major resource pulse for cavity-nesting communities. In nestwebs, niches are partitioned by excavation ability and types of cavities used, but events of high resource availability may promote greater overlap. In our 15-year study, we examined niche space for red-breasted nuthatch, a facultative cavity excavator and bark insectivore, and mountain chickadee, a secondary cavity nester and foliage insectivore, before, during, and after large-scale outbreaks of mountain pine bark beetle and western spruce budworm. Increases in populations of nuthatches and chickadees corresponded to increases in availability of bark beetles and budworm, respectively. Before the insect outbreaks, nuthatches nested in areas of high aspen densities and ~50% of nests were newly excavated (50% reuse); Mountain chickadees used cavities excavated predominantly by red-naped sapsuckers. During the outbreaks, nuthatches reused more cavities, and moved to areas of high beetle-infected pine densities. Chickadees tracked increases in nuthatches, and used more cavities excavated by nuthatches. The plasticity in resource use exhibited by these species suggests that niche expansion and overlap may promote coexistence during large-scale disturbance events.

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RESOLVING MIGRATION CONNECTIVITY - RESPONSE HOTSPOTS AND WING CHORD MODELS

Determining where in the Neotropics local populations overwinter (migratory connectivity) can help identify anthropogenic stressors on Neotropical migrants and predict the effects of climate change on their population dynamics. We collated data from a) Monitoring Avian Productivity and Survivorship (MAPS) banding stations that operate across North America during the breeding season, and b) Monitoreo de Sobrevivencia Invernal (MoSI) banding stations that operate during the winter throughout Mexico and Central America. We modeled annual variation in the body condition and survivorship of Neotropical migrants as functions of spatially-explicit annual variation in seasonal environmental conditions. These models revealed "response hotspots" suggesting the approximate wintering location of local breeding populations. We compared these locations with predictions from wing chord models that compared the spatial structure of sex- and age-specific wing chord measurements across both breeding and winter ranges. These investigations suggest that fall, winter, and pre-spring migration conditions influence breeding success during the following breeding season. Furthermore, wing chord distributions follow the expectations of "leap-frog migration" and provide a useful method of resolving migratory connectivity.

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VARIABLE EFFECTS OF FOOD AVAILABILITY AND TIMING OF BREEDING ON THE PROBABILITY OF DOUBLE BROODING IN MOUNTAIN BLUEBIRDS

In facultatively double brooded species, timing of breeding, food availability and individual quality independently affect propensity to produce a second clutch, and hence annual fecundity. We examined interactions among these factors by simultaneously manipulating both food and hatching date in mountain bluebirds (*Sialia currucoides*) over two breeding seasons. Hatching dates were altered by 5 days via clutch exchanges, supplemental food was provided throughout first broods, and we subsequently identified females that initiated second clutches. Supplemented females were more likely to produce a second clutch in one year; however, in both years, advancing hatch increased and delaying hatch decreased the probability of double brooding, but only in females that initiated first clutches later in the season (i.e. younger,

lower quality birds). This suggests that annual fecundity is limited by food in some years, and among lower quality females, is sensitive to variation in environmental conditions over the breeding season. In contrast, high-quality females were equally likely to double brood regardless of experimental conditions, and hence may be less subject to trade-offs between reproduction and self-maintenance predicted by life history theory.

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PHYLOGEOGRAPHY OF THE BARRED OWL (*STRIX VARIA*): EVIDENCE FOR TWO RUFUGIA IN THE CENTRAL AND EASTERN UNITED STATES

The Barred Owl (*Strix varia*) is distributed from British Columbia to Nova Scotia and south to Florida and Texas with isolated populations in the Sierra Madre of Mexico. It recently expanded its range to include Idaho, Washington, Oregon, and northern California. Barred Owls are divided into four subspecies based on size, color, and extent of feathering on their toes. However, there is substantial clinal variation at subspecies boundaries, bringing into question the validity of current subspecies distinctions. To better understand the evolutionary history of this species, we used mitochondrial DNA data to infer the phylogeographic history of the Barred Owl. We isolated a 540bp fragment from the control region of 100 Barred Owls from 10 populations throughout the United States. All owls belonged to one of two clades of haplotypes: one predominate in the central eastern coastal populations and the other abundant in the Great Plains and central southern United States. Both haplotypes occurred throughout all remaining populations. This pattern suggests two refugia, one coastal between New York and North Carolina and the other inland between Kansas and western Tennessee.

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DO BROOD PATCH AND BODY TEMPERATURE VARY ALONG A LATITUDINAL GRADIENT?

The avian brood patch plays an important role in heat transfer between adult birds and their eggs, and the heat provided is critical to embryonic development. Tropical birds generally have longer incubation periods, lower embryonic temperatures, and slower embryonic development than their temperate counterparts, but the relationship between these traits and brood patch temperature (BPT) is untested. Because tropical birds have slower metabolism than birds from temperate regions, we predict BPT and core body temperature (CBT) will be lower in tropical birds relative to temperate birds. Using infrared thermometers, we measured the BPT of 11 species at a temperate (Arizona) site and 9 species at a tropical (Malaysia) site. CBT was also measured in Malaysia. Surprisingly, BPT did not differ significantly between sites. BPT correlated with CBT in Malaysian birds, but was unrelated to body mass or incubation period at either site. BPT did not differ significantly between sexes in species with biparental incubation at either site. Further study will increase sample size to see if trends in the data become significant and will include CBT measurements of temperate birds.

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AGE STRUCTURE IN A POPULATION OF BROWN-HEADED COWBIRDS IN SOUTHWEST COLORADO: THE EFFECTS OF SURVIVAL PROBABILITY.

During the summers of 1992 to 1999, we live-trapped (and banded) Brown-headed Cowbirds in La Plata County, southwest Colorado. Within a year, our minimum age estimates for captured adult males and females suggested that individuals of both sexes were typically 1 to 2 years old, though much older individuals were present. While our mean minimum age estimates indicated males were significantly older than females for the years of 1992 to 1997, this did not occur in 1998 and 1999. Program MARK analyses, using our most parsimonious model, $\phi(g^*a2-t)/p(t)$, indicated that survival probability values

were, on average, comparatively low in the years immediately following the initial year of capture (adult females, $\phi = 0.092 + 0.025$; second-year males, $\phi = 0.184 + 0.050$; after-second-year males, $\phi = 0.197 + 0.068$), but they were larger in all following years (adult females, $\phi = 0.358 + 0.082$; second-year males, $\phi = 0.477 + 0.048$; after-second-year males, $\phi = 0.461 + 0.043$). Indeed, adult males tended to have larger survival probability values than did adult females; this corroborated our estimated minimum age data.

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ANOMALOUS SONGS IN SYNALLAXIS SPINETAILS AND THE INTERPRETATION OF SUBOSCINE SONG BEHAVIOR

Most tropical suboscines are presumed to have innate vocalizations that reflect underlying genetic diversity, and many recent taxonomic studies have emphasized the importance of vocal differences in the diagnosis of species-level taxa. However, a broadly applicable definition of song in both structural and functional terms remains contentious for many suboscine groups, and the limitations of vocal data in suboscine systematics have not been evaluated. Vocal characters may mislead taxonomic assessments if they are not associated with homologous display behaviors; conversely, rare vocalizations may potentially be informative in elucidating relationships among species. Here, I present five examples to illustrate the confounding effects of variation in vocalizations and song behavior within the furnariid genus *Synallaxis*. I argue that such variation is widespread in suboscines and may render spurious the comparison of vocalizations at higher taxonomic levels within and among ecologically diverse clades, especially in the absence of information regarding behavioral context. Comparative studies of suboscine vocalizations should de-emphasize small differences in spectrogram measurements and incorporate behavioral data into analyses.

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LATE PLEISTOCENE PASSERINE BIRDS FROM SONORA, MEXICO

From the late Pleistocene (Ranchlabrean Land Mammal Age) fossil site of Terapa in east-central Sonora, Mexico, we identified eight species of Passeriformes, all belonging to the Icteridae (the blackbirds *Agelaius phoeniceus*, *Xanthocephalus xanthocephalus*, and *Euphagus cyanocephalus*, the grackle *Quiscalus mexicanus*, the oriole *Icterus spurius*, and the cowbirds *Molothrus aeneus*, *M. ater*, and *Pandanaris convexa*, the latter an extinct genus and species). Among the few late Pleistocene sites from Mexico or the United States with well studied passerine assemblages, Terapa is unique in its overwhelming dominance of icterids (which are usually common but not dominant) and its absence of corvids. The passerines corroborate previous fossil evidence that marsh, savanna, and riparian forest existed at Terapa during the late Pleistocene; today, foothills thornscrub occurs at Terapa except for riparian forest along the rio Moctezuma. The extinct cowbird genus *Pandanaris* was known formerly only from southern California (*P. convexa*) and Florida (*P. floridana*). We attribute its loss to the late Pleistocene extinction of most of the North American mammalian megafauna.

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UNCOMMON ENDINGS: UNUSUAL TERMINAL STROPHES IN A WESTERN POPULATION OF WHITE-THROATED SPARROWS.

Introduction of novel elements within bird song may be enhanced on the edges of the species' distributions. Individuals in isolated populations may have reduced numbers of song tutors, and slight errors in syllable reproduction could arise with greater frequency, becoming widespread if individuals in these peripheral populations are philopatric and learn songs from neighbors. The white-throated sparrow is a predominately eastern species, with a small disjunct population occurring west of the Rockies in north-central British Columbia. Males in this western population were recorded in 2000-2004 singing two-syllable terminal notes to the song, rather than the species-typical, three-syllable repeats. Transects from central BC through to eastern Alberta suggest the two

syllable terminal notes are more prominent in the west. Reciprocal playback studies conducted in both northern BC and eastern Ontario, Canada (where the three-note ending predominates) found that males in either population show no differentiation between songs with either ending type. This may allow the introduction of novel, but apparently neutral, elements into song. Recent evidence suggests these two-syllable terminal songs are becoming more prominent east of the continental divide.

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FUNCTIONAL ROLE OF REMNANT HABITATS FOR MAINTENANCE OF CAVITY NESTERS IN EVEN-AGED MANAGED LANDSCAPES OF THE EASTERN CANADIAN BOREAL FOREST

In the eastern Canadian boreal mixed-wood forest even-aged management results in landscapes of aggregated clear cuts with remnant forests being mostly concentrated in linear strips (either cut-block separators or riparian buffers). Such habitats are the last fragments of mature and overmature forests in these managed landscapes. They may be used as movement corridors, or for foraging and nesting by some forest dwelling species. The Quebec provincial government considers, however, these retention strips as temporary. Thus partial or total harvesting is authorized when regeneration in adjacent cuts reaches 3 meters. Unfortunately, treeless regenerating clear-cuts are unsuitable for most forest birds. We conducted a study on woodpecker's nest densities, nesting success and productivity in linear remnants of managed forests and compared these parameters with those of woodpeckers in continuous unmanaged landscapes. We found higher nesting densities and comparable nesting success and productivity between habitats in managed and unmanaged landscapes. These results suggest that linear remnant habitats in even-aged managed landscapes provide quality habitats for woodpeckers. Hence, Quebec forest regulations should change the status of these habitats from temporary to permanent biological legacies in managed forest landscapes.

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THE EFFECTS OF INVESTIGATOR DISTURBANCE ON AMERICAN KESTRELS: A STUDY OF INCUBATION BEHAVIOR AND NESTING SUCCESS

Few studies of human disturbance and avian biology have examined the effects of investigator disturbance on avian incubation and nest success; however, investigator disturbance may cause decreased nest attendance, hatching success, or chick survival. We studied the effects of investigator disturbance on American kestrels (*Falco sparverius*), a common study subject. We hypothesized that investigator disturbance negatively affects incubation behavior and nesting success. We used a disturbance protocol with varied nest visit frequencies. During each visit we collected morphometric data and prevented the female from returning to its nest for 15 min. We monitored nest attendance with temperature data loggers to record incubation bouts and assessed nesting success based on the presence of 25-day-old nestlings. Results indicated that increasing disturbance frequency resulted in decreased total daily incubation time and suggested an increase in egg and chick failure in nests disturbed more frequently. These results provide insight into the effects of investigator disturbance on American kestrel reproduction and inform researchers about effects of common study methods.

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SPECIES VULNERABILITY ASSESSMENT IN MEXICO: PROCESS, METHODOLOGY, AND RESULTS

Under CONABIO's leadership, we conducted a conservation vulnerability assessment of the entire Mexican breeding avifauna using the same Partners in

Flight (PIF) criteria applied in Canada and USA. Assessments were conducted during workshops involving 112 Mexican ornithologists and wildlife managers. We evaluated global distribution, population size, population trend and threats for 592 Mexican breeding species that had not previously been assessed under PIF criteria or otherwise had at least half their North American range within Mexico. We relied on published accounts, empirical data and expert opinion to assign factor scores for each species. Where published accounts were unavailable, we developed an alternative method to assign population size scores. The Mexican assessment data were integrated with those from USA and Canada to form a single tri-national assessment database for landbirds. Of the 822 landbird species found in Mexico, 390 (47%) are shared with USA and Canada, 133 (16%) are of immediate conservation concern, and an additional 178 (22%) exhibit high vulnerability equivalent to PIF Watch List status, demonstrating the overall high importance of conservation for North American landbirds in Mexico.

Pape Møller, A. P., Univ. Paris-Sud, Orsay, France, anders.moller@u-psud.fr IMMUNITY, PARASITISM AND LIFE HISTORY IN A CHANGING WORLD

Parasitism constitutes a major cause of mortality, selecting for behavioral, anatomical and physiological defenses, with the immune system constituting a major component of defense. Bird species exposed to diverse and/or virulent parasites have evolved particularly strong immune responses, as exemplified by scavenging and colonial birds. In addition, bird species living in environments with high loads of bacteria have evolved strong innate immune defenses as a first line of defense. Invasion relies on mechanisms of successful immigration, establishment and expansion. Bird species with long dispersal distances, and an elevated ability to colonize novel environments, have high levels of T-cell responses and natural antibodies in dispersing young, but not in adult individuals. A long-term study of barn swallows *Hirundo rustica* revealed a decrease in T-cell response during the last 14 years, associated with climate change, and an increase in prevalence of blood parasites. These findings suggest that birds have adapted to specific parasite environments through changes in immune function, and that long-term studies of parasite communities and host immunity may provide important insights into major ecological and evolutionary problems.

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FEMALE ORNAMENTATION IN THE AMERICAN ROBIN

Colorful male traits have been the subject of research for decades, and sexual selection is recognized as the foremost explanation for their evolution. The expression of ornamentation in females has received much less study. Recent models predict the evolution of honest signals in females under certain circumstances, especially where male investment is high and female quality is variable. Male and female American robins (*Turdus migratorius*) invest heavily in offspring, and both display conspicuous breast plumage and bill coloration. Although female robins show a subdued expression of these traits, considerable variation exists. I used field data to assess whether female ornamentation acts as a signal of individual quality, and whether variation is correlated with reproductive investment. I analyzed clutch size, egg size, yolk androgen, carotenoid deposition, and relative parental effort. Results suggest that female plumage color is a reliable indicator of condition and age, and that saturation of yellow bill pigment reflects ability to lay larger and better quality eggs.

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PATTERNS OF SONG SHARING AS A FUNCTION OF HABITAT AND SITE FIDELITY IN DICKCISSELS

Dickcissels show striking patterns of high conformity to local song traditions and decline in song sharing with geographic distance. However, the degree of local conformity varies, as does shape of the decay in song sharing with distance. These patterns may be common in passerines in geographically continuous populations. If habitat influences population variables such as site fidelity and population density, these population characteristics could in turn impact patterns of song copying, and thus of vocal culture. However, this idea remains largely untested. We hypothesize that that local and landscape

habitat patterns influence dickcissel site fidelity which in turn influences the dynamics of vocal traditions in this species. We are testing this hypothesis by recording and monitoring marked dickcissels at prairie and row-crop agricultural sites and by recording large numbers of dickcissels along transects through either agricultural or rangeland matrices. In our preliminary data set, within-season site fidelity is significantly higher at our prairie sites than our cropland sites. As predicted, male dickcissels at prairie sites appear to have higher within-site song-type conformity than dickcissels at cropland sites.

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THE MATING SYSTEM OF THE YELLOW-FACED GRASSQUIT THE MATING SYSTEM OF THE YELLOW-FACED GRASSQUIT.

J. Parsell, California State Polytechnic University, Pomona, USA; D.W. Still, California State Polytechnic University, Pomona, USA; D.J. Moriarty, California State Polytechnic University, Pomona, USA. We determined the genetic mating system of the Yellow-faced Grassquit (*Tiaris olivacea*) a socially monogamous asynchronously breeding passerine in Costa Rica. During the breeding season of 2006, 29 nests with 60 nestlings were sampled where the identity of the social parents was known. Of these young, 48% of the nestlings and 74% of the broods were from extra-pair fertilizations. These results do not support the hypothesis which predicts low levels of extra-pair fertilizations in asynchronously breeding populations. This discrepancy indicates the necessity for similar studies of tropically breeding species.

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ELEGANT TERN COLONIES IN GULF OF CALIFORNIA AND CALIFORNIA CURRENT SITES; INFLUENCE OF OCEANOGRAPHIC EVENTS IN SIZE AND COMPOSITION

Isla Rasa, situated in a highly productive area of the Gulf of California, has the largest nesting colony of Elegant Tern, (*Thalasseus elegans*), with some 200,000 representing about 90% of the total species population. Other nesting colonies have been reported in the coast of southern California. These nesting colonies have been increasing in size for the last decade and a half, coinciding with the eradication of introduced rodents from Isla Rasa. Also, long term counts in these Pacific colonies and in Isla Rasa have suggested that, such as has also been observed in the Brown Pelicans (*Pelecanus occidentalis*) there may be frequent exchanges of individuals between both areas.

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TAMARISK BIOCONTROL IMPACTS OCCUPIED BREEDING
HABITAT OF THE ENDANGERED SOUTHWESTERN WILLOW
FLYCATCHER

The Southwestern Willow Flycatcher is a riparian obligate breeder declared an endangered species in 1995. Although the majority of flycatcher territories rangewide are in native vegetation, nearly 25% of territories are in habitat dominated by exotic vegetation, primarily tamarisk. Tamarisk is an invasive species that dominates Southwestern riparian systems and efforts to control it include the introduction of a biocontrol agent, the tamarisk beetle (*Diorhabda elongata*). The tamarisk beetle was introduced at St. George, Utah along

the Virgin River where mixed native-exotic vegetation supports a breeding population of flycatchers. In the summers of 2008 and 2009, tamarisk beetles induced widespread defoliation of tamarisk trees at St. George which corresponded to poor reproductive success of the flycatchers. The beetle induces repeated annual defoliation/re-foliation responses in tamarisk, with vegetation appearing normal the spring following defoliation when migratory flycatchers arrive to settle into territories, setting up a form of ecological trap for the flycatchers. We present information on the timing and extent of the defoliation, the breeding productivity of the flycatcher population, and discuss how the beetle may impact this and other flycatcher breeding sites.

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REVERSE MIGRATION IN INTERCONTINENTAL GULF OF MEXICO LANDBIRD MIGRANTS

Reverse migration is the phenomenon in which migrants encountering a large ecological or geographic barrier will move in a direction contrary to the seasonally appropriate direction. Reverse migration is thought to occur when there is insufficient fuel to cross the barrier or in response to inclement weather (e.g., head winds), and therefore may be adaptive despite increasing the time and energy costs of migration. We studied reverse migration during fall in Swainson's Thrushes, Red-eyed Vireos, and Grey Catbirds along the Alabama Gulf of Mexico Coast. Individuals of different fat levels were radio transmitted and tracked to determine movement behavior (e.g., initiated transgulf flight, reverse migrated). Generally, low fat levels and inclement weather were good predictors of reverse migration, and some individuals were tracked moving over 50 km away from the coast to new stopover locations. The results suggest that many individuals reverse migrate to refuel for a transgulf flight, rather than immediately initiating circumgulf navigation, which provides insight into behavioral strategies by intercontinental migrants as well as stopover duration and fueling rates.

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THE INFLUENCE OF EL NINO SOUTHERN OSCILLATIONS ON GULF OF MEXICO INTERCONTINENTAL MIGRANTS

The El Niño Southern Oscillation (ENSO) is a large-scale weather phenomenon that can affect climatic conditions across much of the western

hemisphere. Weather patterns can cause drought or excessive precipitation in different areas, which have been shown to affect migratory birds in terms of arrival time on breeding grounds, productivity, and survivorship. To directly link fluctuations in ENSO weather patterns with changes in habitat conditions at over-wintering sites we correlated ENSO index values with changes in precipitation and vegetation measured via satellite imagery. We then utilized a 20-year dataset of migratory birds banded on the North Coast of the Gulf of Mexico to evaluate the influence of ENSO on large-scale spring migration patterns, correlating ENSO index values with mean arrival date at stopover sites, arrival conditions, and stopover duration for a group of representative migrants. The frequency of strong ENSO conditions is predicted to increase in the future which will have important implications on long-term population dynamics of migratory species.

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NUCLEAR INTRONS SUPPORT MALE MEDIATED GENE FLOW AND NOT INCOMPLETE LINEAGE SORTING IN A SPECIES WITH MONOPHYLETIC MTDNA

Waterfowl genetic studies have observed limited to strongly differentiated populations for mitochondrial (mt) DNA, but no corresponding nuclear (nu) DNA structure, a pattern often attributed to female philopatry and male dispersal. An alternative conclusion, debated in the recent literature, is that the slower sorting rate of nuDNA relative to mtDNA explains this pattern. To test between these hypotheses, we sequenced 11 nuclear introns for Common Mergansers *Mergus merganser*, for which mtDNA haplotypes cluster into four structured clades: two in North America, one in Eurasia, and one that is shared between continents but restricted to central Alaska, the Aleutian Islands, and Eastern Russia. The nuDNA supports two genetic populations: Old World and New World. Thus, gene flow is restricted between continents for both molecules. In contrast, coalescent simulations show that within continents nuDNA is too weakly structured given the mtDNA divergences. We conclude that female philopatry has contributed to rapid mtDNA sorting, but male dispersal has homogenized nuDNA within continents. This study illustrates the importance of using quantitative tests to differentiate between sex-biased gene flow and unequal rates of lineage sorting.

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AVIAN INFLUENZA ACROSS TAXA AND FLYWAYS:
CHARACTERIZING VIRAL GENOMIC DIVERSITY TO OPTIMIZE
SURVEILLANCE PROGRAMS FOR NORTH AMERICA

Phylogenetic analysis of avian influenza has revealed distinct groupings of lineages that differ between Eurasia and North America. However, there is growing evidence of intercontinental genetic exchange of low pathogenic avian influenza (LPAI) viruses. Using whole genomic data from LPAI viruses across North America, we examined whether such genetic exchanges are related to migratory connectivity of hosts, if evidence for intercontinental virus exchange differed between breeding and wintering grounds, and whether viral gene flow was consistent across years. In North American waterbirds we found that the presence of Asian lineage LPAI viruses was higher in intercontinental migrants, lower on wintering areas in California than on Alaskan breeding grounds, and that persistence of Asian lineages varied across years. Our data indicate that North American surveillance programs for detection of the highly pathogenic avian influenza (HPAI) H5N1 subtype could be optimized using LPAI genomics, especially for regions and bird species that demonstrate intercontinental viral linkages.

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MATERNALLY DERIVED TESTOSTERONE AND CAROTENOIDS INFLUENCE OFFSPRING PERFORMANCE IN JAPANESE QUAIL
Maternal resources deposited in eggs affect the development of multiple offspring phenotypes and result in trade-offs among traits. Maternal testosterone in eggs may benefit offspring by increasing growth rate and competitive ability, but may also reduce immunocompetence and increase oxidative stress. In contrast, maternal carotenoids may counteract the oxidative stress and immune-depressive effects of testosterone. We investigated the independent and interactive effects of maternal testosterone and carotenoids on offspring physiology by simultaneously manipulating levels of testosterone (via gonadotropin releasing hormone (GnRH) challenges) and carotenoids (via diet supplementation) in captive female Japanese quail. Repeated GnRH challenges and carotenoid supplementation in females elevated testosterone and carotenoid deposition in eggs. Carotenoids supplementation enhanced offsprings immune function, whereas GnRH-challenges to adults enhanced offsprings growth during development. Testosterone and carotenoid levels in egg yolks were positively correlated, suggesting a compensatory deposition pattern. Moreover, chicks from eggs produced by GnRH challenged and carotenoid supplemented females had immune performances similar to offsprings of females supplemented with carotenoids, and higher than offsprings of females receiving GnRH challenges and offsprings of control females.

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PHYLOGEOGRAPHY AND THE PLEISTOCENE HISTORY OF THE GREEN WOODPECKER COMPLEX (PICUS VIRIDIS)

The Green Woodpecker complex consists of *Picus viridis*, with four subspecies distributed from Western Europe to the Caucasus and Iran, and *Picus vaillantii*, restricted to North Africa. Much of the range of *P. viridis* consisted of unsuitable habitat during glacial maxima. We sequenced the mitochondrial ND2 gene for 83 individuals representing 17 populations and all generally recognized subspecies. Phylogenetic analysis indicated the existence of three clades of haplotypes, separated by 2.5% to 7% sequence divergence, corresponding to populations restricted to 1) North Africa, 2) Iberia, and 3) the rest of Europe and the Near East. These populations are morphologically differentiated and ought to be considered species-level taxa. Within non-Iberian Europe, the Italian and Balkan samples were not greatly divergent from each other, contra the canonical Pleistocene pattern. The non-Iberian European samples showed significant isolation-by-distance, with the Caucasus and, especially, the Iranian population possessing high frequencies of private haplotypes. This suggests either restricted gene flow between those regions and Western Europe, or the presence of additional Pleistocene refugia in the Near East.

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SPATIAL DISTRIBUTION OF OCCUPIED LEACH'S STORM-PETREL BURROWS.

As burrow nesters, Leach's Storm-Petrels (*Oceanodroma leucorhoa*) occupy inconspicuous and often inaccessible nests, where generalized estimates of occupancy rates may obscure clustering by breeding pairs. Occupied burrows could exhibit a non-random distribution, since prior studies indicate that social facilitation may influence colony formation and habitat utilization in this species. This study examines the spatial distribution of occupied Leach's Storm-Petrel burrows on Great Duck Island, Maine. I investigated: 1) burrow occupancy relative to burrow proximity to nearest neighbors, 2) whether nearest neighbors reflect one another's occupancy status, and 3) the distance between occupied burrows relative to macro-habitat features. The frequency of occupied burrows was not significantly different between burrows one standard deviation above (N=25) versus one standard deviation below (N=25) mean nearest neighbor distance. The occupancy status of burrows were not reliable predictors of the occupancy status of their nearest neighbors (N=37). The distance between occupied burrows and their nearest burrow was not

significantly different between forested and open habitat (N=40). However, the distance between occupied burrows and their nearest occupied neighbor was significantly different between open and forested areas.

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EFFECTS OF GRAZING INTENSITY AND YEARS GRAZED ON SONGBIRD NESTING SUCCESS IN NORTHERN MIXED-GRASS PRAIRIES

Nesting success of prairie songbirds is influenced by vegetation, which can be affected by grazing. Cattle were introduced into Grasslands National Park of Canada using an adaptive management experiment. We used hand-dragging to find nests in 26 plots (each 300- m²) in pastures with grazing intensities ranging from 0-70% biomass removal, which were grazed for 0, 2 or >15 years. We monitored nests of seven songbird species, and present analysis for three. Modified logistic regression indicated a nonlinear effect of grazing intensity on nesting success of Sprague's Pipits, which had lowest success at low grazing intensities, but highest success at moderate intensities. There was a negative correlation between years grazed and nesting success for Chestnut-collared Longspurs, but a positive correlation with grazing intensity. Nesting success of Vesper Sparrows, and all species combined, was not influenced by grazing. If the management objective is to maintain songbird diversity, grazing does not influence the quality of nesting habitat. However, if management is aimed toward increasing threatened Sprague's Pipit populations, certain grazing regimes may reduce nesting success, while others may increase it.

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COLLISION-AVOIDANCE BEHAVIOR OF HAWAIIAN PETRELS AND NEWELL'S SHEARWATERS IN THE HAWAIIAN ISLANDS

We studied collision-avoidance responses of Hawaiian Petrels (*Prerodroma sandwicensis*) and Newell's (Townsend's) Shearwaters (*Puffinus auricularis newelli*) to transmission lines on Kauai Island, Hawaii, in 1992–2002 and to communications towers (Hawaiian Petrels only) on Lanai Island in 2007–2008. Hawaiian Petrels responded to transmission lines more often (19.3% of the time) than Newell's Shearwaters did (7.4%) and responded more often with increasing proximity to transmission lines, whereas Newell's Shearwaters showed little variation in response rates by distance. Among all petrels/shearwaters observed, one Newell's Shearwater collided with a transmission line. On Kauai, Hawaiian Petrels mostly responded to transmission lines by changing flight velocity and flight altitude, whereas Newell's Shearwaters mostly responded by changing flight direction and flight altitude. Hawaiian Petrels on Lanai responded to communication towers most often by changing flight direction and flight altitude. On Lanai, Hawaiian Petrels responded to towers 38.8% of the time and responded more often with increasing proximity to towers; however, all 26 petrels flying directly toward towers on Lanai exhibited collision-avoidance behavior. Mean response distances to towers on Lanai were significantly smaller during fog conditions.

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WHAT'S HAPPENING TO HAWAIIAN BIRDS?

Hawaiian birds continue to be a difficult conservation challenge. Trapped in a modern environment with novel diseases, mammalian predators, and habitat altering non-native species, nearly all Hawaiian birds now depend on active management for their survival. The Hawaiian story tells how tried-and-true techniques—wetlands management, predator control, and reintroductions—can work for island seabirds and waterfowl, particularly when applied to small focal areas. Most of these species have demonstrated recent population gains or stability. However, the story is still unfolding for forest birds, which require

novel approaches applied over extensive blocks of habitat. Most forest bird populations continue to decline (14 of 26 species). Reversing these declines seems feasible through a combination of forest restoration, ungulate and predator control, and reintroductions. Yet, a greater conservation response must be launched to accomplish what is needed.

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POPULATION STATUS AND BREEDING ECOLOGY OF THE BAHAMA ORIOLE (ICTERUS DOMINCENSIS NORTHROP)

Recent studies suggesting the elevation of the Bahama Oriole to full species prompted us to evaluate its population status and breeding ecology. From surveys, we estimated that 90-180, 25-50, and 25-50 individuals remain on North Andros (NA), Mangrove Cay (MC), and South Andros (SA), respectively, suggesting the taxon is a critically endangered island endemic. Orioles mostly used residential areas during the breeding season, though home ranges included pine forest and coppice. The majority (84%) of 37 nests observed was constructed in Coconut Palms (*Cocos nucifera*), with native Sabal and *Thrinax* palms and an introduced *Schefflera* tree also used. Lethal yellowing recently devastated Coconut Palms on NA (local mortality 8-97%), but those on MC and SA remain healthy. On NA, a higher proportion of oriole pairs included a second year mate (50% of 18) compared to MC and SA (7% of 15), suggesting low oriole density. Tree height was the only predictor distinguishing nest sites from paired random sites on NA, suggesting preference for taller trees. Three of eight nests with known contents were parasitized by Shiny Cowbirds (*Molothrus bonariensis*).

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SURVIVAL FROM FLEDGING TO INDEPENDENCE IN THE COOPERATIVELY BREEDING FLORIDA SCRUB-JAY (*APHELOCOMA COERULESCENS*)

Avian survival is lowest during the post fledging period, yet little is known about this life history stage. We used a long-term demography dataset and modeled fledgling survival against hierarchical parameters from individual nestlings, territories, and for the annual cohort. Year was included in all models to account for annual variation in timing of breeding and overall survival. We used Akaike's information criterion to evaluate a priori candidate models representing our hypotheses about factors that may influence survival during this critical period. Nestling mass, earlier fledging dates, and the presence of helpers had a positive influence on survival to independence, but a strong annual effect was evident. Predation has been the leading explanation for post-fledging mortality. We suggest that while food may not generally be limiting, early weight gain is important and may influence vulnerability to predators later in life. Therefore, understanding how the bottom up process of early food acquisition influences susceptibility to predators after fledging is an important step in describing avian life histories.

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PHYLOGEOGRAPHY AND POPULATION GENETICS OF THE DOWNY WOODPECKER (*PICOIDES PUBESCENS*)

The processes and mechanisms explaining the historical and contemporary distribution of temperate-zone birds are poorly understood. The Downy Woodpecker (*Picoides pubescens*) is a common and widespread woodpecker found in temperate areas of North America. Despite documented variation in terms of plumage and ecology, almost nothing is known about the patterns of genetic variation in a spatio-temporal context. We compared DNA sequences of the mitochondrial gene *ATPase6/8*, among individuals from 18 geographic

sites throughout the species' range, using Bayesian and coalescent analysis. We found little geographic variation in terms of haplotype and nucleotide diversity among populations as distant as Alaska and Newfoundland. The aforementioned pattern could be explained by a past population bottleneck during the Pleistocene or by recent or continuing gene flow.

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DOES CLUTCH SIZE DECREASE WITH INCREASING ELEVATION?

A fundamental paradigm of avian reproductive ecology is that clutch size increases with latitude but the relationship between clutch size and altitude is less clear. I examined clutch sizes of seven species nesting across an elevational gradient in the Sierra Nevada, California. Clutch size decreased with increasing elevation for three open-nesting species (Cassin's Vireo, Dark-eyed Junco, and Dusky Flycatcher). Two other open-nesting species (American Robin and Hammond's Flycatcher) showed no significant response but followed the same pattern. In contrast, clutch size did not vary with elevation in two cavity-nesting species (White-headed Woodpecker and Mountain Chickadee). These results suggest that the response of cavity nesters to environmental conditions that vary with elevation differs from that of open nesters. Cavity nesters breed earlier and tend to be single brooded and are therefore less constrained by the shorter breeding season at higher elevations. Reduced thermoregulatory costs relative to open-cup nesting species due to the insulation of cavities and larger brood sizes may allow cavity nesters to lay similar-sized clutches at different elevations. Clutch size patterns across latitudinal and elevational gradients appear to differ.

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AVIAN RESPONSE TO LAND USE AND LAND COVER PATTERNS ASSOCIATED WITH ORGANIC FARM SYSTEMS

Avian species associated with conventional agricultural landscapes continue to experience significant global population declines. A positive relationship between organic farm management and biodiversity has been demonstrated. Yet, because organic regulations stipulate only what practices cannot be used, certified organic lands vary greatly in adoption of species-friendly practices, perhaps masking negative impacts. To determine how birds respond to land use and land cover patterns associated with organically managed cropland, we conducted counts on 22 certified organic farms in eastern Nebraska and Kansas in 2007-2009. We modeled bird abundance in relation to field, patch, and landscape variables and detectability covariates using N-mixture models. Richness and abundance of species varied. While grassland obligates responded positively to associated non-crop habitat, we found that shrub birds responded positively to associated non-crop habitat patterns and crop and weed structure and diversity within arable fields. As demand for food production continues to increase, identification of cultural practices that benefit biodiversity while maintaining production is essential. These results suggest an important place for working farmland in species conservation plans, though many species will continue to require protected habitat.

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THE EFFECTS OF TWICE-OVER ROTATION GRAZING ON THE ABUNDANCES OF GRASSLAND BIRDS

The mixed-grass prairie region of southwestern Manitoba is a hotspot for many endangered grassland birds. Once covering approximately 6,000,000 ha, this region has been degraded to less than a quarter of historical amounts. Presently, the remaining prairie is primarily used for livestock grazing. We evaluated the potential role of sustainable land management practices, such as rotational grazing, for aiding in conservation of the regional avian community. We sampled 273 100-m fixed-radius point count plots, dispersed among 22 twice-over rotation grazed pastures, 15 pastures grazed season-long, and 8 ungrazed fields. An ANOVA indicated no significant difference in species richness among treatments. A similarity test (Sorensen's Index) indicated 82.76% of the species were common to both grazed treatments, 61.40% were similar between idle and continuously grazed sites, and 65.04%

similarity between idle and twice-over sites. However, the twice-over pastures surveyed have only been in this regime 2-7 years, which may be too brief to see any changes on the landscape. Further analysis of species diversity among treatments is required to determine the effects of land management on the abundances of grassland birds.

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OCCUPANCY MODELING TO ESTIMATE POPULATION TREND OF THE NORTHERN SPOTTED OWL: A PILOT STUDY

Occupancy modeling offers an approach for estimating population trend of the Northern Spotted Owl (*Strix occidentalis caurina*). To evaluate the efficacy of an occupancy model, we performed a set of daytime and nighttime surveys in two study areas to estimate detection probabilities from each approach and to estimate a proportion of sites occupied by owls. Detection rates were higher for nighttime surveys than daytime surveys, but because daytime surveys allow a better random selection of Primary Sample Units (PSUs), and given the inherent safety issues associated with nighttime surveys, we believe daytime surveys are the better choice. The top daytime models had separate probabilities of presence for each study area but a common detection probability. For daytime surveys, proportion of PSUs occupied varied from 0.20 on the Wenatchee forest in Washington to 0.61 on the Willamette forest in Oregon. Probability of detection at a single station on a single visit was 0.13. We recommend 3 visits to a PSU, and 7 stations per PSU, to achieve 90% power for detecting an annual decline of 2-7% in proportion of occupied sites.

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HABITAT RESTORATION FOR YELLOW-BILLED CUCKOOS ON THE LOWER COLORADO RIVER

The Yellow-billed Cuckoo is one of 26 species covered under the Lower Colorado River Multi-Species Conservation Program (LCR MSCP). The LCR MSCP is a multi-stakeholder partnership which is being implemented by the Bureau of Reclamation to balance the legal use of LCR water and the conservation of species and their habitats. Of the 2,400 ha of cottonwood (*Populus fremontii*), willow (*Salix gooddingii* and *S. exigua*), and mesquite (*Prosopis glandulosa*) habitat being restored for Yellow-billed Cuckoos and other riparian species, 660 ha have been planted. This habitat has replaced agricultural or previously undeveloped lands within the LCR floodplain between Needles, CA and Yuma, AZ. All restored habitat is managed by flood irrigation during the breeding season. Documentation of cuckoos using this habitat began in 2005 and by 2008, cuckoos were detected at least once during the breeding season at all restored sites. Nesting was documented for the first time in 2008, in a 3 year old, 121 ha stand of cottonwood and willow near Blythe, CA.

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ESTIMATED DATES OF RECENT EXTINCTIONS FOR NORTH AMERICAN AND HAWAIIAN BIRDS

Sighting records – the years in which species have been recorded – can be used to infer whether a species has gone extinct and when extinction occurred. We compiled sighting records for 52 bird species, subspecies, and island populations from North America and Hawaii that disappeared in the last 200 years or are possibly extinct. Of these, 38 of proved adequate for analyses. Only 'Alala and Oloma' o on Molokai have $p > 0.05$ chance of persistence to 2009. We suggest that ranking according to their likelihood of persistence can be used to prioritize future searches to minimize the risk that resources are spent on extinct species. Estimated extinction dates spanned

the 1850s-2000s, with evidence for a peak in the early 1900s. On average, 5 years passed between a species' last sighting and its estimated extinction date. Long gaps between sightings were rare; mean and median times between consecutive sightings were 2.9 and 0 years, respectively. Gaps between the last and penultimate sightings were smaller than average gap sizes earlier in sighting records. A non-parametric method that uses more limited data proved a poor alternative.

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DEVELOPMENT OF INDIVIDUAL SIGNATURES AND THE EFFECT OF HUNGER ON BEGGING CALLS IN AN AFRICAN WEAVER BIRD

It is widely known that food-provisioning parents and fledglings of many bird species use acoustic signals to reveal their identity. However, begging calls are additionally important hunger-related signals of need in young birds. Here we investigate how begging calls develop an individual signature and additionally how they incorporate dynamic signals of need. In a field study with Jackson's Golden-backed Weavers (*Ploceus jacksoni*) we followed the development of begging calls. Begging calls largely increased in complexity during the nestling's development. Additionally we experimentally manipulated the hunger of nestlings close to fledging to investigate the effects on begging call parameters. As expected from other studies, hunger affected call rate, amplitude, and several other call components. Most interestingly, our results further indicate that the perception of hunger is dependent on the signaller's identity. Based on the properties of most acoustic parameters, showing both high between-individual differences and consistent changes with hunger, we suggest that hunger information is individual-referenced. The information in those acoustic parameters is a relative signal, individually referenced to the sender, and cannot be estimated absolutely without knowing the sender's identity.

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THE FUNCTION OF COMPLEX LOW AMPLITUDE VOCALIZATIONS IN DARK-EYED JUNCOS: MALE RESPONSE TO SHORT- AND LONG-RANGE SONG

In contrast to long-range song (LRS), which typically functions in territoriality and mate attraction, the function of complex, low amplitude short-range song (SRS) remains understudied. Dark-eyed Juncos sing a distinct LRS and SRS. Junco LRS consists of a simple trill typically sung from elevated perches. SRS contains a greater diversity of note types and a significantly larger frequency bandwidth. SRS is most commonly sung during courtship, and less frequently during intense aggressive interactions between males. Males also sing LRS at low amplitude (soft LRS) when near their mates and during aggressive interactions. We presented twenty male Dark-eyed Juncos whose mates were fertile with a simulated territorial intrusion of long-range song, short-range song, and soft long-range song. Male response to loud and soft LRS did not differ, indicating that LRS may have a similar function regardless of amplitude. Male response to SRS was significantly stronger than to either of the LRS treatments, indicating that SRS may serve a different function than LRS or soft LRS. Ongoing work is addressing the potential role of SRS in mate choice and female stimulation.

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EFFECTS OF SURVEY AND ANALYTICAL METHODS ON ESTIMATES OF DENSITY FROM POINT COUNTS OF SONGBIRDS

Few studies have compared the effects of using different survey and analysis methods to estimate detection probability and density from point counts. We conducted point counts of six songbirds in two habitats in the Central Hardwoods Bird Conservation Region during the breeding season in 2007 and 2008. We used distance and time-removal methods to estimate detection probability and density. We found detection probabilities differed between distance and removal models and individual species were affected differently by year, habitat type, and state. We found strong support for heterogeneity in removal models. We investigated how count length (5-min versus 10-min

and radius (50 m or 100 m) affected density using time-removal models. Five-minute counts tended to produce the highest density estimates. Distance density estimates tended to be within the range of removal estimates. Density estimates can be dramatically different because these methods estimate different parts of the detection function and because survey design affects number of detections and detectability. We recommend researchers carefully consider assumptions for analysis methods when choosing a method and examine the sensitivity of their results to survey methods.

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FLOOD EFFECTS ON SWAINSON'S WARBLERS IN BOTTOMLAND HARDWOOD FOREST IN EASTERN ARKANSAS.

The Swainson's Warbler (*Limnothlypis swainsonii*) (SWWA) is a species of conservation concern in the southeastern U.S. Our research focused on the demographical response of the SWWAs to a catastrophic flood event in 2008 at White River National Wildlife Refuge (WRNWR) and at a reference unflooded site at Saint Francis National Forest (SFNF). Both sites experienced reductions in the return rates of marked birds after the flood event. Occupancy also dropped during 2008 at WRNWR to 25 male SWWAs compared to a mean of 43 males between 2005 and 2007. Occupancy at SFNF was approximately the same as previous years. Based on survival models, apparent survival was lower for both study sites (41%) than previous estimates (48.5-66.1%). At WRNWR, we characterized vegetation locations to determine what impact flooding had on occupied and unoccupied sites (previously occupied 2005-2007). Overall, we found higher percent of bare ground, less litter cover, and less vegetative cover at unoccupied locations compared to occupied sites. Also, we saw SWWAs occupying completely inundated habitat. However, our data suggest that flooded bottomland habitat may be sub-optimal for SWWAs.

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IMPROVING MONITORING OF WINTERING SHOREBIRDS IN CALIFORNIA

The development of a wintering shorebird monitoring program for California is an essential step towards the long-term conservation and management of shorebirds in the Western Hemisphere. Within California, the San Francisco Bay estuary provides habitat for more migrating and wintering shorebirds than any other coastal wetland and has been designated as a site of hemispheric importance in the Western Hemisphere Shorebird Reserve Network. As part of a larger project to develop a monitoring program for wintering shorebirds in all of California, we employed existing data from comprehensive November censuses of the San Francisco Bay estuary (1990 – 1992 and 2006 – 2008) to conduct spatial sampling simulations. We assessed the efficacy of reduced effort surveys (e.g. 50% of comprehensive survey) and several sampling frameworks (i.e. stratified random sampling, generalized-random tessellation stratified sampling) to identify trends in shorebird populations in San Francisco Bay that were observed in the high-effort, comprehensive censuses. Our analyses will guide the development of a statistically robust, logistically feasible, long-term monitoring program for wintering shorebirds in the San Francisco Bay estuary and other important wetlands of coastal California.

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IMMATURE BALD EAGLE SPACE USE ON THE CALIFORNIA CHANNEL ISLANDS

We studied the space use patterns of a re-introduced population of Bald Eagles on the Northern Channel Islands, CA using global positioning system platform transmitter terminal data in a geographic information system.

Space use patterns were investigated using the program LoCoH (Local Convex Hull) to estimate 50% core use areas and 95% home range areas. The proportion of time eagles spent on different islands was also determined. Space use patterns varied with year, season, and island. Immature Bald Eagles shifted their space use from the larger islands of Santa Cruz and Santa Rosa to the small island of Anacapa, especially in the spring and summer in years 3 (2005-2006) and 4 (2006-2007). This shift appeared to be due to spatial and temporal changes in available food resources. It is important to understand space use by immature Bald Eagles on the islands to estimate foraging areas, use of contaminated items, use of non-native items, impact on other sensitive species, and to direct current and future management strategies.

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DYNAMIC WINTER BIOGEOGRAPHY: MULTIPLE SPECIES OF HUMMINGBIRDS ADD THE GULF COAST OF THE USA TO THEIR WINTER RANGES

Human modification of ecological conditions can provide examples of the dynamic nature of avian biogeography as well as examples of how long-distance dispersal might be an important process in biogeography. Until recently, no species of hummingbird's winter range included temperate eastern North America. Beginning in the 1970s, populations of at least five species of hummingbirds have added the Gulf Coast to their winter range: Rufous, Black-chinned, Buff-bellied, Ruby-throated, and Calliope hummingbirds. These wintering populations, 100-1000 km disjunct from the primary winter ranges, are in areas with dramatically different winter climates from their largely tropical primary ranges. For the species from western North America, the seasonality of arrival on the Gulf Coast appears bimodal, with a pulse dominated by returnees in late summer followed by a larger wave in early winter. Banding data indicate high over-winter survival and philopatry. Populations are small, likely 100-1000, and are found almost exclusively in gardens with sugar-water feeders, although the extent to which they depend on them for daily caloric needs is uncertain. Three additional species (Allen's, Broad-tailed, Broad-billed) also show signs of ongoing colonization.

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IMPORTANCE OF THE LILAC-CROWNED PARROT IN PRE-DISPERSAL SEED PREDATION OF *ASTRONIUM GRAVEOLENS* IN TROPICAL DRY FOREST

Parrots represent a large biomass of canopy granivores in tropical forests, and may be effective pre-dispersal seed predators. We evaluated the importance of the lilac-crowned parrot (*Amazona finschi*) as a pre-dispersal seed predator of *Astronium graveolens* in tropical dry forest. Seeds were collected in fruit-traps beneath 22 trees to compare pre-dispersal seed predation by parrots and insects, and determine whether intensity of seed predation was related to fruit-crop size or the aggregation of fruiting trees. Ground-level exclosures compared post-dispersal seed predation by vertebrates and insects. The lilac-crowned parrot predated 43% of seeds pre-dispersal, while insects predated only 1.3%. Intensity of pre-dispersal seed predation by parrots was significantly greater in high-fruiting 0.79-ha resource patches, and was not related to fruit abundance of the focal tree. Foraging parrots discarded immature fruits below the tree, causing a total 56% pre-dispersal loss, which was greater than post-dispersal removal by vertebrates (51%), or insects (36%). Parrots play an important role as pre-dispersal seed predators in tropical dry forests. The reduction of parrot populations may have consequences for seed predation, affecting recruitment patterns of canopy trees.

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CONSERVATION TAXONOMY OF THE CUBAN PARROT (*AMAZONA LEUCOCEPHALA*): FLIGHT CALL VARIATION

Our previous work on morphology and plumage variation within the Cuban Parrot suggested greater diversity than previously recognized. Here, we tested two hypotheses: that the flight (contact) call of parrots from each of the six extant island populations (Abaco and Inagua, the Bahamas; Cuba; Isla de la Juventud; Cayman Brac; Grand Cayman) is diagnosably distinct, and that the structure of the call corresponds to morphological and plumage variation (i.e., character concordance). We found the flight calls (N = 23 individuals) from each island to be diagnosably distinct; however, flight call structure based on quantitative characters was largely but not entirely congruent with the morphological and plumage differences among island groups. Although diagnosability is important for examining taxonomic limits in birds, applying this principle to vocalizations may be problematic, particularly when a strong cultural influence exists, as in psittacid contact calls. Thus, the diagnosable differences we found among populations should not be interpreted as support for species-level differentiation. We nevertheless recommend that each population be managed not only as a separate conservation unit, but also as a culturally significant unit.

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DOES A SUCCESSFUL TRANSLOCATION + POPULATION ESTABLISHMENT = POPULATION PERSISTENCE? CHALLENGES AFTER THE SUCCESSFUL REINTRODUCTION OF LAYSAN TEAL

In an attempt to reduce the high extinction risk inherent to small island populations, we translocated wild Laysan teal (*Anas laysanensis*) to a portion of its presumed prehistoric range. We monitored survival and reproduction of the 42 founders using radio telemetry for 2 years after the first release and used resultant demographic rates to model population growth. The asymptotic growth rate was 1.73 after the first two years. The population size grew from 0 in 2004 to > 200 in 2007 exceeding benchmarks for translocation success. However, isolated island populations are extremely susceptible to stochastic threats, and vital rates are expected to change with population density, changes in habitat, and environmental variability. The Midway population was expected to increase to 380 individuals in 2008, but experienced a Botulism C epizootic with 181 Laysan teal carcasses recovered illustrating the vulnerability of small island populations to catastrophes and the importance of population monitoring. We used mark-resight data in 2008-2009 to monitor population Using empirical data through 2010, we evaluate and update the early population projection. On any given island, persistence of the Laysan teal will depend primarily on the frequency of catastrophic events created by ecological conditions, anthropogenic factors, and diseases.

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COMMON BIRDS IN DECLINE IN NORTH AMERICA

North American nations (Canada, Mexico, and the U.S.) share responsibility for nearly 900 species of landbirds. We identified 42 species whose populations have declined by 50% or more in the past 40 years. Most of these have not been identified as species of high concern by Partners in Flight or Birdlife. But their steep population declines are important ecologically; the combined loss across these species is estimated at 800 million breeding birds

- roughly two-thirds of the breeding bird population present 40 years ago. Most of these species are migrants that breed primarily in the northern U.S. and southern Canada, and winter in the southern U.S., Mexico or farther south. We lack long-term monitoring data for most Mexican species, so it is likely that many common birds have declined there as well. Among the major threats to these species are the loss and fragmentation of habitat. Reversing these declines will require improved land-use practices and policies in all three countries. It also will require the conservation community to become more effective in working for the maintenance and restoration of ecosystems.

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REMOVAL OF WINTER GRAZING INCREASES PATCH COLONIZATION RATES OF CALIFORNIA BLACK RAILS

The secretive and state-threatened California Black Rail (*Laterallus jamaicensis coturniculus*) inhabits the edges of shallow, densely vegetated marshes and is thought to be especially sensitive to edge-related disturbances such as livestock grazing. Grazed sites are expected to have greater annual variation in vegetation cover and therefore higher turnover rates than non-grazed sites. We applied single-species multi-season occupancy models to examine monthly turnover events of Black Rails in a network of 31 small marshes (13 winter grazed by cattle and 18 non-winter grazed) in the Sierra Nevada foothills where ranching has been a dominant land use for well over a century. Black Rail colonization rates were positively associated with the removal of winter grazing and marsh area, while local extinction rates were positively related to isolation and seasonal water regimes but did not differ strongly between grazed and non-grazed marshes. Black Rail detection probabilities were high (0.92 ± 0.021) and did not differ by season. We conclude by presenting management recommendations for livestock grazing with respect to Black Rail conservation.

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DOES SINGLE-TREE SELECTION HARVESTING INFLUENCE NESTLING PROVISIONING RATES FOR ROSE-BREADED GROSBEAKS IN HARDWOOD STANDS?

We undertook this study to determine whether changes in habitat structure resulting from single-tree selection harvesting influence nestling provisioning rates in Rose-breasted Grosbeaks. We tested whether time since harvesting influences 1) nestling provisioning rates (# trips/nestling/hr), 2) prey load sizes, 3) the relative contribution of males and females to provisioning, and 4) the ability of older males versus second-year males to provide food for their offspring. We monitored 87 nests in twelve stands in Algonquin Provincial Park representing four stages in the harvest rotation (0-5, 15-20, 20-25, and >50 years post-harvest). Mean provisioning rate (# trips/nestling/hr) was lowest in stands 0-5 years post-harvest, and 54% of prey loads in these stands were categorized as small. Provisioning by males and females was approximately equal, irrespective of time since harvest. Older males had higher provisioning rates than second-year males in all stand age classes except 20-25 year post-harvest stands. The results of this study suggest that selection harvesting does influence nestling provisioning rates which could result in reduced fitness of offspring in some stands.

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SEASONAL HABITAT REQUIREMENTS OF KING AND CLAPPER RAILS—IMPLICATIONS FOR MANAGEMENT OF IMPOUNDED COASTAL WETLANDS IN SOUTH CAROLINA

Population numbers of two marsh bird species, the King Rail (*Rallus elegans*) and Clapper Rail (*R. longirostris*), have suffered declines due to loss of wetland and tidal marsh habitats. Managed coastal impoundments may supplement rail habitat, if they meet rails' habitat needs. We evaluated habitat selection of radio-marked King and Clapper Rails in fresh to saline tidal marsh within the Ashepoo-Combahee-Edisto (ACE) Basin, South Carolina. Between February and August 2009, we collected over 1200 radio-locations and defined home ranges for 31 Clapper and 2 King Rails. We also measured habitat characteristics at three scales: study area, home range, and nest site. Home range sizes and movement patterns of both species are variable. Clapper Rails generally do not use impoundments but King Rails do. We plan to capture and track additional rails during Fall 2009 and Winter to Summer 2010 to determine if similar patterns are observed. From this information, we can develop management recommendations for existing coastal wetland impoundments such that rails, in addition to waterfowl and shorebirds, can use and benefit from these areas.

Riegner, M. F., Prescott College, Prescott, USA, mriegner@prescott.edu OCCURRENCE OF NON-FEATHERED AVIAN INTEGUMENTARY OUTGROWTHS: EVIDENCE FOR PARALLEL EVOLUTION

Non-feathered integumentary outgrowths, such as caruncles, knobs, wattles, and combs, comprise some of the most unusual morphological features among birds yet have received surprisingly little study. For example, it is unclear why these structures rarely occur in passerines. I surveyed the presence of these integumentary outgrowths in 183 families of birds and examined whether such features are associated with body size. I found that non-feathered head outgrowths occur in 6% of nonpasserines and in 2% of passerines, and that taxa possessing such features tend to be the largest, most robust morphotypes within a clade. These morphological associations recur across diverse taxa with diverse ecologies and thereby lend support to parallel evolution as the generator of morphological diversity. Moreover, I propose that the scarcity of these structures in relatively small-bodied passerines may be attributed to aerodynamic considerations: whereas ornamental plumes can be erected for display and lowered during flight, permanent integumentary outgrowths would generate unacceptable levels of turbulence for small-bodied birds. Indeed, 48% of passerines with integumentary outgrowths have eye wattles, which presumably offer little air resistance.

Riehl, C., Princeton University, Princeton, USA, criehl@princeton.edu REPRODUCTIVE BIOLOGY AND MATING SYSTEM OF THE GREATER ANI (*CROTOPHAGA MAJOR*), A COMMUNALLY BREEDING NEOTROPICAL CUCKOO

The ani and their allies practice communal nesting, a rare form of cooperative breeding in which several socially monogamous pairs lay eggs in a single nest. Very little is known about the genetic mating systems of ani due to the difficulty of trapping adults and the lack of suitable molecular markers. Here I present the results of a four-year study on the reproductive biology of a color-banded population of Greater Anis in Panama. I developed 12 polymorphic microsatellite loci to evaluate mating patterns and reproductive skew in 16 breeding groups, which ranged in size from four to seven individuals. Group members engaged in a variety of reproductive strategies, including monogamy, polygyny, polyandry, and conspecific brood parasitism; approximately 30% of nestlings were the result of extra-pair copulations. Reproductive skew was low among female group members but higher among males, and the degree of skew increased with group size. Parental care, which I quantified with motion-activated nest cameras, was similarly biased: males that achieved the majority of paternity in the communal clutch also performed the majority of incubation and nest defense.

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EFFECTS OF LAND-COVER CHANGE ON PATTERNS OF BIRD DIVERSITY IN THE UNITED STATES

Anthropogenic land-cover change can alter bird community composition, yet few studies explicitly examine the link between land cover dynamics and bird diversity. In this study, we investigated whether patterns of North American landbird diversity observed in 2002 were associated with land-cover changes in the conterminous U.S. from 1992 to 2001. Using the National Land Cover Database Land Cover Change Product and North American Breeding Bird Survey data, we found that changes in land cover type (i.e., land cover type transitions calculated for each pixel) and persistent land cover (i.e., no change in land cover type) were significant predictors of landbird richness, abundance, and community stability. Persistent agriculture was associated with high community stability, richness and abundance, suggesting that past anthropogenic activities have substantially altered habitat such that generalist or human commensal species dominate these areas. In addition to the effects of persistent land cover, our results indicate land-cover change on only 1 – 3 percent of the landscape from 1992 to 2001 altered bird diversity in the conterminous U.S.

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ASSESSING WHETHER THE CORTICOSTERONE STRESS RESPONSE PREDICTS POST-FLEDGING SURVIVAL IN A TEMPERATE PASSERINE.

Post-fledging survival is a critical demographic rate, yet its measurement under field conditions can be difficult and labor-intensive. Researchers have used body mass at the time of fledging as a proxy for post-fledging survival, but this metric may not predict survival in all species. Corticosterone (CORT) is a hormone whose production increases under conditions of nutritional stress and may be useful in predicting songbird post-fledging survival. In this study, we tested whether baseline and restraint-induced CORT predicted post-fledging survival in the Swainson's Thrush (*Catharus ustulatus*). Nestlings were sampled for CORT shortly before fledging, fitted with a radio transmitter, and then monitored until death or movement from their natal area. Logistic regression analysis revealed that neither baseline CORT nor restraint-induced CORT were significant predictors of post-fledging survival. These results may be explained by the finding that the fledging stress response does not appear to be fully mature and may not function like that of adults. Based on our initial analysis, the CORT stress response may not accurately predict post-fledging survival, and additional physiological measures should be assessed in this regard.

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STARTING SMALL: POPULATION SIZE AND DISTRIBUTION OF THE PUAIOHI, AN ENDANGERED KAUAI ENDEMIC

The Puaiohi, or Small Kauai Thrush, has been on the Endangered Species list for more than a decade, yet information on the current population status and distribution of this single-island endemic has been very limited. We present the results of surveys undertaken between 2002 and 2006 within the current range, during which approximately 65% of stream corridor habitat was surveyed, which is the primary habitat type. We found that Puaiohi were distributed patchily across the Alakai plateau, with high density patches occurring in at least four different streams. The areas with the highest densities of individuals tended to occur in the uppermost reaches of the surveyed streams, although density was highly variable across the region. These findings dispel the idea that the Puaiohi's distribution can be represented by a core / periphery model. Instead, Puaiohi were closely associated with stream topographic features, which is likely related to a preference for nesting on vertical faces. We present population sizes estimated under different assumptions of pairing frequency, all of which are less than 1000 individuals in total.

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EFFECTS OF REPEATED TOUR BOAT PASSAGES ON THE PRODUCTIVITY AND POPULATION TRENDS OF BLACK-LEGGED KITTIWAKES

Eco-tourism is a growing sector in the travel industry across the globe and brings economic benefits to many rural communities. Seabird colonies are a particularly popular tourism destination, yet there is concern about the amount of human traffic that can be sustained at these sites. Starting in 1984, a tour boat industry emerged in communities adjacent to the Witless Bay Islands Ecological Reserve, in southeastern Newfoundland. Nowadays a mature tourism industry is in place, with upwards of 1000 passages annually. Due to the orientation and topography of Gull Island, tour boats only pass close to the west (landward) side of the island. From 1999-2009, kittiwake productivity was compared between visited and unvisited parts of Gull Island. Annual variation was pronounced, but overall the visited side of the island showed productivity values comparable or higher than unvisited areas. Similarly, population trends from 2001 to 2009 were not different among visited and unvisited sides of the island. At the current levels of boat traffic, from a production and recruitment perspective, kittiwakes are not obviously impacted by tour boat traffic at this colony.

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AVIAN REPRODUCTIVE FAILURE IN TROPICAL FOREST FRAGMENTS

Fragmentation of forest leads to biotic changes with consequences for forest-dwelling birds. A higher rate of reproductive failure is one consequence demonstrated frequently in temperate forests, but reproductive parameters in tropical forest fragments are difficult to measure. Key challenges include the large home ranges and overall rarity of many tropical species, the rapidity with which species sensitive to fragmentation disappear from fragments, and challenges of finding tropical bird nests. I summarize our current understanding of avian reproductive parameters in tropical forest fragments around world, indicate the primary logistical challenges we face in making progress on these important issues, and set an agenda for international collaborative research that can generate progress toward a better understanding of consequences of fragmentation for tropical forest birds.

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OLDER BUT NO WISER: THE IMPACTS OF BROWN-HEADED COWBIRD BROOD PARASITISM ON THE BREEDING PERFORMANCE OF FEMALE YELLOW WARBLERS

The brown-headed cowbird (*Molothrus ater*) is a generalist brood parasite known to lower the reproductive success of hosts. In many songbird species,

female age affects breeding productivity and older, more experienced breeders have higher reproductive success than younger females. We examined whether female age influenced the probability of being parasitized and the reproductive costs of brood parasitism in female yellow warblers (*Dendroica petechia*) breeding in Revelstoke, British Columbia in 2004-2009. Older females were as likely to be parasitized and accept cowbird eggs as younger females. Older females had larger clutches and higher fledging success than younger females, and cowbird parasitism reduced clutch sizes of all females by an average of 0.7 eggs and 1.4 fledglings. Sex ratios and the condition of nestlings in parasitized broods were the same as in unparasitized broods. We found little evidence that older females are able to mitigate the impacts of brood parasitism. The cumulative effects of cowbird parasitism reduced annual productivity of old females from an average of 2.7 to 1.7 fledglings, and young females from 2.0 to 0.3 fledglings.

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THE EFFECTS OF SUPPLEMENTAL FEEDING ON EASTERN BLUEBIRD FECUNDITY AND FLEDGLING SURVIVAL

We used supplemental feeding to test the effects of food abundance on Eastern bluebirds (*Sialia sialis*) during their breeding cycle and early fledgling period. Food abundance is a widely known factor which limits reproductive success. We evaluated the annual fecundity of females given a supplemental diet of mealworms (FED) compared to controls over two years on Spring Island, SC. During 2007 none of the control females (N=7) attempted a second clutch after a successful first brood, while 25% of FED females (2/8) attempted a second brood. Treatment groups did not differ in any other aspect of measured fecundity, nor did individual females returning in 2008 (N=8) respond to changes in food supply when placed in opposite treatment groups during the second year. Additionally in 2008, we used radio telemetry to monitor the survival rates and spatial use patterns of Control (N=10) and FED (N=11) fledglings. Control and FED fledglings did not differ in survival, natal home range, and distance traveled from the food resource, or spatial use. These results suggest that rates of food limitation vary by year.

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ABUNDANCE OF PAINTED BUNTINGS (*PASSERINA CIRIS*) IN AGRICULTURAL FIELDS ENROLLED IN THE CP-33 CONSERVATION RESERVE PROGRAM IN CENTRAL SOUTH CAROLINA

CP-33 is a Conservation Reserve Program (CRP) administered by the US Farm Service Agency. It is a habitat buffer practice targeted at Northern Bobwhite Quail Conservation. Evidence has shown that avian species other than Northern Bobwhite Quail may also benefit from this program. We examined the abundance of Painted Buntings (*Passerina ciris*) to determine if CP-33 could be beneficial to the management of this declining species. We compared bird abundance on paired fields (N=8), 4 of which had CP-33 buffers, 4 of which did not. The monitoring was done from May to August 2009 and was located in Clarendon and Sumter Counties in South Carolina. We observed Painted Buntings in forest fragments surrounding our fields significantly more than any other habitat, including CP-33 buffers as tested by an ANOVA, followed by a Tukey post-hoc test ($F=27.460$, $df=3$, $P<0.0001$). This suggests the surrounding land use/ land cover is more important for this species than the CP-33 buffers. Although these are only preliminary findings from year one, these data could aid management decisions in central South Carolina.

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INFLUENCE OF TEMPERATURE AND CLIMATE ON SPRING ARRIVAL TIME OF MIGRATORY BIRDS IN SOUTHERN CALIFORNIA

Climate change is predicted to influence arrival time on the breeding grounds which can in turn influence breeding success. We analyzed capture dates between April 1 and May 20 for five common migrant species (Yellow-breasted Chat, Black-headed Grosbeak, Pacific-slope Flycatcher, Least Bell's Vireo, Yellow Warbler) at two MAPS stations at Marine Corps Base Camp Pendleton to determine if arrival date of migrant birds breeding in southern California is influenced by temperature and climate. We calculated median arrival period and compared it to mean monthly temperature on wintering grounds and climate indices for North Atlantic Oscillation and El Niño Southern Oscillation during spring migration. Using linear regression, we found the median arrival period for Black-headed Grosbeak and Pacific-slope Flycatcher was correlated ($P\leq 0.10$) with all climate indices and Black-headed Grosbeak arrival was correlated with temperature in January. The median arrival period for Least Bell's Vireo was significantly correlated with mean temperature during migration (March-May). Temperature and climate indices can be used to detect which species show a response to changes in climate and may provide a tool for managing migrant species.

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A CLASSIC LIFE HISTORY PATTERN REVISITED: DAY LENGTH AND THE LATITUDINAL GRADIENT IN AVIAN CLUTCH SIZE

One of the most ubiquitous geographic patterns in apparently adaptive traits is the latitudinal gradient in clutch size of birds. While this pattern is well-known and widespread, its causes have remained contentious and unclear for over 80 years. Using a comparison of two temperate populations of tree swallow (*Tachycineta bicolor*) breeding across 25 degrees of latitude I show that one of the most commonly invoked explanations of the gradient – differences in food resources – does not explain differences in clutch size or total mass of chicks reared. In contrast, I find overwhelming support for a simple explanation of the latitudinal gradient: increased hours of daylight at high latitudes during the breeding season allow increased foraging time for parents. My approach provides an objective way to assess the relative importance of day length and food availability to the determination of the latitudinal gradient in clutch size in many additional bird species and my findings have implications for other efforts to tie life history patterns to their ecological and environmental drivers, especially with regard to shifting climate effects on ecological and evolutionary processes.

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APACHE CICADAS AS A POTENTIAL DRIVING FACTOR FOR YELLOW-BILLED CUCKOO POPULATIONS WITHIN THE LOWER COLORADO RIVER DRAINAGE

Western populations of the Yellow-billed Cuckoo (*Coccyzus americanus*) fluctuate annually along the lower Colorado River. Populations of the eastern subspecies have been shown to respond to fluctuations in periodical cicada populations (Koenig and Liebhold 2005). On the lower Colorado River, Apache cicada (*Diceroprocta apache*) emergence and Yellow-billed Cuckoo arrival both occur in mid June and their numbers decline in September. In 2009, we used two methods to quantify cicada populations at natural and restoration sites that were surveyed for cuckoo presence. Cicada numbers were compared with cuckoo detections to test whether there was a correlation. Within the lower Colorado River drainage both excuviae counts ($r^2=0.42$) and live cicada counts ($r^2=0.59$) were significantly correlated with the number of cuckoos detected at natural sites. At restoration sites, no significant relationship was found in 2009 using either method. Ongoing monitoring

will continue to detect fluctuations in cicada populations, in addition to other variables that may contribute to annual variation in cuckoo numbers.

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PHENOLOGY MONITORING ACROSS TAXA TO TRACK RESPONSE TO CLIMATE CHANGE: AN EMERGING EFFORT AT THE USA NATIONAL PHENOLOGY NETWORK

Patterns of phenology for plants and animals control ecosystem processes and affect food production, health, conservation, and recreation. Although phenological data and models have broad applications, until recently there was no coordinated effort to understand phenology at the national scale in the United States. The USA National Phenology Network (USA-NPN; www.usanpn.org) is an emerging and exciting partnership between federal agencies, the academic community, and the general public to establish a national initiative focused on phenology as a tool to understand how plants, animals and landscapes respond to climate variation and change. In March 2009, the USA-NPN released a plant monitoring program, followed this spring by the release of an animal monitoring program. As a first step towards integration with historical datasets, the USA-NPN recently joined forces with the North American Bird Phenology Program, an effort to digitize six million cards documenting 90 years of migratory bird arrivals. Future directions include integration with national and international, formal and informal science networks; enhancing availability of remote sensing phenology products; and improvement of tools for contemporary and historic data entry, download and visualization.

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IMMEDIATE CONSERVATION PRIORITIES FOR PREVENTING LOSS OF AVIFAUNAL DIVERSITY THE TRI-NATIONAL SCALE

Assessment of conservation vulnerability across 882 native landbird species that breed in Canada, USA, and Mexico identified 147 species in need of immediate conservation action to prevent extinction or extirpation from North America. For 60 species at greatest risk, high or severe threats are exacerbated by small global populations and very limited distributions. Most are Mexican endemics and are concentrated in tropical dry and highland forests. An additional 44 Meso-American forest species and 24 widespread South American species are at the northern limit of their distribution in southern Mexico, where populations are highly threatened. The remaining 19 species with high threats and declining populations are widely distributed in temperate and boreal forests, grasslands, and aridlands. The most critical conservation actions to prevent loss of the continental avifauna include (1) increased support for a network of protected areas in Mexico, linked to forest reserves throughout Central and South America; (2) implementation of endangered species recovery plans in each country; and (3) community-based conservation initiatives and land-use policies that promote sustainable agriculture, forestry, and energy development, and that limit urban sprawl.

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IDENTIFYING INDIVIDUAL CANADA GEESE IN THE HUDSON RIVER BIRDSTRIKE

Shortly after USAirways Flight 1549 crash-landed into the Hudson River on 15 January 2009, bird remains were submitted to the Feather Identification Lab, Smithsonian Institution in Washington DC for analysis. Using molecular technology, morphological tools, and hydrogen isotope analysis, it was previously determined that migratory Canada Geese (*Branta canadensis*) were involved in this accident. Further investigation to determine

how many individuals were ingested into each engine was performed by the CCEG. Using available microsatellite and mtDNA control region markers we analyzed 24 samples from the wreckage to determine the number of individual birds. In addition, the mtDNA markers indicate that these birds fell within the clade containing large Canada Geese subspecies. This study represents the first attempt to use microsatellite markers in an applied manner in an aircraft mishap investigation. These analyses underscore the utility of highly variable markers such as microsatellites and mtDNA control region for identifying specific individuals in bird-strikes, and provides vital detailed information for use by aviation officials and engine manufacturers for the design of safer aircraft.

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METAPOPULATION ECOLOGY OF A RARE TEXAS SUBSPECIES.

Habitat fragmentation is particularly severe in the Lower Rio Grande Valley (LRGV) of south Texas where an estimated 95% of the native brushland has been affected by agricultural and urban development. This fragmentation effectively divides bird populations into smaller "subpopulations within a population", or a metapopulation. A good model for studying the effects of fragmentation in the LRGV is the Brownsville Common Yellowthroat (*Geothlypis trichas insperata*), a subspecies of the Common Yellowthroat. Its distribution is restricted to the southern region of Cameron County, Texas and possibly in adjacent north Tamaulipas, Mexico. Blood samples were collected from captured individuals (n=128) for genetic microsatellite testing. These data were used to examine parent-offspring relationships, test for heterozygosity as well as explore immigration and emigration patterns between subpopulations in the LRGV. Because the Brownsville Common Yellowthroat utilizes wetlands as their primary habitat, I hypothesized that the Rio Grande River acts as a corridor for this species. As a result, individuals and subpopulations occurring on or near the Rio Grande should be more closely related and less so for northern subpopulations.

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THE PHENOLOGICAL PLASTICITY OF RAPTOR MIGRATION

The timing of life history traits has received considerable attention in recent years for its responsiveness to changes in climate. To understand how the phenology of migration changes over time and how it relates to environmental and phenotypic variables, I studied 12 species of raptors during a period of 17 years from a locality in Mexico. I used multiple metrics to quantify interannual change under two different views: (1) a single-species approach, examining variation in curve-shape parameters and (2) a species-assemblage approach, measuring the pattern of temporal succession of species, dominance, turnover, and deviations the sequential position found in a typical season. In spring, more species show bimodal distributions with a trend of increasing peakedness. The complete assemblage shows a temporally aggregated pattern with unclear single-species dominance over the length of the season. During the autumn, more species have normal distributions and turnover shows clumped patterns that denote successional dominance during migration. In both seasons, the timing of species is highly plastic and directional; deviations from the typical season range from -3.1 to -11.8 days (earlier) in spring and 2.3 to 8.5 days (later) in the autumn. The influence of extrinsic variables has been shown to advance/delay events such as the timing of migration in birds; the study of phenotypic correlates contributes to our understanding of the mechanisms that govern these seasonal events.

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PHYLOGENETIC DESCRIPTION OF THE THREE NORTH AMERICAN CARDUELIS RADIATIONS

Eurasian siskin (*C. spinus*, Eurasia) could be the ancestor of all American Carduelis finches. 3 North American Carduelis radiation have been identified.

Pine siskin radiation comprises siskin, Antillean siskin, black-capped siskin, pine siskin and pine siskin perplexus. *C. spinus* could have passed to America through the Beringia or Greenland coast. During Pliocene Epoch, *C. spinus* reached the Antilles and evolved into Antillean siskin (*C. dominicensis*), endemic to Hispaniola Island. It could be ancestor Pine siskin which thrives in North America from Alaska to Guatemala since about 0.2 MYA. It lives below the Mexican Isthmus in the highlands from northern Chiapas (Mexico) to western Guatemala. Black-capped siskin (*C. atriceps*) is a "sister" species of *C. pinus*, with which it shares territory. North American goldfinch radiation includes *C. tristis* (American goldfinch), *C. psaltria* (lesser goldfinch), and *C. lawrencei* (Lawrence's goldfinch). They all thrive in western United States and Mexico, down to northern South America. *C. psaltria* is a North American bird that colonized South American habitats and evolved into darker head and back. South American siskin radiation. Parental *C. notata* thrives in Mexican mountains and successfully colonized South America about 3 MYA giving rise to this radiation. South American *Carduelis* radiation occurred only when mesothermal plants from the Rocky Mountains invaded the Andean spine after emergence of the Panama Isthmus.

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EFFECTS OF INCUBATION PATTERNS OF RED-WINGED BLACKBIRDS: NESTLING QUALITY AND NEST SITE SELECTION

We investigated both the effects of nest site selection to incubation patterns and the effects of incubation patterns on nestling quality in Red-winged Blackbirds (*Agelaius phoeniceus*) nesting in mixed-grass prairie of central Nebraska using I-buttons (Maxim, Sunnyvale, CA). We measured incubation efficiency (percent time female detected incubating) from 2000 to 0800, and incubation bout durations and departure rates (departures/hr) from 0600 to 0800 from 29 hatched nests. We found no significant difference in incubation patterns related to nest site selection among upland grassland (11), sedge tussocks (9), and lowland grassland (9) nesting habitats. We quantified nestling quality using measurements of mass, gape, flange and tarsus from day 7 nestlings in 15 fledged nests. Variation in incubation efficiency only significantly influenced nestling gape size, but not mass, flange, or tarsus measurements. Variations in both bout duration and departure rate significantly affected both nestling mass and gape, implying a stronger relationship with nestling quality. Though bout duration did not significantly affect flange and tarsus, it did show a similar trend. Departure rate showed a similar trend for flange, but not tarsus.

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INFORMATION GAPS ON LIMITING FACTORS AND OTHER CRITICAL RESEARCH NEEDS FOR LANDBIRD CONSERVATION

The Partners in Flight (PIF) "Saving our Shared Birds" document to be released in 2010 and PIF International Conference proceedings from McAllen, TX identify research required to support the conservation of North American landbirds. They include three broad, high priority research areas: (1) filling crucial gaps in our knowledge of the ecology, life history, and limiting factors for priority bird species; (2) studying effects of human actions on birds and habitats of conservation concern; and (3) socio-economic research related to bird conservation. Additionally, modeling is a critical tool for addressing many research needs and for conservation planning and design. Examples of high-priority research needs from a continental perspective include identifying seasonal connectivity for full life-cycle conservation of migratory species, comparing habitat needs of wintering migrants and highly threatened endemic species in tropical forests, and modeling species' response to climate change and other large-scale stressors. Scientists and managers from all three countries (Canada, USA, and Mexico) must work together to apply these general research priorities to a local or regional level, conduct collaborative research, and disseminate the information to end users.

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 EFFICACY OF COMMUNITY-BASED SCIENCE IN THE CONSERVATION OF SNOWY PLOVERS AND LEAST TERNS IN LOS ANGELES COUNTY, CALIFORNIA

From 2007 through 2009, Los Angeles Audubon collaborated with project biologists and management agencies to coordinate volunteers to monitor and restore habitat for Snowy Plovers (*Charadrius alexandrinus*) and Least Terns (*Sternula antillarum*) on Los Angeles County beaches. The goals of the project were to (1) enhance the data-gathering capacity of projects staffed by only 3-4 biologists; (2) to engage the public in community-based science as a means of encouraging support for these threatened and endangered species in the highly urbanized setting of Los Angeles. More than 80 volunteers participated in Snowy Plover and Least Tern monitoring; volunteers contributed over 1,440 hours to plover monitoring, over 450 hours to tern monitoring, and 1,360 hours to habitat restoration. Volunteers proved highly effective in gathering data on target species' population size, location, and behavior, and greatly enriched the data set by noting threats to target species, such as human and predator use patterns. By also coordinating habitat restoration opportunities, we were able to engage a broad spectrum of the public, including public school children, experienced birders, and local beach communities.

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STATUS AND CONSERVATION OF SNOWY PLOVERS ON LOS ANGELES COUNTY BEACHES.

Prior to 1945, the Snowy Plover (*Charadrius alexandrinus nivosus*) was common and nested on beaches throughout Los Angeles County. However, increased human recreation brought increased predators, off-leash dogs, beach grooming and driving. This reduced the ability of Snowy Plovers to nest and roost on LA County beaches. Here, we assessed the status of the non-breeding population of Snowy Plover on LA County beaches using community volunteers. We found that 250-330 Snowy Plovers overwinter at six roosting sites. Roosting area averaged 319 m x 75 m placed on the dry beach. They arrived in July and departed in May. Between 2004 and 2009, the population has declined, and tended to decline between fall and spring. We observed vehicle strikes, flushing of roosting birds, and removal of kelp wrack, all of which may contribute to these declines. We recommend the use of protected areas and enclosures, reducing driving and vehicle speed, altering beach cleaning practices, and enforcement of existing dog regulations.

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GEOGRAPHIC VARIATION AND FLEXIBILITY IN SPATIAL NEEDS OF THE YELLOW-NAPED AMAZON (AMAZONA AUROPALLIATA) IN COSTA RICA

Many parrots range over wide areas, and may present great adaptability to local conditions when dispersing. We evaluated geographic variation in spatial needs of the Yellow-naped Amazon (*Amazona auropalliata*) at three sites in Costa Rica. We also tested the ability of translocated birds to match local birds' movements after simulated dispersal. We tracked 25 local birds and 28 translocated birds using radio telemetry. We found geographic variation among sites for Minimum Convex Polygon (MCP) 100% (H2,21=17, P<0.001), MCP95% (H2,21=15.6, P<0.001), core areas (H2,21=14.9, P<0.001), feeding-site fidelity, daily distance traveled, and core area overlap for local individuals. This variation is likely due to differences in habitat type and resource dispersion among the three sites. The 49% core areas overlap of translocated parrots with local birds was larger than the 27% overlap of local birds to each other. Our results highlight the plasticity in ranging patterns exhibited by this species. Such plasticity is likely driven by social interactions, such that the behavior of a local parrot population is a critical cue used by dispersing birds to locate key local resources.

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VULNERABILITY OF NORTH AMERICAN BIRDS TO CLIMATE CHANGE

The 2010 U.S. State of the Birds Report presents a comprehensive summary of vulnerability of bird species to climate change in the United States. Vulnerability is assessed for 720 species based on adaptability to change in 5 characteristics: migration, habitat dependence, dispersal ability, niche specialization, and reproductive potential. We combined these scores with a habitat susceptibility ranking to identify species-habitat groups predicted to be at risk from climate change. Summary of species vulnerability are presented for habitat-based species groups as well as for some secondary species groups such as urban species. Within these groups, species identified as Watchlist species are analyzed to determine whether species already at risk are more likely to be vulnerable to climate change. Monitoring the status of these species will allow us to refine our understanding of bird responses to climate change. Monitoring data from large-scale surveys exist for 68 % of North American bird species, but some groups are largely unmonitored. We recommend that survey designs and analyses be tailored to facilitate evaluation of climate change effects on bird populations.

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AUTUMN MOVEMENTS OF MIGRATING WOODPECKERS ALONG THE QU BEC NORTH SHORE AS DOCUMENTED BY CAPTURE AND VISUAL OBSERVATIONS

We compared standardized visual counts and capture rates of woodpeckers at the Observatoire d'oiseaux de Tadoussac (OOT) at Tadoussac, Qu bec. Non migratory species (Arctic Three-toed (*Picoides trydactylus*), Black-backed (*P. arcticus*) and Hairy woodpeckers (*P. villosus*)) were more numerous at the coastal survey site whereas the migratory Northern Flicker (*Colaptes auratus*) and Yellow-bellied Sapsucker (*Sphyrapicus varius*) were more common at the inland survey site. Only non migratory species were captured and numbers of individuals captured were proportional to numbers detected visually. As most captured birds were hatching year (HY) birds (>96%), fluctuations in numbers between years reflect productivity. We hypothesize that resident species disperse radially and concentrate along the St. Lawrence River northern shore. In migratory species, both young and adults migrate directionally explaining why they are not more numerous along the St. Lawrence. Sex ratios of immature woodpeckers (% males) varied between years ranging from 37-60% in Black-backed Woodpeckers and from 46-82% in Arctic Three-toed Woodpeckers. Reasons for this variation are unknown.

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CAPTIVE BREEDING AND RELEASE OF LOGGERHEAD SHRIKES IN SOUTH EASTERN ONTARIO: INSIGHT INTO A CHALLENGING AND COMPLEX CONSERVATION INITIATIVE

In 1997 and 1998, 48 Loggerhead Shrikes (*Lanius ludovicianus migrans*) were taken from the wild to preserve genetic diversity. By 2008, ~ 500 surplus young had been released at three different locations. Return rates of released birds and of the wild population have been closely monitored ever since. The number of shrikes recruited into the population was positively correlated with the winter Northern Atlantic Oscillation index (NAO) and the reproductive success of wild birds with the spring NAO index. A positive NAO index reflects mild conditions on wintering areas. Released birds integrated into breeding populations at various distances from their release site (eight < 50km, four 190km and one 253 km). Thus survival and return rates are likely underestimated. Current estimates of return rates of released young surviving to migration are: in 2006, 8.4%, in 2007, 10.5% and in 2008, 5.2%. Knowledge acquired in this complex conservation initiative will improve the design of the migrans subspecies captive breeding and release program, help design better programs for other shrike populations, and eventually for other migratory passerines.

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ORIGIN AND MAINTENANCE OF THE CIRCUM-AMAZONIAN DISTRIBUTION: INSIGHTS FROM ENVIRONMENTAL NICHE MODELING AND IMPLICATIONS FOR BIOGEOGRAPHY

The circum-Amazonian distribution occurs in a variety of avian and non-avian taxa and begs inquiry into the origin and maintenance of this unique distributional phenomenon. This distribution extends across, through, or on the edge of major biomes that are highly differentiated floristically. We use environmental niche modeling to evaluate the hypothesis that climatic conditions during the last glacial maximum provided more suitable habitat and greater interconnectivity among several circum-Amazonian groups relative to present distributions. We also review the evolutionary backgrounds of taxa that have this distribution, and consider the implications of their varying geographical and temporal origins. Our results indicate that periodic expansions and contractions of non-Amazonian forest with which circum-Amazonian taxa are often associated have been instrumental in establishing and maintaining this distributional trend and that taxa with this pattern have diverse historical backgrounds.

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HOME RANGE AND HABITAT USE OF BREEDING COMMON RAVENS IN REDWOOD NATIONAL AND STATE PARKS, CALIFORNIA.

Understanding the relationship between nest predator ecology and predation risk can increase our ability to conserve sensitive species and make effective management decisions. Very little is known about the distribution and habitat use of breeding Common Ravens (*Corvus corax*) in Redwood National and State Parks (RNSP) despite their identification as important nest predators of Marbled Murrelets (*Brachyramphus marmoratus*). We used radio telemetry to examine home range and habitat use of breeding Common Ravens (N=3) in RNSP during the 2009 breeding season. We used fixed-kernel density estimates to determine utilization distributions, estimate home range and core-use areas. We calculated resource utilization functions to examine habitat use within home ranges. Average home range was 296 ha and average core-use area was 57 ha. Common Ravens utilized old growth, prairie, and human-use habitats

most frequently. Edges between forest and non-forest habitats and along roads were also areas of high concentration. Better understanding of Common Raven space and habitat use will assist in implementation of management changes to enhance the nesting success of Marbled Murrelets in RNSP.

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COLD, BUT NOT WARM TEMPERATURES AFFECT ONSET OF INCUBATION AND HATCHING FAILURE IN HOUSE WRENS

Understanding the patterns and mechanisms underlying expression of avian life history traits, including latitudinal and seasonal trends in variation in the onset of incubation and clutch size, will shed light on the degree of and limitations on plasticity of avian responses to environmental change generally, and global climate change in particular. In order to evaluate the behavioral responses of female House Wrens, *Troglodytes aedon*, to variation in ambient temperatures, I tested the predictions of the egg viability, egg hypothermia, energy constraints, and clutch cooling hypotheses. I assessed early onset as a strategy to counteract negative effects of temperature on egg viability, and evaluated to what degree temperature is an environmental constraint affecting parental behavior. The probability of early onset decreased during colder ($\leq 16^{\circ}\text{C}$) weather, but did not vary significantly with increased pre-incubation temperatures above physiological zero. Clutch size did not vary significantly with ambient temperature. Partial hatching failure within a clutch and the per-egg probability of not hatching increased with the time pre-incubation temperatures were at or below 16°C , but did not vary with pre-incubation temperatures 24°C or above.

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IMPACTS OF RESIDENTIAL IRRIGATION ON URBAN BIRD DIVERSITY: A GUILD-BASED ANALYSIS

The availability of water is arguably the most important landscape factor, particularly in arid climates. Homeowner decisions made regarding irrigation are likely to have a direct effect on bird species richness. We hypothesize that neighborhood socioeconomic status influences residential irrigation intensity, which influences plant cover, in turn influencing bird diversity and abundance. Preliminary data from the Fresno Bird Count, a citizen science project, show that spatial variation in bird diversity is best explained by a multivariate model including significant negative correlations with % building and grass cover, and positive correlations with interactions between irrigation intensity, median family income, and grass height. Additional analysis of bird guilds and habitat variables will provide a better picture of how urban landscapes including irrigation affects bird communities. We will discuss implications of our findings for urban water management policies in general and for Fresno's planned switch to metering water use in 2013. Understanding water management is thus critical for both a deeper theoretical understanding of urban ecosystems and creating effective urban policy.

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WOMEN IN CELL BIOLOGY: A RESOURCE FOR PROFESSIONAL DEVELOPMENT

Women in Cell Biology (WICB), currently a committee of the American Society for Cell Biology (ASCB), sponsors activities at the annual meetings, including Junior and Senior Awards, followed by an evening program on some topic germane to being a scientist, a Career Lunch Table program where persons self-select to talk to those with experience on a wide range of topics (e.g. teaching at liberal arts colleges, the shift from academia to biotechnology, dual-career partnerships), and professionally led workshops on such topics as conflict management. Monthly columns, produced for the ASCB Newsletter, address the WICB mandate, which is to consider and nurture the human side

of being a cell biologist. Two collections of WICB columns, called Career Advice for Life Scientists, have been published Volume I and Volume II. The WICB website is geared to serve as a resource for women and men at all stages in their scientific trajectories. (Information from the WICB Web site).

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HABITAT SELECTION IN AN UNCERTAIN WORLD: PRIVATE AND PUBLIC INFORMATION AND THE INFORMED BIRD

One of the most important decisions a bird makes is where to breed. The decision is challenging because birds live in a spatially and temporally heterogeneous world. Information reduces uncertainty associated with breeding outcomes and hence should guide habitat selection. We discuss several information sources (e.g., pre-and post-breeding cues) and mechanisms of updating (imprinting, Bayesian) from the literature and our own work on ground-nesting songbirds. Accumulating empirical evidence shows that birds respond to predator cues to bias settlement towards areas of low nest predation risk. Second, we use signal detection theory to examine habitat selection when habitats vary in nest predation rates and birds use their individual nest success or failure as a cue of habitat quality. We show how Bayesian updating links reproductive behavior and productivity in one habitat to qualitative and quantitative changes in another. Breeding likewise samples a habitat for potential future occupancy. The resulting temporal patterns of habitat selection may affect population dynamics and provide insights into the decision-making behind dispersal or site fidelity.

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USING WOODPECKER OCCURRENCE TO IMPROVE OCCUPANCEY MODELS FOR FLAMMULATED OWLS (*OTUS FLAMMEOLUS*): THE ROLE OF BIOTIC FACTORS IN MODELING AVIAN HABITAT

We investigated whether the inclusion of biotic interactions improve performance of occupancy models for cavity nesting owls in the Boise National Forest. Specifically, we asked if including woodpeckers, which excavate potential nesting cavities for a variety of species, improved predictions of Flammulated Owl occurrence. To locate owls we broadcasted conspecific vocalizations during nighttime hours at point-count locations (N=83). We surveyed for woodpeckers at these same locations during daylight hours in a similar manner playing broadcasts for Northern Flicker (*Colaptes auratus*), Lewis's Woodpecker (*Melanerpes lewis*), Hairy Woodpecker (*Picoides villosus*), Pileated Woodpecker (*Dryocopus pileatus*), and Red-naped Sapsucker (*Sphyrapicus nuchalis*). We compared models fitted with two sets of variables: (1) a suite of landscape and stand-level measurements, and (2) landscape and stand-level measurements with the addition of woodpecker presence. The best regression models were selected using AIC. We found the presence of Hairy Woodpeckers was the best predictor of owl occurrence. Our research suggests that inclusion of biotic interactions improves models of Flammulated Owl occurrence and could provide a novel means for assessing owl abundance.

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EFFECTS OF FOOD AVAILABILITY ON REPRODUCTION AND SURVIVAL IN THE FEDERALLY ENDANGERED SOUTHWESTERN WILLOW FLYCATCHER (*EMPIDONAX TRAILLII EXTIMUS*)

We studied effects of variation in arthropod availability on patterns of reproduction and survival in the federally endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*) to assess whether long-term changes in food resources have driven a local population decline. We collected arthropods from eight malaise traps in California's South Fork Kern River Valley between 1997 and 2005, a period in which the local breeding population declined by more than 50%. The dry mass of arthropod samples varied significantly among traps, across the breeding season, and among years. Despite a small decline over the course of the study, arthropod availability did not appear to limit

reproduction or survival. Southwestern Willow Flycatchers bred earlier when and where arthropods were abundant but earlier breeding did not translate into greater reproductive success. Return rates of adults and fledglings were not associated with variation in arthropod availability. Our results suggest that food availability does influence flycatcher decision-making early in the breeding season but that other factors play a dominant role in determining individual productivity and survival as well as population dynamics.

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FACTORS AFFECTING THE REPRODUCTIVE SUCCESS OF AMERICAN OYSTERCATCHERS IN NORTH CAROLINA

We took an information-theoretic approach to the analysis of factors affecting the survival of American Oystercatcher nests and broods in North Carolina. Variation in survival was evaluated with respect to nesting island, year, time of season, brood age, distance to tide, presence of off road vehicles, and proximity of foraging habitat. Nest survival was affected by year and island, and declined over the season. There was some evidence that vehicle traffic had a negative impact on nest survival. Mammalian predators accounted for 54% of identified nest failures, while storms cause an additional 29%. Human disturbance directly caused only 3% of identified failures, but disturbance may have increased the risk depredation. Brood survival varied by island and increased non-linearly with age. Proximity of food resources had a direct positive effect on brood survival, while off road vehicles had a negative effect. Vehicles caused direct mortality and affected chick behavior. Chicks on closed beaches spent less time hiding than chicks on beaches with vehicles. Predators were identified by radio tracking individual chicks, and included Great-Horned Owls, Crows, Cats, Mink, Raccoons, and Ghost Crabs.

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WESTERN SANDPIPERS (*CALIDRIS MAUR*) ON THE BREEDING GROUNDS: EVIDENCE FOR POPULATION DIFFERENTIATION?

Western Sandpipers are long-distance migrants that breed in Western Alaska and Eastern Siberia and winter along the Pacific and Atlantic coast from southern North America to northern South America. Across this non-breeding range, Western Sandpipers show differences in morphology and life history strategies. We are investigating whether breeding population differences may explain some of the observed variation. We sampled adults at several breeding sites in Alaska and are conducting analyses on genetic, morphological and acoustic data. Analyses to date found some significant differences in wing and tarsus length in females, but no clear genetic differentiation among sites. Male songs had the same general structure (several introductory notes followed by a trill), but showed significant differences among sites in frequency and bandwidth characteristics. The peak frequency of the initial part of the trill increased with latitude and differed significantly between southernmost and northernmost sites. In addition, the bandwidth of the trill and one introductory note were significantly smaller at the northernmost site. As shorebirds do not appear to learn songs, these differences may indicate population differentiation.

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FACTORS ASSOCIATED WITH LANDBIRD OCCUPANCY AND SPECIES RICHNESS ACROSS VERMONT, USA

Although much research has focused on how individual bird species respond to landscape composition and structure, less is known about how patterns of species richness emerge from the collective responses of species, particularly across gradients of human-induced landscape change. We estimated landbird species richness across the state of Vermont by summing predictions from occupancy models for 97 bird species. Of the landscape variables we examined, distance to edge had the strongest effect on species richness. Richness peaked in ecotones and declined away from edges, especially in nonforested sites. Considering other landscape variables, species richness

peaked at intermediate levels (65%) of percentage of surrounding forest and was positively but weakly related to road density and percentage of coniferous forest. Contrary to previous studies, we did not find that occurrence patterns of common species were more highly correlated with species richness than less common species. The relatively uniform predicted species richness suggests both flexibility of the bird community in responding to a diversity of landscape types and strong constraints limiting the number of species that can be supported per site.

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CONSERVATION-RELIANT BIRDS: OUR NEW RELATIONSHIP WITH NATURE

The recovery (delisting) of a threatened or endangered species is often accompanied by the expectation that conservation management of the species will no longer be necessary. However, the magnitude and pace of human impacts on the environment make it unlikely that substantial progress will be made in delisting many species unless the definition of "recovery" includes some form of active management. Preventing delisted species from again being at risk of extinction may require continuing, species-specific management actions. We characterize such species as "conservation-reliant" and suggest that viewing recovery as a continuum of states rather than as a simple recovered/not recovered dichotomy may enhance our ability to manage such species within the framework of the Endangered Species Act. We review the status of conservation-reliant birds, the scale of needed recovery actions, and identify management programs needed to provide regulatory assurances necessary for delisting. With ongoing loss of habitat, disruption of natural disturbance regimes, and increasing impacts of non-native invasive species, the number of conservation-reliant species is likely to increase.

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INTEGRATING BIRD HABITAT SUITABILITY INDICES INTO A CONSERVATION PLANNING FRAMEWORK FOR THE SAN JOAQUIN RIVER, CALIFORNIA

Ecological restoration and conservation may be enhanced by using ecologically-based methods for prioritizing actions. We used bird habitat suitability models developed for the entire Central Valley of California to describe the habitat quality of 18 reaches of the San Joaquin River to 1) rank the habitat quality of the reaches and 2) compare these rankings to independently derived evaluations of wildlife habitat. For each reach, we averaged habitat suitability scores for multiple species to provide an aggregate measure for three species groups: Marsh Birds, Early-successional Riparian Birds, and Mid/Late-successional Riparian Birds. We found little evidence that the rankings of the 18 reaches for the three species groups were correlated, suggesting that any prioritization decisions will need to consider habitat suitability for all three groups of birds, rather than one group acting as a surrogate for the others. Of the three species groups, rankings from the Early-successional species group were most strongly correlated with the independent measure of existing habitat quality.

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WESTERN YELLOW-BILLED CUCKOO HOME RANGE, HABITAT USE, AND MIGRATION STUDIES ON THE MIDDLE RIO GRANDE, NEW MEXICO.

The Bureau of Reclamation has been recording casual detections of Western Yellow-Billed Cuckoos (*Coccyzus americanus occidentalis*) on the Middle Rio Grande in central New Mexico since 1998. Formal surveys were initiated in

2006, in an attempt to estimate territory sizes, distribution, and abundance of Western Yellow-Billed Cuckoos within this system. In 2007 and 2008, a radio telemetry-based home range and habitat use study (n=10) was implemented. In 2009, Western Yellow-Billed Cuckoos were captured and fitted with Geolocators (n=13) in an effort to document migration corridor utilization and wintering areas. Survey data indicate Western Yellow-Billed Cuckoo territory numbers have increased on the Middle Rio Grande annually since 2006. Telemetry-based home range estimates of Western Yellow-Billed Cuckoos along the Middle Rio Grande were determined to be variable (range: 5-282 ha), with an average size of 81.6 ha. The home ranges of these birds were not always associated with surface water, but were always associated with some percentage of native vegetation overstory or native overstory / aggregate understory vegetation type. Work continuing in 2010 will involve attempting to recapture those Western Yellow-Billed Cuckoos instrumented with Geolocators for data recovery and subsequent wintering ground delineation.

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POPULATION RESPONSES OF COMMON RAVENS TO REINTRODUCED GRAY WOLVES

Common Ravens (*Corvus corax*; raven) are opportunistic scavengers widely distributed throughout the western United States. Local scale increases in raven populations may impact threatened prey populations. While ravens have increased in response to anthropogenic subsidies, they also scavenge from carnivore kills and have a close, coevolved relationship with the gray wolf (*Canis lupis*; wolf). The wolves' reintroduction to the Greater Yellowstone Ecosystem in 1995, and their subsequent expansion throughout large portions of the west, may contribute to increasing raven populations. We investigated the relationship between ravens and wolves in Yellowstone National Park and northern Idaho, before and after wolf reintroduction. The results suggest that wolves in Yellowstone may help sustain a larger raven population than prior to reintroduction. This local increase, not yet reflected at larger scales, may not be detectable using existing broad scale survey methods (e.g. Breeding Bird Survey). Our results, in addition to declining prey populations in areas of human development, highlight the need for a better understanding of broad scale raven population dynamics. Specialized surveys will be needed to better track trends in this wide-ranging bird.

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PREDATION, LANDSCAPE CHANGE AND LONG-TERM DECLINE IN RECRUITMENT OF BRANT

Black Brant (*Branta bernicla nigricans*) on the Yukon-Kuskokwim Delta have declined > 50% since 1980. Adult survival is high (0.89); declines are a result of low recruitment. We used individuals captured during breeding to estimate number of recruits entering the breeding population, 1989-2007. Number of recruits exceeded 800 in 1989 but declined to < 100 by 2003. Pradel temporal symmetry capture-recapture models confirmed that recruitment declined 86% between 1989 and 2007. Number of recruits was positively related to nest success 2 years earlier (P<0.001) and first-year survival (P<0.0002). First-year survival was, in turn, strongly influenced by food abundance for goslings. Foods required by goslings for rapid growth (grazing lawns) are maintained by grazing by geese, and years of poor nesting cause loss of grazing areas for future goslings. Consequently, predation on nests, by arctic foxes (*Alopex lagopus*), had direct effects on recruitment by reducing the number of eggs that hatched, and indirect effects on recruitment by reducing food for future goslings, which reduced growth rates and first-year survival. Consequently, in recent years recruitment has been low, even in years of high nest success.

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EFFECTS OF URBAN NOISE ON AVIAN SONG

We examined the extent to which acoustic noise in urban environments influences song characteristics and singing behavior of Northern Cardinals (*Cardinalis cardinalis*) and American Robins (*Turdus migratorius*). We predicted that, in response to loud noise, birds would improve signal transmission by (1) increasing singing rate and (2) adjusting song characteristics such as pitch and length. From May – July 2006, 42 cardinals and 53 robins were recorded in forests located within four acoustic environments in central Ohio: rural, residential, commercial, and highway. Following each recording, we measured ambient noise level and recorded information describing location, weather, habitat, and conspecific presence within 75 m. As predicted, frequency range was positively correlated with noise level for both species, but neither song length nor rate was related to noise level for either species. These data support the idea that anthropogenic noise influences avian singing behavior and acts as a selective force in urban areas.

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BIRD FUNCTIONAL DIVERSITY IN TROPICAL FOREST AND AGRICULTURAL ECOSYSTEMS

Although most bird species avoid agricultural areas, nearly a third of all birds occasionally use such habitats, often providing important ecosystem services like pest control, pollination, and seed dispersal. Combining literature review with a meta-analysis of world's birds, I compared tropical bird species that prefer forests, agricultural areas or both, with respect to body mass, diet, habitat and resource specialization. Compared to primary forests, in agro-forests species numbers of large frugivorous and insectivorous birds (especially terrestrial and understory species) often decline. In contrast, nectarivores, small-to-medium insectivores (especially migrants and canopy species), omnivores, and sometimes granivores and small frugivores do better, frequently by tracking seasonal resources. However, changes in guild species numbers do not necessarily translate to changes in relative abundance, biomass or function, and more studies are needed to quantify these important measures. The findings suggest that the replacement of forests and agro-forests with simplified agricultural systems can result in shifts towards less specialized bird communities with altered proportions of functional groups. These shifts can reduce avian ecosystem function and affect the ecosystem services provided by birds in agricultural landscapes.

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ANCIENT DNA REVEALS INTROGRESSION ACROSS A CLASSIC AVIAN HYBRID ZONE

Increasingly, studies of genetic variation across hybrid zones demonstrate that the evolutionary dynamics within these zones are more complicated than once thought. An ornithologically classic hybrid zone occurs in North America between the Bullock's (*Icterus bullockii*) and Baltimore Orioles (*I. galbula*) (Sutton 1938). Sibley and Short (1964) provided the first in-depth investigation of this zone via their collection and scoring of hundreds of specimens. As a part of my undergraduate honors thesis at Cornell University, I am investigating the molecular genetics of this zone using ancient DNA methods applied to their 705 specimens. I have developed and am using mtDNA markers to investigate the pattern of mtDNA introgression across the hybrid zone; my preliminary results based on >400 specimens suggest that the mtDNA and plumage clines are highly coincident. Ultimately this study will incorporate cline-based analyses of autosomal and sex-linked markers using similar ancient DNA techniques.

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SPACE USE AND HABITAT SELECTION OF LONG-BILLED CURLEWS IN CALIFORNIA'S CENTRAL VALLEY

A significant number of the world's population of Long-billed Curlews (*Numenius americanus*) winter in California's Central Valley amidst a variety of human-altered habitats. We studied the movements and habitat selection of Long-billed Curlews (N=10, 5 male and 5 female) during two non-breeding seasons. Individual curlews differed greatly in their use of space with home ranges varying from 1,200 to 13,500 ha. We used core use areas (50% probability of utilization distribution) to examine third order habitat selection using compositional analysis. Curlews selected a variety of agricultural habitats, including flooded alfalfa, grains, pastures, and some semi-natural wetlands. They tended to occur in areas of lower road densities, suggesting that road-side monitoring might inadequately represent both habitat use and population estimates.

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THE COSTS OF AN IMMUNE CHALLENGE ON EGG PRODUCTION IN THE ZEBRA FINCH (*TAENIOPYGIA GUTTATA*)

Although the immune response provides important defense from infection, activation of the immune response may induce trade-offs between fitness components. The cost of diverting limited resources from other physiological functions to the immune response may be measured as a reduction in growth rate, elevation of metabolic rate, reduced sexual ornamentation, or a reduction in reproductive success. Depending on the nature of the immune challenge, reproduction can be affected in several ways. Parental behavior may be impacted or the number of offspring produced may be reduced. Furthermore, the costs of an immune response may not be equivalent for all antigens. In particular, antigens that strongly stimulate the innate immune system are thought to involve greater energetic costs. This study compared the effects of immune challenge with a T-cell dependent antigen, T-cell independent antigen, and non-specific stimulation of the immune response through use of an adjuvant on reproduction in breeding female zebra finches (*Taeniopygia guttata*). The effects of immune challenge on latency to produce a clutch after challenge, clutch size, egg size and latency to produce a replacement clutch were recorded.

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MORPHOLOGY OF MELANOSOMES IN BLACK, BROWN AND GREY FEATHERS

Research into the functional significance and evolution of melanin-based color in birds is burgeoning, and the recent discovery of fossilized melanin granules in feathers opens up the exciting possibility of reconstructing ancient feather color. In feathers, melanin is distributed in the form of tough granules that contain either eumelanin, thought to produce black or grey colors, or pheomelanin, thought to produce brown colors. However, almost nothing is known of the morphology of these two melanin types. We used scanning electron microscopy (SEM), transmission electron microscopy (TEM) and atomic force microscopy (AFM) to compare the morphology of melanin granules in feathers colored black, brown or grey. Color of feathers was strongly predicted by length and density of melanin granules; however, grey colors are associated with a wide variety of melanin shapes and distributions. These data will be significant in the study of modern feather color as well as the reconstruction of ancient feather color.

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THE IMPORTANCE OF FOOD TO HABITAT SUITABILITY

Habitat provides different resources to different species, but it's always a place to forage, and food considerations are informative of habitat suitability. We review case studies from our lab involving considerations of diet and foraging to illustrate both food's impact on habitat suitability and ways to quantify diet and food availability. For example, Swainson's Warblers (*Limnothlypis swainsonii*) select breeding territories in Louisiana with significantly thicker foraging substrates than nearby non-territory; and do so consistently in both bottomland hardwoods and commercial pine plantations. In winter, branch-clips modified to reflect the feeding locations and prey of American Redstarts (*Setophaga ruticilla*) provide an index of food abundance that predicts the birds' ability to maintain body mass among habitats, and even survive to the next winter. Correspondingly, experimental food manipulation significantly impacts wintering Ovenbirds' (*Seiurus aurocapillus*) body condition. Resident tropical rainforest insectivores in Costa Rica select foraging microhabitats whose disappearance from fragmented reserves predicts population declines better than alternative hypotheses. Our studies demonstrate how standard resource-sampling methods can be modified to provide meaningful food indices for diverse species.

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FLEDGLING SPOTTED TOWHEE SURVIVAL NEAR URBAN PARK EDGES AND TRAILS

Habitat fragmentation, and the resulting increase in edge habitat, has important effects on birds, including increased nest predation. It is critical to understand the effects of fragmentation at all stages of the avian life cycle, including the often-overlooked post-fledging period. Because much of juvenile mortality occurs during the immediate post-fledging period, and juvenile mortality contributes substantially to population dynamics, it is necessary to understand if fledgling survival is reduced in edge habitats. During 2008 and 2009 we radio-tracked 52 fledgling Spotted Towhees (*Pipilo maculatus*) for the first 30 days post-fledging in a 24-ha urban park in Portland, Oregon. Thirty-six fledglings (69%) survived the tracking period. A Cox proportional hazards regression and parametric comparisons of means indicated that fledglings located closer to park edges had a higher probability of dying, but that survival was unrelated to distance to park trails. Our results, and those of others, establish that fledgling survival should be considered in addition to nest success when examining the effects of habitat fragmentation on bird populations.

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COOTS USE HATCH ORDER TO LEARN TO RECOGNIZE AND REJECT CONSPECIFIC BROOD PARASITIC CHICKS

Hosts of avian brood parasites almost universally fail to recognize and reject parasitic chicks once they've hatched from the egg, even when the host and parasitic chicks differ in appearance to almost comic degrees. One theory implicates the costs of learning errors as a major constraint to the evolution of chick recognition as host defense, but this has never been empirically tested. Here, we demonstrate that American coots, *Fulica americana*, can recognize and reject conspecific parasitic chicks in their brood using learned cues. We experimentally show that coots learn the first-hatched chicks in a brood as their own, and then discriminate against later-hatched parasitic chicks. When provided with the wrong reference chicks, coots can be induced to discriminate against their own offspring, confirming that the learning errors proposed by theory can exist. However, learning based on hatching order is reliable in this species because host eggs predictably hatch ahead of parasite eggs. Conversely, lack of reliable information may help explain why the evolution of chick recognition is not more common in hosts of most interspecific brood parasites.

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DIFFERENT PATTERNS OF PLUMAGE EVOLUTION BETWEEN SEXES IN A CLADE OF LOWLAND TANAGERS

Differences in avian coloration can be shaped by many different factors including aspects of sexual and natural selection. Color evolution can be constrained by mate selection, predator avoidance, physiology, or material properties of the feather. Furthermore, color evolution may differ by region. To see if body regions and sexes are under different selection pressures, we examined the *Ramphocelus-Tachyphonus* clade of the tanagers. For each of the 26 species, we measured up to five males and five females for nine standard plumage regions. We identified the underlying coloration mechanisms for each region for each sex based on the shape of the reflectance curves. Parsimony reconstructions across the phylogeny for each region reveal that males change mechanism much more often in the crown and breast, while females change more often in the belly. Males and females also show different patterns when broken down by coloration mechanism. In addition, the tail and wing tip regions rarely change mechanism, presumably due to constraints of flight. In summary, plumage regions have different patterns of evolution both across species and between males and females.

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REINTRODUCTION OF ISLAND SCRUB-JAYS TO SANTA ROSA ISLAND, CALIFORNIA: AN OPPORTUNITY FOR PROACTIVE SPECIES MANAGEMENT AND RESTORATION OF AN INSULAR ECOSYSTEM

Aphelocoma insularis currently exists only on Santa Cruz Island in Channel Islands National Park (CINP), and with a total population size < 3000, is one of the rarest birds in North America. Here, we present a conservation framework for the reintroduction of *A. insularis* to nearby Santa Rosa Island (SRI) in CINP. Recent evidence indicates that scrub-jays existed on SRI into the late 1800s and were likely extirpated by widespread destruction of vegetation by sheep. Although some vegetation has recovered since sheep were removed in the 1950s, hundreds of non-native deer and elk minimize regeneration of chaparral habitat. After all ungulates are removed in 2011, the regeneration of SRI would be hastened by *A. insularis*, which through their acorn and seed caching behavior are important ecosystem engineers. Re-establishing *A. insularis* on SRI would also increase population size and hence species viability. Based on a hierarchical model for predicting habitat-specific abundance of *A. insularis*, we estimate that SRI could support a small but viable population of jays now, and a population of several thousand when native vegetation has fully recovered.

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AGE DETERMINATION IN RUSTY BLACKBIRD EUPHAGUS CAROLINUS

We examined Rusty Blackbirds captured and photographed in southern Yukon Territory, Canada in fall 2005-2009 in order to identify plumage or other characteristics which differ between hatch-year and after-hatch-year birds. Age determination is difficult in this species outside of the brief period in fall when young birds' skulls are incompletely ossified, because plumage and moult patterns are almost identical for both ages. Yet age determination is a necessary tool for investigating demographic patterns which could elucidate reasons for the species' precipitous population decline. Age of each bird was determined using degree of skull ossification, and then plumage features of hatch-year and after-hatch-year birds were compared. Consistent differences between ages were found in the plumage of the head and underwing, and differences were more striking in males than females. Differences in the median underwing coverts between hatch-year and after-hatch-year birds were consistent but difficult to see. Thus differences in head plumage may be

a valuable new tool for age determination in Rusty Blackbird. More study is needed to determine how long into the winter and spring these age-related plumage differences persist.

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FORECASTING THE EFFECTS OF SEDIMENTATION AND CLIMATE CHANGE ON PRAIRIE WETLANDS: IMPLICATIONS FOR MIGRATING SHOREBIRDS.

Agricultural driven environmental change and global warming are major concerns in the conservation of prairie wetland landscapes, and in turn, for the conservation of temperate- breeding shorebirds and en route arctic-breeding shorebirds. As a tool for conservation, we are developing spatially explicit models to forecast the extent of erosion and wetland sedimentation in regions of the Great Plains of North America under future scenarios of precipitation, temperature, and land use. We are using the Revised Universal Loss Equation (RUSLE) to determine upland soil loss based on rainfall, runoff erosivity, soil type, topography, and land use. The amount of sediment entering wetlands (sediment delivery ratio) is inferred from empirical studies of colleagues. Models use projections of future precipitation and temperature on an 8-km grid from downscaled climate models using IPCC4 scenarios. To understand the implications of wetland change for migratory birds, we are building, refining, and applying shorebird-landscape models for shorebirds migrating across the playa lakes and prairie pothole regions of North America.

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INTEGRATED MONITORING IN BIRD CONSERVATION REGIONS

Recent efforts have increased interest in assuring that bird monitoring programs are integrated, well designed, target priority species and are responsive to management issues. We developed a hierarchical, grid-based, generalized random tessellation design based on unchanging features to address these issues. The design ensures a spatially balanced sample even with annually fluctuating implementation ability. Numerous monitoring approaches can be incorporated with this sampling design. We utilized a point-transect sampling approach with collection of vegetation data to allow for post-stratification, direct hypothesis testing and evaluation of causes of population trends. For abundant species, distance analysis is utilized, whereas for less common species, removal and occupancy models are often effective alternatives. As an example, we integrated large-scale monitoring programs across the Rocky Mountains and Great Plains including all land ownerships in BCR 17, Colorado and Wyoming. This approach demonstrates increased scientific defensibility, improved spatial relevance, and more flexibility for partner participation. The result is an integrated monitoring strategy for priority bird species across landownership boundaries.

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NOCTURNAL INCUBATION BEHAVIOR OF THE MOUNTAIN PLOVER (CHARADRIUS MONTANUS)

The rapid multi-clutch mating system of the Mountain Plover (*Charadrius montanus*) is an opportunity to examine sex-specific differences in uniparental care. We monitored nocturnal incubation activity in Phillips County, Montana using video recordings and temperature data-loggers. Possible differences in activity were modeled using the duration of nest departures of incubating adults. We examined the effects of sex, time of departure, nest age, day of season, maximum temperature, precipitation the previous day, and year on nest departures. We recorded 857 hours of video at 25 nests and >10,000 hours of temperature data from 142 nests during the 2006-2008 breeding seasons. Males contributed 1925 nocturnal departures with a mean duration of 0.38 hr (SE = 0.01) while females contributed 2,716

nocturnal departures with a mean duration of 0.36 hr (SE = 0.01). The time of the nocturnal departure was the only factor that had a strong effect on the duration of the departure. Our study furthers knowledge of incubation patterns in an uncommon mating system and helps understand the behavior of this species of conservation concern.

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SPATIAL MOVEMENTS AND HABITAT USE OF NORTHERN WATERTHRUSHES AND YELLOW-RUMPED WARBLERS DURING SPRING MIGRATORY STOPOVER ALONG THE UPPER MISSISSIPPI RIVER

Stopover areas are critical for a successful migration, yet little is known about spatial movements and habitat use of individual migrants. In spring 2009, transient Northern Waterthrushes and Yellow-rumped Warblers were mist-netted and radio-tagged at Trempealeau National Wildlife Refuge along the Upper Mississippi River in Wisconsin, USA. Birds were translocated to four predetermined release sites and radio-located every 30 min for 2 days, and twice daily thereafter. Stopover duration (mean \pm SE) following release was 4.3 ± 0.8 days for Yellow-rumped Warblers (n=10) and 3.7 ± 0.5 days for Northern Waterthrushes (n=14). For the first full day after release, the median minimum convex polygon area occupied was 66.0 ha for Yellow-rumped Warblers (n=7) and 1.4 ha for Northern Waterthrushes (n=14). Within three hours, Northern Waterthrushes released in upland forest habitat (n=8) moved 1.3 to 2.2 times farther (95% CI) from the release point than those released in floodplain forest habitat (n=10). These data suggest that migrants encountering suboptimal stopover habitat rapidly search for more suitable habitat. Such movements may be costly, however, especially in landscapes where adequate stopover habitat is not readily available.

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REPRODUCTIVE SUCCESS OF SHRUBLAND BIRDS IN CONSERVATION-MANAGED FIELDS AND AN EVALUATION OF HABITAT SOURCES AND SINKS

Loss of breeding habitat has been recognized as a leading cause of decline in Neotropical migrant birds that nest in shrubland. This study was conducted in Connecticut on sites managed for shrubland bird conservation, called conservation-managed fields. We used an information-theoretic approach to model effects of nest site vegetation, nest area vegetation, edge, and time on daily nest survival (DNS) of Blue-winged Warbler (*Vermivora pinus*), Prairie Warbler (*Dendroica discolor*), Indigo Bunting (*Passerina cyanea*), and Field Sparrow (*Spizella pusilla*). We also used source-sink estimation to evaluate conservation-managed fields in comparison to other studies in the literature. Top models showed that DNS of each species is affected differently by habitat, edge, and time covariates. Amount of woody vegetation was the only variable affecting all species. Estimates of DNS were 0.96 ± 0.019 for Blue-winged Warbler, 0.99 ± 0.003 for Prairie Warbler, 0.99 ± 0.010 for Indigo Bunting, and 0.96 ± 0.011 for Field Sparrow. Source-sink estimation showed that conservation-managed fields are source habitat for only Blue-winged and Prairie warblers. We suggest that techniques creating conservation-managed fields may be a useful in areas where these species are conservation targets.

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CONGRUENCE ACROSS GENE TREES AND MORPHOLOGY: POPULATION HISTORY OF THE NORTHERN CARDINAL

The Northern Cardinal (*Cardinalis cardinalis*) is a geographically widespread songbird that is distributed throughout Mexico and eastern North America. Across its range are 18 subspecies that are divided into four major subspecies groups that correspond to geographic regions. The goal of our study was to further investigate the intraspecific variation within the Northern Cardinal by employing a molecular approach. We sequenced one mitochondrial (mtDNA) and nine nuclear markers from individuals throughout the species' range. The mtDNA gene tree and the species tree inferred from all 10 loci have a congruent topology that supports the monophyly of the four traditional subspecies groups along with two distinctive island populations. The Northern Cardinal groups correspond to well known biogeographic breaks such as the Sonoran-Chihuahuan filter barrier and the Isthmus of Tehuantepec. Multi-locus time estimates suggest that the species began diversifying by the onset of the Pleistocene and has continued up to the last glacial cycle.

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FACTORS INFLUENCING THE MIGRATORY PATHS OF SWAINSON'S THRUSHES FACED WITH A LARGE WATER BODY
 The timing and direction of departure from stopover areas may have especially important consequences for migratory birds confronted with large ecological barriers. During autumn 2008 and 2009, we used automated tracking to investigate how fat and age influence the paths of migrating Swainson's Thrushes (n=44) departing from a stopover site situated on the northern coast of the Gulf of Mexico. Birds carrying a large amount of subcutaneous fat generally departed in southerly directions (23/28) whereas departures by lean birds nearly always included a northerly component (13/16). Hatch-year birds did not show greater tendency to fly in seasonally inappropriate directions or to stopover for longer periods than did older birds. All birds in 2008 (n=22) departed the same day of capture. However, in 2009 some lean birds (6/8) remained in the stopover area for extended periods. These findings suggest that energetic condition has an important influence on departure direction while age does not. Additionally, short stopover durations by most thrushes indicate that this habitat may not provide necessary food resources for individuals trying to gain fat prior to a barrier crossing.

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AN ANALYSIS OF NESTING TRENDS AND RECOVERY DATA OF BLACK SKIMMERS (*RYNCHOPS NIGER*) IN SOUTH CAROLINA

Two important techniques used to monitor Black Skimmers are nest counts and analysis of band recovery data. From 1975 to 2009, nest counts (n=186) were conducted in South Carolina and nest numbers are stable. Mean nest count is 768.85 and total number of sites used for nesting is 35. Since 1992, nest counts have been conducted every year and have allowed biologists to

identify important breeding locations. In addition to nest counts, recovery of banded chicks (n=79) from South Carolina has identified wintering habitat as well as some threats to the species. The majority of the recoveries occurred in Florida with other recoveries observed in North Carolina, South Carolina and Georgia. No Black Skimmers were recovered over the age of four and 22 percent of the recoveries were HY birds indicating that young birds are particularly vulnerable. Human related causes of death included entanglement in fishing gear, motor vehicle strikes or gunshot wounds.

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A COMPARISON BETWEEN WARBLERS ON TWO ISLANDS: TESTING LACK'S AND SKUTCH'S HYPOTHESES

Variation in avian clutch sizes has received considerable study, yet remains poorly understood. Lack hypothesized that food availability drives variation in clutch sizes, while Skutch proposed that visually oriented nest predators limit feeding trips, and thereby limit clutch sizes. We exploit differences in the rainfall regimes and predator communities of Catalina and Santa Cruz Islands to test these hypotheses in Orange-crowned Warblers (*Vermivora celata*). Lack's hypothesis predicts larger clutch sizes on Santa Cruz Island, which receives more rainfall and has higher insect abundance than Catalina Island. In contrast, Skutch's hypothesis predicts lower nest visitation rates and clutch sizes on Santa Cruz, where the Island Scrub-Jay (*Aphelocoma insularis*) is endemic. We documented significantly lower nest visitation rates on Santa Cruz, and measured behavioral responses to spatial variation in scrub-jay abundance. Yet while our behavioral results support Skutch, clutch sizes were significantly larger on Santa Cruz, as predicted by Lack. In addition, rainfall and mean clutch sizes were correlated across years, further supporting Lack's hypothesis. We will compare per-nestling feeding rates between islands, and discuss implications for life history theory.

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A LARGE-SCALE MODELLING EFFORT TO SUPPORT MANAGEMENT OF INCIDENTAL TAKE OF MIGRATORY BIRDS IN CANADA'S BOREAL FOREST

Canada's boreal forest, previously considered remote and pristine, is subject to increasing pressure from the expansion of resource extraction and climate change. Management of migratory birds across this vast ecosystem is hampered by a lack of integrated information on populations and communities, their response to human activity and associated mitigation efforts. To illustrate how a broad collaboration can help address these gaps, we introduce a new partnership, involving universities, government, private and non-government groups, created to develop spatially explicit, predictive models of boreal bird habitat across Canada using a consistent analytical framework. Concurrently, the Canadian Wildlife Service is now expanding its management of the incidental take of migratory birds across Canada to include protection and conservation of populations as well as individuals. These proposed changes to regulations under Canada's Migratory Birds Convention Act provide conservation and scientific opportunities to improve the management of boreal forests. We demonstrate how the results of our partnership, the Boreal Avian Modelling Project, are positioned to inform core planning and policy tools that will underpin implementation of proposed regulations, among other policy applications.

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PHYLOGENETIC RELATIONSHIPS AND RATES OF MOLECULAR EVOLUTION IN THE EXTINCT HAWAIIAN MOHOIDAE

Here we use mtDNA analysis of museum specimens to reconstruct the phylogenetic relationships of an extinct group of Hawaiian songbirds, the Hawaiian honeyeaters (Mohoidae). A recent study showed that Hawaiian honeyeaters were not part of the Meliphagidae, but rather fell within a radiation of passerid songbird families that includes silky flycatchers, palm chat, and waxwings. Their pattern of radiation parallels the formation of the Hawaiian Islands: *M. braccatus* is basal on the reconstructed phylogeny and was endemic to Kauai, the oldest main island. This pattern continues through the *Mobos* with *M. apicalis* (Oahu) branching next, followed by a clade with *M. bishopi* (Maui-nui) and *M. nobilis* (Island of Hawaii). However, *Chaetoptila* appears to be paraphyletic with respect to *Mobo*. The low support for the placement of *Chaetoptila* suggests that this species may be congeneric with *Mobo*; differences observed may not warrant its own genus. The correlation of topology with island formation allowed us, with certain assumptions, to use island ages to calibrate rates of sequence evolution. We estimated an internally consistent overall mtDNA rate of 2.1%/my (95% CI: 1.4–2.8%).

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IDENTIFICATION OF SOURCE-SINK POPULATION DYNAMICS IN A METAPOPULATION OF NORTHERN GOSHAWKS OF THE ALEXANDER ARCHIPELAGO

Northern Goshawks breeding in southeastern coastal Alaska nest exclusively in old-growth and mature forest, resulting in spatial heterogeneity in the distribution of individuals. We used allelic frequency data in concert with Bayesian analyses and the coalescent to estimate asymmetry in migration rates, effective population sizes, fluctuations in population demography, and to identify potential source and sink populations. Northern Goshawk assemblages located in the Alexander Archipelago appear to interact through a metapopulation framework, though may not fit the 'classic' model of a metapopulation. Long-term population sources (Coastal British Columbia) and sinks (Revillagigedo and Vancouver islands) were identified. However, the directionality of dispersal among the remaining assemblages is not consistent, which is suggestive of a 'rescue-effect' dynamic. Metapopulations with sufficient connectivity of habitat are described as 'rescue-effect' metapopulation systems. We found that Admiralty, Douglas, Chichagof and Baranof islands have become recent source populations in the Alexander Archipelago. In addition, Kupreanof island complex and Kispixof Forest District populations have high dispersal rates to populations in close geographic proximity and potentially serve as 'local' source populations.

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THE EFFECTS OF GRASSLAND MANAGEMENT ON MATING PATTERNS IN DICKCISSELS (*SPIZA AMERICANA*)

Habitat destruction has well-known effects on populations of native organisms. Less clear are the effects of habitat restoration efforts. Because restoration techniques could affect the structure and distribution of key resources, they may affect the reproductive decisions of individuals. This could have important effects on a species' conservation because such decision-making could impact demography, population genetics, and population viability in the managed environment. I investigated the effects of managed burning used to maintain prairie habitat on the mating system of an obligate grassland breeding bird, the dickcissel *Spiza americana*. Mating patterns were examined for birds occurring in sites with managed burn intervals of one, two, four, and twenty years. Polygyny and extra-pair paternity rates did not differ significantly among sites, nor were any differences in nesting success observed. Sites did differ in the timing of breeding, with nest initiation

occurring significantly later in unburned watersheds than in burned ones. Thus, burn interval does not appear to affect mating patterns in dickcissels, but can significantly shorten the amount of time a site is used for breeding.

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TUNDRA SWANS WINTERING ON THE SOUTHERN ALASKA PENINSULA

Tundra Swans breeding on the Southern Alaska Peninsula (SAP) comprise a unique, essentially non-migratory population characterized primarily by local movements in response to variable ice conditions. Seventy-five percent of swans collared on the SAP from 1978-1986 (n=383) were observed wintering on nearby Unimak Island, especially spring-fed Peterson Lagoon (55.9N, 164.2W). Only 5% of these swans were observed during migration or winter outside of Alaska. SAP swans differ morphologically from Tundra Swans breeding in five other areas of Alaska; males (n=142) averaged larger in four body measurements (mass, culmen, total tarsus, mid-toe), while females (n=170) were comparable or above average in these measurements. The SAP breeding population has been estimated at <300 swans, but up to 650 wintering swans congregate at Peterson Lagoon indicating that the full extent of the breeding range for non-migrant swans has not been described. In 2008, 10 adult females were fitted with satellite transmitters and location information was received through the winter of 2008-2009. Preliminary data indicate a greater amount of movement throughout the SAP than was previously known and a more complex migratory behavior.

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MODELING BIRD DISTRIBUTIONS AT BIOLOGICALLY RELEVANT SCALES

We used data from the Badlands and Prairies Bird Conservation Region bird monitoring program, which incorporates a spatially-balanced study design, to predict geographic distributions for three grassland species, Lark Bunting (n=84), Grasshopper Sparrow (n= 81) and Chestnut-collared Longspur (n = 21). These species are stewardship species of management concern in the Partners in Flight North American Landbird Conservation Plan within the Prairie Avifaunal Biome. We used Maximum entropy (Maxent) methods to estimate species' environmental requirements and geographic distributions using eight climatic, land cover, elevation and slope variables. Models for all three species performed better than random models with AUC values > 0.8. Annual precipitation, total rainfall amount for the three driest consecutive months in a year, and land cover are the best variables for predicting the distribution of these species within this ecoregion. We used these models to identify areas of high probability of occurrence and connectivity among species. Large Scale monitoring programs provide important occurrence data which can be used in the conservation planning process.

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GLACIAL ISOLATION AND POSTGLACIAL COLONIZATION ENHANCE GENETIC DIVERSITY IN A NEOTROPICAL MIGRANT PASSERINE

Phylogeographic study of North American vertebrate taxa has revealed that many species were isolated in Pleistocene glacial refugia and only recently expanded to occupy their current distributions. The consequence of these

rapid postglacial expansions has been a reduction of genetic diversity throughout the majority of a species' range. We analyze genetic variation (mtDNA sequences, N=344; and nuclear DNA sequences, 6 loci, N=39) and use paleoecological niche modeling to infer the phylogeographic history of the Western Tanager (*Piranga ludoviciana*). Phylogenetic analysis (mtDNA = 180 haplotypes) reveals two well-supported monophyletic lineages (Clades A and B). Populations from the southeastern and eastern Rocky Mountains possess only A haplotypes, and all other populations contain a mixture of A and B haplotypes. Paleo-niche modeling indicates the species was likely isolated in two glacial refugia. Analysis of genetic variation at multiple loci reveals that genetic diversity in the species is more than double the amount found in most North American passerines. We argue that glacial isolation, postglacial expansion, and lack of reproductive isolation have led to this hyper genetic diversity.

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BIRDS IN SEED DISPERSAL WEBS: CONSEQUENCES FOR NATIVE COMMUNITIES AND SPECIES INVASIONS IN FRENCH POLYNESIA

Mutually beneficial relationships such as seed dispersal by frugivorous birds are crucial to the maintenance of biodiversity on Earth. Arrival of introduced organisms can disrupt these relationships triggering cascading consequences for native communities. In the tropical high islands of French Polynesia, three frugivores disperse the seeds of many plants, both native and exotic. We investigated the network of relationships between frugivores and fruit bearing plants on the islands of Tahiti and Moorea. Bird diet was determined through analysis of fecal samples. Seed viability was assessed with germination tests with seeds extracted from intact fruits and fecal samples. Our results show that exotic organisms are highly integrated into native dispersal webs. Exotic plants benefit from dispersal by birds which transport seeds long distances and deposit them intact. Native plants show enhanced germination after digestion by native frugivores highlighting the important role of dispersal. Native frugivores consume many exotic species which provide a highly abundant and continuously available resource. These indirect impacts of species invasions are likely to be detrimental to the regeneration of native forests.

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POST-RELEASE SURVIVAL AND REPRODUCTIVE SUCCESS OF CAPTIVE-BRED SAN CLEMENTE LOGGERHEAD SHRIKES

The San Clemente Loggerhead Shrike (*Lanius ludovicianus mearnsi*) is endemic to San Clemente Island, California. Among the most critically endangered avian subspecies in the world, the wild population reached a low of 14 individuals in 1998. To augment the wild population, the U.S. Navy contracted the Institute for Wildlife Studies to release shrikes hatched at the San Diego Zoo's captive breeding facility into the wild. Between 1999 and 2009, 374 shrikes were released using a variety of soft-release techniques. Survival of shrikes released as hatch-year birds (mean = 9.83±16.76 months) exceeded that of shrikes released as adults (second-year or older; mean = 6.61±10.43 months). In both released hatch-year and wild-born shrikes, annual reproductive output increased with age. Furthermore, lifetime reproductive output did not differ between released hatch-year and wild-born shrikes. However, shrikes released as adults had significantly lower age-specific reproductive output (and lower lifetime reproductive output) than wild-born or released hatch-year shrikes. Overall, we found that to facilitate recovery efforts, releasing hatch-year captive-bred San Clemente Loggerhead Shrikes was the most successful technique for maximizing survival and reproductive output.

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PROGRESS TOWARD RECOVERY OF THE ENDANGERED SAN CLEMENTE LOGGERHEAD SHRIKE.

The San Clemente Loggerhead Shrike (*Lanius ludovicianus mearnsi*; SCLS) is a federally endangered subspecies endemic to San Clemente Island, California. Habitat loss and non-native predation pressure reduced the population to a low of 14 individuals in the wild in 1998. The U.S. Navy, in conjunction with numerous collaborators, initiated a recovery program in 1991. This program consisted of predator management, habitat restoration, captive breeding and release, and population monitoring. Data collected from 1997–2009 illustrate the remarkable recovery of this population, culminating with a high of ≥ 179 adults in the wild in 2009. We have released 394 captive-bred SCLS and adapting our release methodologies through time has resulted in the survival of released juveniles being similar to that of wild juveniles. In wild SCLS, annual survival for adults ($\geq 64.7\%$) was higher than for juveniles ($\geq 37.4\%$) and apparent nest success was 46%. Rainfall and supplemental feeding were positively correlated with reproductive output and non-native predation pressure continues to affect reproductive success. Future modeling efforts will incorporate these and other data to evaluate long-term population viability and to develop recovery goals.

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 CONSEQUENCES OF WINTER HABITAT OCCUPANCY: THE STRESS RESPONSE IN WOOD THRUSH IN PRIMARY AND SECONDARY FOREST

Deforestation throughout Central and South America has drastically altered the landscapes occupied by many Neotropical migrants during the non-breeding season. In this study I examined the physiological consequences of tropical deforestation on a migratory songbird, the wood thrush (*Hyllocichla mustelina*) on its wintering grounds in Costa Rica. I measured plasma levels of corticosterone, the major stress hormone in birds, to compare the condition of individuals occupying primary forest versus secondary forest. Blood samples were collected within 3 minutes of captures (baseline levels) and 30 minutes after capture (acute corticosterone secretion) and concentration of corticosterone measured using radioimmunoassays. Individuals occupying secondary forest had significantly higher corticosterone levels after 30 minutes of capture and a higher amplitude corticosterone response. The steeper increase of corticosterone in birds occupying secondary habitat is evidence of a greater sensitivity of the adrenocortical axis to stress and is indicative of a more unpredictable environment. Habitat occupancy during the non-breeding season may therefore have important physiological consequences for wood thrush on their wintering grounds and may therefore have important repercussions throughout the annual cycle of this species.

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WHY IS SONG RATE NEGATIVELY ASSOCIATED WITH COWBIRD PARASITISM IN BELL'S VIREOS? A TEST OF ALTERNATIVE HYPOTHESES.

Studies both across and within hosts of the brown-headed cowbird (*Molothrus ater*) have reported a positive correlation between host song rate and probability of brood parasitism. In contrast, 2 recent studies have reported a negative correlation between song rate and parasitism in Bell's vireo (*Vireo bellii*). This is surprising, given high rates and high costs of parasitism experienced by Bell's vireos. We tested 5 alternative hypotheses to explain this seemingly paradoxical pattern. These hypotheses invoke nest concealment, nest attentiveness, nest predation, cowbird densities, or energetic constraints as potential mediators of the relationship between song rate and parasitism probability. Our results supported the hypothesis that frequent singing increases nest attentiveness by vireo pairs, thereby preventing cowbirds

from accessing nests. Percent nest attentiveness was positively correlated with song rate and negatively correlated with probability of parasitism. Our study suggests a novel function of bird song: reducing brood parasitism risk. We recommend that future studies attempt to elucidate underlying causal pathways between song rate and brood parasitism, as this relationship apparently differs among species.

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SELECTION OF DIVERSE NEST SITES BY COMMON EIDERS

Nest sites of Common Eiders (*Somateria Mollissima*) vary widely, ranging from depressions on bare ledges to dense thickets of juniper where they are nearly invisible. We hypothesized that this represents a trade-off because covered sites shield the nest from egg predators, but may hinder escape from a predator on the female. We tested four predictions of this female and clutch safety trade-off hypothesis and found that (1) nest concealment was negatively related to escape possibilities, (2) our capture of females, which mimics predation, was higher in covered nests, (3) clutch size, which is influenced by partial clutch predation, was higher in covered nests, and (4) overall nest success was unrelated to nest cover. We also found that older females selected more concealed nests. This could result from older females with little chance of survival attempting to maximize their last reproductive effort, but since survival may increase with age, this cannot explain the result. More likely, older females may have greater confidence in surviving despite selecting a concealed nest or may simply be better at choosing safe sites.

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NEST-SITE AND FORAGING HABITAT SELECTION BY BLACK TERNS IN THE PRAIRIE POTHOLE REGION

Black Terns are a species of concern due to habitat loss and population declines. They nest in freshwater wetlands and often forage in surrounding wetlands. To determine the relative importance of landscape- and site-level variables in predicting use of wetlands for breeding and foraging, we conducted surveys at wetlands in the prairie pothole region of North and South Dakota, and used remote sensing data to estimate the proportion of land cover types surrounding wetlands. We used a novel algorithmic model, Random Forest, to relate breeding and foraging sites to cover types in the landscape and to site-level habitat characteristics. Black Tern breeding wetland selection was positively related to the amount of floating matted vegetation, wetland size, and amount of wetland in the landscape. Black Tern foraging wetland selection was positively related to wetland size and amount of open water. Our results demonstrate the efficacy of using a technique such as Random Forest to look at the relative importance of habitat features across spatial scales, and contribute to a better understanding of Black Tern breeding and foraging habitat requirements.

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Bidstrup, F. C., PRBO Conservation Science, Petaluma, USA SEX RATIO, SURVIVAL, AND MATING OPPORTUNITY IN ADULT SNOWY PLOVER (CHARADRIUS ALEXANDRINUS)

Sexual differences in adult mortality may be responsible for skewed adult sex ratios in birds. A surplus of breeding males has been reported in serially polyandrous populations of *Charadrius alexandrinus*. We examined a Snowy Plover population in coastal California for a biased sex ratio, for sexual differences in opportunities for early season nesting, and for sexual differences in adult survival. Over 11 years when most plovers in the study area were banded, the median population of nesters was 99 males and 84 females

(median male-female difference = 8), resulting in 1 extra male per 6-8 pairs. The number of potential breeders without mates by the date on which the first nest hatched each year was higher for males than females by 1-14 (median = 8) individuals. True adult male survival (0.73, SE = 0.02) exceeded that of females (0.69, SE = 0.02) in top ranked models using Barker's (1999) joint model for combined sources of information. Overall, our results support the hypothesis that a male-biased sex ratio in *Charadrius alexandrinus* results from a sexual difference in adult mortality.

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CATS AND FAT DOVES: RESOLVING THE URBAN NEST PREDATOR PARADOX

Reduced nest predation is one hypothesis to explain the success of urban adapters. Data from Northern Mockingbirds (*Mimus polyglottos*) from 2005-2009 support the hypothesis that urban nest predation rates are lower, on average, than non-urban nest predation rates. Avian nest predators, however, are more abundant in urban habitats, leading to the urban nest predator paradox. One explanation for this mismatch is a shift in predator community from important nest predators to less important species. We used video cameras on nests in 2008-2009 to identify predators. Cats were the dominant urban nest predator while Cooper's Hawks (*Accipiter cooperii*) were the dominant non-urban nest predator. The most abundant avian nest predators in urban habitats accounted for none of our recorded predation events. Cooper's Hawks were present at our urban sites, yet were not recorded as urban nest predators. We hypothesize that urban Cooper's Hawks have undergone a dietary shift as a result of abundant dove populations. We conclude that changes in nest predator community composition, as well as dietary shifts of predators, are responsible for the urban nest predator paradox.

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CORTICOSTERONE AND REPRODUCTIVE SUCCESS IN AMERICAN KESTRELS NESTING ALONG A HUMAN DISTURBANCE GRADIENT

We examined two non-mutually exclusive hypotheses to explain reproductive success in American Kestrels (*Falco sparverius*) nesting along a human disturbance gradient. We hypothesized that habitat quality, individual quality, or both were lower in high disturbance areas. Alternatively, kestrels nesting in high disturbance areas may have chronically elevated levels of the stress hormone corticosterone. We monitored 89 nest boxes posted along Interstate-84 and secondary roads in Southwest Idaho during the 2008 and 2009 breeding seasons. We found no association between quality measures (estimated by clutch initiation date and adult condition) and disturbance level; further, habitat and individual quality did not predict breeding success. Disturbance score and nest distance from road best predicted kestrel reproductive success. In addition, adult female kestrels nesting near interstates and busy roads had elevated corticosterone and nests of females with elevated corticosterone were more likely to fail. There was no relationship between adult male corticosterone and disturbance or success. Our results suggest that the relationship between high human disturbance and poor reproductive success in kestrels is mediated by female corticosterone levels.

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PHYSIOLOGICAL CONDITION DURING MOLT AFFECTS PACE OF MIGRATION IN A NEOTROPICAL MIGRANT

One of the most energetically demanding periods in a songbird's annual cycle is the post-breeding molt of flight and body feathers which can increase energy expenditure by over 30% and impose constraints on pre-migratory fattening. Little is known about how energetic condition during molt affects subsequent migration because until recently it has not been possible to track

migratory songbirds. We deployed geolocators on Wood Thrush to quantify the pace of fall migration and arrival date on the winter territory. We found that levels of plasma beta-hydroxy-butyrate and triglyceride during molt in mid-August, and feather growth bar width, were good predictors of when individuals crossed into the tropics on fall migration two months later (and about 2,000 km away). Timing of migration into the tropics was significantly correlated with arrival date on the winter territory (14 October - 6 December). Wood thrush that were still relatively far north (> 30°N) in early October did not subsequently increase their pace of migration. This suggests that energetic condition not only affects immediate departure and stopover decisions to stay versus fly, but also affects overall migration strategy and could have important carry-over effects and conservation implications.

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WOMEN IN ORNITHOLOGY TODAY: CHALLENGES AND OPPORTUNITIES

From the mid 1970's to the mid 2000's, women made up an increasing proportion of the student members of the AOU, COS and WOS. But the makeup of professional members changed remarkably little over this time period. Few professional opportunities in an increasingly competitive job market have led to relatively few women transitioning from student to professional member. One explanation is that early career women often accommodate their partner's career and effectively remove themselves from the job market. Women that remain society members are as likely to become fellows and more likely to assume leadership positions than their male colleagues. The time period from 5-10 years after joining an ornithological society is where the differential loss of women members occurs and should be a focus of retention efforts.

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IDENTIFYING PRIORITY CONSERVATION AREAS FOR GRASSLAND BIRDS IN THE CHAMPLAIN VALLEY OF VERMONT

Recent programs to set population goals for declining bird species have led to more explicit ties to on-the-ground conservation projects. However, conservation work often proceeds opportunistically, leading to inefficient allocation of conservation funds. This project was designed to focus conservation efforts on grassland bird habitat in the Champlain Valley (VT, USA) that is most likely to maintain viable grassland bird populations. We created detailed layers including landscape level factors (forest, grassland, development and roads) and patch level factors (size, management and conservation) important in grassland bird habitat selection. Integrating the GIS dataset into a multicriteria decision analysis framework, we produced maps in which grassland patches were ranked based on their quality for grassland birds and we used these maps to identify priority conservation areas. These procedures resulted in habitat quality maps that federal, state, and non-governmental land managers will use as a baseline to focus conservation efforts. The maps emphasize the selection of blocks of >50 ha of protected or bird-friendly grassland habitat and can serve as a model to help researchers set priorities for land conservation in other regions.

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BOZINOVIC, E, Pontificia Univ Católica de Chile, Santiago, Chile DOES METABOLIC CAPACITY INFLUENCE BIOGEOGRAPHY OF OSCINE AND SUBOSCINE PASSERINE BIRDS?

Biogeographic analyses of passerine birds demonstrate that suboscines are dominant in South America and oscines are dominant elsewhere, suggesting that oscines generally outcompete suboscines wherever they come into contact. What factors allow oscines to outcompete suboscines? One hypothesis is that suboscines possess a restrictive tropical physiology that favors oscines in most habitats. We tested this metabolic capacity hypothesis by comparing summit metabolic rate (Msum, maximum cold-induced metabolic rate) between summer-acclimatized oscines and suboscines using conventional and phylogenetically informed approaches. We predicted that if the metabolic capacity hypothesis is valid, then oscines should have higher Msum than suboscines. Both conventional and phylogenetically informed ANCOVA on regressions of log Msum against log mass showed

that oscines had higher Msum than suboscines. Moreover, conventional and phylogenetically informed multiple regressions identified log mass, winter temperature and clade (oscines vs. suboscines) as significant effectors of log Msum in passerine birds. Thus, oscines appear to generally have higher Msum than suboscines, which suggests that one factor influencing broad biogeographical distributions and allowing oscines to outcompete suboscines is their higher metabolic capacity.

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THE HAWAII ENDANGERED BIRD CONSERVATION PROGRAM: CAPTIVE PROPAGATION AS A TOOL FOR THE CONSERVATION OF THE WORLD'S MOST THREATENED AVIFAUNA.

The San Diego Zoo's Hawaii Endangered Bird Conservation Program (HEBCP) is playing a pivotal role in the restoration of endemic Hawaiian avifauna, by preventing extinction and promoting recovery of a number of endangered species. The HEBCP works with several governmental and NGO partners, as a key component in the holistic approach to ecosystem restoration, which also includes the designation of reserves and applied management of protected habitat. Currently, the program focuses on the propagation of five Hawaiian species at the Maui and Keauhou Bird Conservation Centers, applying a range of sophisticated techniques developed in zoos and private aviculture. The program has played a critical role in saving the Alala from extinction and is also actively involved in three release programs. The Puaiohi releases on Kauai, now completing its eleventh year of releases (188 birds), aim to augment the existing population; the trial releases of Palila (28 birds) have the goal of establishing a new sub-population on the slopes of Mauna Kea volcano; and over 400 Nene have been provided for release on four of the islands in the Hawaiian chain.

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SEABIRDS AND CLIMATE IN THE CALIFORNIA CURRENT – A SYNTHESIS OF CHANGE

We investigated changes in ocean climate and seabirds in the California Current Ecosystem (CCE) and the transition zone between the CCE and Gulf of Alaska. Seabird timing of breeding, productivity, and abundance at sea have changed in ways consistent with predictions under an ocean warming scenario, but we cannot dismiss the hypothesis that low-frequency variability explains some of these patterns. Recent reproductive failures of auklets and other species cannot be explained by ENSO or low-frequency variability. Declining trends in the productivity of murre and auklet “trophic chains”, including the relative abundance of mesozooplankton (krill) and forage fish (juvenile *Sebastes*) cannot be explained by low- or high- (ENSO-scale) frequency climate variability. Changes in relative abundance at sea in the CalCOFI and Line P study areas, however, could be related to change points related to regime shifts in the North Pacific. Contrasting trends highlight the need to consider spatial ecology and habitat quality (food web attributes) to develop a deeper understanding of how climate change–ecosystem change is affecting seabirds in the CCE and adjacent North Pacific regions

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PATERNITY IN PURPLE MARTINS: FEMALES PREFER OLDER MALES

We present data on paternity patterns and effects of male age using four highly variable microsatellite loci (mean alleles/locus = 49) in the purple

martin (*Progne subis*), a species with a distinctive first-year male plumage.

Earlier studies showed female purple martins obtained extrapair fertilizations (EPFs) from adult-plumaged males. In our study we examine if age (2 years or older) affects mating success. Our data were based on a total of 193 families (N = 1,060 young) sampled in 2006–2007 in northwestern Pennsylvania, USA. Extrapair fertilizations resulted in 42.5% (34/80) of nests in 2006 containing at least one EPY; 52.2% (59/113) of nests contained EPY in 2007. Based on known-age males, extrapair sires were usually the same age or older than the social males whom they cuckolded. We also examine how paternity patterns change over time for known-age adults to determine if there is senescence in mating success in this species.

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PRE-REPRODUCTIVE SURVIVAL AND THE FACTORS INFLUENCING SURVIVAL IN A TROPICAL PASSERINE BIRD

Estimates of pre-reproductive survival and the factors influencing survival are essential for evaluating parental investment theory, evolution of life history traits, and demography. Despite their key importance, rarely are estimates available. Instead, juvenile survival is often assumed to be half that of adult survival. This assumption is questionable, particularly in tropical birds where extended post-fledging care and delayed dispersal are observed. We used re-sighting and radio-telemetry to estimate survival and the factors influencing survival in a Neotropical passerine, the western slaty antshrike. We found offspring that delayed dispersal had higher survival than offspring dispersing earlier. Offspring that dispersed at an older age had higher survival the first two months after fledging than those dispersing when younger. Mass and fledge date influenced survival. Males and females had similar post-fledging and first year survival. We observed higher post-fledging survival, higher first year survival and higher survival until reproduction compared to Northern hemisphere passerines. These results have important implications for understanding the costs and benefits of dispersal strategies and latitudinal variation in key life history traits.

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SPATIAL, TEMPORAL, AND LIFE HISTORY ASSUMPTIONS INFLUENCE CONSISTENCY OF LANDSCAPE EFFECTS ON SPECIES DISTRIBUTIONS

Models describing relationships between landscape features and species distributions often display inter-study inconsistencies. Identifying factors contributing to these inconsistencies is a vital step in clarifying the ecological importance of landscape features and synthesizing knowledge for use in conservation contexts. We examined the influence of several spatial, temporal, and life history assumptions on the outcomes of distribution vs. landscape models (DLMs) relating wetland bird communities to urbanization, wetland, forest, and agricultural landscape gradients. Univariate models indicated that our wetland bird specialization index showed: 1) the strongest response to landscape gradients at small extents; 2) a negative, threshold response to urbanization was superior to a linear fit; and 3) no evidence of time-lagged effects of landscape change. Multivariate models relating the specialization index as well as obligate and facultative species richness to landscape gradients showed annual variability (i.e. composition, parameter estimates, and variability explained) that did not depend upon degree of specialization. Our results provide evidence that violations of common assumptions (e.g. selection of appropriate extent, lack of time-lagged effects) can impact the outcome of DLMs, which could lead to inter-study inconsistencies.

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LESSONS LEARNED FROM THREE YEARS OF POSTBREEDING SHOREBIRD RESEARCH IN ARCTIC ALASKA

Shorebird surveys in Arctic Alaska are often conducted ancillary to surveys for other species because shorebirds are dispersed on the landscape and can be difficult to detect. We used aerial surveys, radio telemetry, and physiological measurements to locate postbreeding shorebird concentration areas and compare staging site quality across Alaska's North Slope. In the process we

learned much about appropriate methodology and data analysis. First, to use distance sampling as an analysis method, survey transects must be located perpendicular to the coast along which shorebirds concentrate. Failing to account for 1) the offset distance between the transect line and where an aerial observer can first see the ground, and 2) the fact that most shorebirds can only be seen from the air while in flight can violate distance sampling assumptions. Second, radio telemetry for small shorebirds over a large area does not result in known fate data. Lastly, evaluating physiological parameters such as plasma triglyceride or corticosterone levels can provide a comparative assessment of site quality as long as variables such as age, stage, molt strategy, and movement propensity are considered.

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VICARIANCE INTERRUPTED? PREHISTORIC BIRD TRADE ACROSS THE ANDES

I identified bird bones from various archaeological sites in Ecuador. Among these sites, La Chimba in the northern Andes of Ecuador stands out. Nine of the 39 species (23%) identified for this site are currently found in the lowlands of eastern (N=7) and western (N=2) Ecuador. In addition, two species are currently found more than 250 km to the south in the Andes. Half of these currently non-local species are psittacids. Single bone elements often imply that there was a trade in bird parts. Historical accounts, however, describe active trade in live birds. Bones possibly belonging to a single individual of *Pionites melanocephala* suggest the bird was traded whole, possibly alive. Bones of *P. melanocephala* were also identified from the coastal site of Loma Alta. On the other hand, bones belonging to *Aratinga erythrogenys* suggest trade from the western lowlands. The prehistoric trade of birds could have resulted in contact between subspecies from the two sides of the Andes, possibly explaining the difficulties in finding consistent characters for some psittacid subspecies.

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INVESTIGATING SEASONAL FLUCTUATIONS IN NEST SUCCESS OF THE ACADIAN FLYCATCHER (*EMPIDONAX VIRESCENS*).

The risk of nest predation can vary through time. As part of an ongoing study, we observed seasonal increases in nest survival, consistent across years, for Acadian Flycatchers (*Empidonax virens*). Using linear regression with nest and behavioral data from 2007-2009, we tested for relationships between date and five variables associated with hypotheses regarding variation in nest survival. Acadian Flycatchers reduced call rates and built higher nests as their breeding season progressed. Increased nest height also reduced the risk of nest predation independent of date. By contrast, there was no evidence of seasonal shifts in nest visitation rates, nest concealment, or the mean number of young per brood. The behavioral shifts (call rate and mean nest height) of Acadian Flycatchers may help explain a pattern of increased nest survival across time that has important demographic consequences for this species.

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EFFECTS OF PARTIAL HARVESTING ON HABITAT SELECTION PATTERNS IN A FOREST WARBLER.

In most passerine species, reproductive success largely depends on the selection of a good-quality territory. While several different models describe this selection process, they all predict that the best available territories will be the first to be occupied, sequentially leaving lesser-quality areas open for settlement as population density increases. To test this prediction, we monitored temporal patterns in territory selection by male ovenbirds (*Seiurus aurocapilla*) upon their return from spring migration in 2008 and 2009. Each of the 5 pairs of study sites included a control, and a site subjected to selection harvesting (30-40% removal) in the winter of 2006-2007. While population density was lower in treated sites, preliminary results showed no significant differences between the rate of saturation (cumulative change in

proportion of final density) in control vs treated sites during the spring arrival period. However, the first territories to be occupied each year were mostly located in control sites. Greater attraction to high capacity sites may reflect differences in vegetation characteristics, food abundance, and it may also reflect public information.

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THE STATUS OF BEWICK'S WRENS (*THRYOMANES BEWICKII BEWICKII*) IN ARKANSAS: THE CITIZEN SCIENCE COMPONENT
We established a statewide citizen science program, the Arkansas Wren Survey, to evaluate the status of Bewick's Wrens (*Thryomanes bewickii bewickii*) in Arkansas. Citizens were recruited using web resources and various news outlets. At this time, we have 59 volunteers. Each participant selects at least two sites with suitable habitat and uses playbacks to elicit a response from any wrens in the area. If a Bewick's Wren is detected, we follow-up on the reported detection to determine if it is valid. Thus far, volunteers have surveyed at 70 sites. We have had five Bewick's Wren reports and all have been Carolina Wrens (*Thryothorus ludovicianus*). These results, combined with our own professional surveys, suggest that Bewick's Wrens are extirpated from Arkansas. Additionally, we have created a short survey to determine the attitudes of survey participants. We will present additional results at the conference.

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APPROACHES TO STUDYING BREEDING HABITAT RELATIONSHIPS: EVOLUTION FROM SELECTION TO POPULATION PERFORMANCE

Investigations of habitat use by songbirds gained momentum from 1960-1990 with greater interest and efforts in non-game bird conservation. These studies initially focused on effects of habitat structure on bird communities but then increasingly focused on attributes important to individual species. This research led to the development of numerous habitat relationship or suitability models that were used in conservation efforts. As knowledge developed of the effects of habitat at multiple spatial scales and the possible disconnect between density and viability greater interest developed in demographics and population performance. I demonstrate how this new focus on understanding habitat effects on population performance has or can be used in habitat-based population modeling to guide bird conservation at different scales. These approaches range from simple source-sink models to spatially explicit demographic metapopulation models that can be linked with landscape change models. The data and validation needs for these approaches have significant implications for adaptive management, monitoring, and research.

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AVIAN ELEVATIONAL SHIFTS FOLLOWING 100-YEARS OF CLIMATE CHANGE IN CALIFORNIA'S SIERRA NEVADA MOUNTAINS

Twentieth century climate warming is being increasingly related to upward shifts in elevational ranges of montane species. However, little information exists on the ecological characteristics of species showing range shifts, encouraging further exploration into the species-level factors associated with movements. We present findings from a recently completed 8-year resurvey of birds along three elevational transects in the Sierra Nevada Mountains of California, that were originally surveyed 80 to 100 years ago. Single-season occupancy models that accounted for false absences using detection covariates that differed between eras were developed for over 80 species and analyzed for shifts in elevational range between eras. Elevational movements showing shifting range boundaries were common, with strong species-specific, idiosyncratic responses; upward shifts in elevation were the dominant response while some species shifted their ranges downward. A substantive percentage of species did not show any elevational range change. Additionally, the responses of low-elevation versus high-elevation species were strongly divergent over time. Our results provide evidence over an unusually long time span of how climate change has already begun affecting bird ranges.

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THE ROLE OF SEED-DISPERSING CORVIDS IN FOREST REGENERATION AND DEVELOPMENT

A small number of the Corvidae—including crows, jays, and nutcrackers—are important dispersers of seeds from broad-leaved trees (the “nut” trees) or pines (*Pinus* spp.) in temperate forest communities. Seed dispersal, effected through scatterhoarding, comes from the corvid tendency to store food for future use. Species in the genera *Aphelocoma*, *Corvus*, *Cyanocitta*, *Garrulus*, *Gymnorhinus*, and *Nucifraga* typically scatterhoard the relatively large seeds or “nuts” from broad-leaved trees (e.g., *Corylus*, *Fagus*, *Juglans*, *Quercus*) and/or the comparatively smaller seeds of *Pinus*. Seed dispersal by corvids leads to forest regeneration, forest development, and tree distribution with respect to climate change, with particular reference to post-Pleistocene tree migration. In particular, the seed dispersal services of Clark’s Nutcracker (*Nucifraga columbiana*) have profoundly influenced pine population structure and forest successional processes of several western North American pines. Nutcracker seed dispersal enables pine distribution to respond rapidly to climate change. Furthermore, nutcracker selection of micro-sites for dispersal of whitebark pine (*Pinus albicaulis*) seeds plays a major role in the development of treeline forest in some geographic regions.

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NON-BREEDING COMPETITION BETWEEN MIGRANT AND RESIDENT WARBLERS

Although migrant songbird populations are highly dependent on winter conditions, little research has been conducted during this time of year. Previous research has focused on habitat, food and competition within species, while largely ignoring competition with other species. I am testing the hypothesis that American Redstarts (*Setophaga ruticilla*) compete for food (insects) with Adelaide’s Warblers (*Dendroica adelaidae*) in southwest Puerto Rico. Results to date suggest that redstarts and Adelaide’s are competing: they feed in the same places using the same methods, insect densities decline sharply over the winter with concurrent declines in body condition of both species, and the two species are aggressive towards each other. The foraging niche of Adelaide’s does not appear to shift after redstarts leave, and their territories overlap in two dimensions, suggesting that Adelaide’s are superior competitors that force redstarts to use a vagrant fugitive strategy.

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DIETARY CAROTENOIDS AFFECT COLOR VISION-BASED FORAGING IN THE HOUSE FINCH

Diet-derived carotenoid pigments are the basis of many colorful sexually-selected ornaments in birds, including the yellow to red plumage of House Finches (*Carpodacus mexicanus*). Carotenoids also accumulate in the cone oil droplets of the avian retina where they filter light and enhance hue discrimination and improve color constancy under variable lighting conditions. In wild House Finches, retinal carotenoid levels vary significantly among individuals with season and body condition. Because of the importance of carotenoids in color vision, this variation may shape the color vision capabilities of individuals. To examine this possibility, we tested the color-vision based foraging performance of adult House Finches before and after manipulating retinal levels with dietary carotenoid supplements. We measured foraging performance by challenging birds to extract chromatically contrasting food items from a matrix of distracters under varying lighting conditions. We found that specific dietary carotenoids significantly affected foraging performance under some but not all lighting conditions suggesting that dietary carotenoids may not only produce plumage coloration, but can influence color vision which has an essential role in foraging and mate choice.

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SUBOPTIMAL REPRODUCTIVE SHARING IN COOPERATIVE CROWS? AN INBREEDING EXTENSION AND TEST OF THE TUG-OF-WAR MODEL OF REPRODUCTIVE SKEW

Theory predicting how reproduction should be partitioned among family members in cooperatively breeding birds is scant, despite the vast reproductive skew literature, because the costs and benefits of inbreeding have yet to be incorporated into current skew models. Here, we extend the tug-of-war model of reproductive skew with inbreeding parameters, and test the predictions of this model in a cooperatively breeding American crow (*Corvus brachyrhynchos*) population. Approximately 20% of offspring in this crow population were produced through incestuous or highly inbred matings, and inbred offspring suffered severe survival costs. Using empirically derived genetic relatedness coefficients, male competitive asymmetries and a range of offspring survival probabilities, we generated expected reproductive shares of the male breeders and auxiliaries, and compared these expectations to patterns observed in the field. We found that expected values predicted observed values, but only when we specified the minimal predicted survival costs of inbreeding—the upper bound of the 95% confidence interval of the survival probability for inbred birds. Our results suggest that these crows partitioned reproduction suboptimally, given the high costs of inbreeding in this population.

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USING PTILOCHRONOLOGY TO COMPARE CONDITION OF FLORIDA SCRUB-JAY (*APHELOCOMA COERULESCENS*) JUVENILES IN DIFFERENT HABITATS

Ptilochronology, which uses feather growth bars as an indicator of nutritional status in birds (Grubb 1989) can be especially useful in studies of nutrition where behavioral data do not exist or are difficult to obtain. The objectives of this study were to evaluate whether ptilochronology is a good measure of condition in Florida Scrub-Jays (*Aphelocoma coerulescens*) and to use ptilochronology to compare condition of juvenile Florida Scrub-Jays between a suburban and a wildland habitat where nestling food availabilities and timing of breeding differ. Growth bars are a reliable indicator of condition in Florida Scrub-Jays. As expected, suburban Florida Scrub-Jays juveniles have smaller growth bars than wildland juveniles, probably reflecting the incorporation of non-preferred human provided foods into the diet. Ongoing analyses are examining temporal patterns of nutritional condition of young within and between suburban and wildland populations.

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SEASONAL PATTERNS OF USE OF SUPPLEMENTAL WATER BY CALIFORNIA QUAIL (*CALLIPEPLA CALIFORNICA*) AND MAMMALIAN PREDATORS ON MCB CAMP PENDLETON

Dry season precipitation is rare in coastal southern California’s Mediterranean climate, and most natural surface water sources are intermittent. The moderating effect of the ocean is restricted to coastal areas during the dry season. We tested whether supplemental water affects distribution of California quail at MCB Camp Pendleton by comparing occurrences at supplemental water sources (guzzlers) with occurrences at comparison sites lacking supplemental water. While surveying for quail, we surveyed for mammalian predators to assess whether guzzlers were predation traps. Although trail cameras confirmed that quail used guzzlers, presence of a guzzler did not prevent quail from migrating downslope to coastal areas during the dry season, where guzzler use continued. Predators were more likely to be detected at guzzlers used by quail and deer, but we detected no predation events, and predators did not affect quail use of guzzlers. Although standing water sources may be important to quail, the moderate conditions found at coastal areas may be sufficiently beneficial to maintaining water balance that presence of standing water does not dictate quail distributions in this population.

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THE SAN DIEGO COUNTY MULTIPLE SPECIES HABITAT CONSERVATION PLAN: HOW WELL ARE WE PROTECTING AVIAN SPECIES?

The rich avian biodiversity in San Diego County has long been threatened by continued growth and development. In an effort to resolve this conflict, the County and several other municipalities developed a Multiple Species Habitat Conservation Plan for the southwestern portion of the County. The goal of this plan was to conserve biodiversity, while facilitating appropriate development. We evaluated how well this program has conserved avian diversity within the Plan area by evaluating whether documented bird locations have been conserved or lost since adoption of the Plan. While the Plan was designed mainly to ensure the conservation of only 27 bird species, we found that conservation acquisitions made to date have conserved a majority of known locations for nearly all bird species found within the Plan area. We also found that a majority of the remaining locations are within the areas proposed for future conservation. The level of conservation already achieved greatly reduces the uncertainty that avian diversity will be protected in the Plan area into the future.

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THE EFFECTS OF URBAN LAND COVER AND DEVELOPMENT AGE ON SONG SPARROW POPULATION CONNECTIVITY

Urbanization converts native vegetation to novel land cover types, which may affect population connectivity. If so, genetic differentiation between sampling locations should be best predicted by measures of distance that incorporate the effect of land cover on dispersal. We studied this relationship in Song Sparrows (*Melospiza melodia*) at 18 sites in the Seattle, WA, metropolitan region. We generated a series of hypothetical "resistance landscapes" based on land cover and development age, calculated "resistance distances" between pairs of sites based on those landscapes, and related those distances to pairwise genetic differentiation. Genetic differentiation was best predicted by a multiple regression model containing resistance distances in which resistance to dispersal was linearly related to age of development and a second set of resistance distances in which high and medium urbanization were 100 times more resistant than vegetation land covers ($R^2=0.149$; $p=.003$). Our results suggest that urban development reduced population connectivity for Song Sparrows. The relation to development age suggests that genetic differentiation in the urban system has not yet reached equilibrium, so the effects of connectivity loss will increase.

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EFFECTS OF BROOD SIZE AND NESTLING AGE ON PARENTAL CARE BY NORTHERN MOCKINGBIRDS (*MIMUS POLYGLOTTOS*)

Factors that affect parental feeding rates and nestling growth rates in the Northern mockingbirds (*Mimus polyglottos*) - brood size and nestling age - were assessed through feeding rate observations, morphometric measurements and hematocrit levels during the 2006 - 2008 breeding seasons in Florida. I hypothesized that brood size and nestling age have an effect on feeding rates, and these factors will cause variation in the growth rates of nestlings. I also examined the variation in male participation in nestling care. Parents increased the number of feeding trips in larger broods but not proportionally to the increment in brood size. However, there was no difference in the mass gained by the nestlings among the different nests with broods larger than two nestlings. Nestling age had a positive effect on feeding rates, and females did most of the feeding and nest sanitation. These results demonstrate that birds can maximize their reproductive efforts by having larger broods that will grow at similar rates. This study has been used to develop an exercise for middle school children in science classes.

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FACTORS ASSOCIATED WITH BEHAVIORAL PROBLEMS AND SURVIVAL FOLLOWING RELEASE OF CAPTIVE-REARED CALIFORNIA CONDORS (*GYMNOGYPS CALIFORNIANUS*)

To evaluate factors that possibly influence the success of captive-reared California Condors released to the wild, we examined rearing data (from San Diego Wild Animal Park and Los Angeles Zoo) and release data (from California Condor Studbook) for 110 individuals. Two dichotomous outcomes—behavior (either normal or "misbehavior" involving affiliation with humans or man-made structures) and survival in the wild—were tested at 1 year and 2 years following release. Outcomes were subjected to Chi-square and binary logistic regression analyses using seven predictor variables: sex, rearing facility, rearing method (parent versus puppet), adult mentoring before release (0-736 days; mean=97), age at release (180-1110 days; mean=374), release site, and established population size at release site (0-30; mean=11.4). Rearing facility and rearing method significantly affected behavior, with San Diego and puppet-reared birds exhibiting misbehavior more often. Sex (females surviving better) and established population (survival better with smaller population) influenced first-year survival, whereas mentoring (presence but not duration) significantly enhanced survival through both years. These findings provide important insights on the rearing and socialization techniques used for reintroducing condors to the wild.

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THE DISTRIBUTION AND RELATIVE ABUNDANCE OF FIVE SPECIES OF FOREST-FALCONS IN SE PERUVIAN AMAZONIA

The diversity of forest raptors is known to be high in the Neotropics, but due to their secretive habits and low abundances, these species have been understudied. I conducted a study of 5 little-known species of Forest-falcons (*Micrastur*: *Falconidae*) aiming to determine their patterns of distribution and relative abundance in lowland rainforest of Los Amigos Biological Station in SE Peru. I confirmed the occurrence of *Micrastur semitorquatus*, *M. ruficollis*, *M. gilvicollis*, *M. buckleyi* and *M. mirandollei* in the area by detecting their vocalizations during 147 auditory surveys conducted at dawn over 3 field seasons. Frequencies of detection for all species were consistent among field seasons and varied by species from 3-43% (higher for *M. ruficollis* and *M. gilvicollis* and lower for *M. mirandollei* and *M. buckleyi*). All forest-falcon species overlapped in their occurrence in the habitats where surveys were conducted. However only *M. buckleyi*, *M. semitorquatus* and *M. gilvicollis* were detected in highly modified floodplain forest, and *M. mirandollei* occurred only in terrace forest. The occurrence data were also corroborated by radio-tracking individuals of all species.

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FROM PATHOLOGY TO POPULATIONS: IMPLICATIONS OF BEAK KERATIN DISORDER

High prevalence of gross deformities in wild populations often indicates underlying population health problems. An epidemic of Beak Keratin Disorder (BKD) among Black-capped Chickadees (*Poecile atricapillus*) and other avian species has recently been identified in Alaska and the Pacific Northwest. In affected birds, the beak's keratin layer becomes grossly overgrown, sometimes accompanied by abnormal skin and feathers. In addition to decreased physical condition resulting from compromised feeding and preening ability, the deformities may be a sign of other systemic problems. To characterize the pathology of this condition, we examined keratinized tissues using histology and scanning electron and x-ray microscopy. We also measured beak growth rates in captivity and documented significantly faster, possibly neoplastic, growth in affected birds relative to controls. For birds with BKD, we observed high mortality rates and increased susceptibility to infectious agents, evidenced by skin lesions of bacterial and/or fungal origin. These results highlight the severity of BKD and potential implications for individual and population health. Increasing occurrence across broad ecological gradients warrants concern about underlying environmental factors in this region and cascading effects on avian populations.

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HEERMANN'S GULL'S SURVIVAL AND FECUNDITY RATES UNDER VARIABLE FOOD CONDITIONS: A CLIMATE CHANGE RELATED POPULATION PROJECTION IN THE GULF OF CALIFORNIA.

Seabirds exhibit high young mortality, deferred maturity, high adult survival, low fecundity, and skip breeding in some years. Environmental stochasticity, may affect one individual several times in its lifetime. Heermann's Gull (*Larus heermanni*), breeding almost exclusively in the Gulf of California, is periodically affected by environmental fluctuations, which limit food availability and, hence, breeding success. We examined survival and fecundity rates of Heermann's Gull and established a matrix model explaining population growth under different food conditions, simulating population growth under diverse frequencies of ENSO events. Heermann's Gulls respond in two main fashions: When ENSO conditions prevail, contribution of survival to demographic dynamics is higher than that of fecundity, while when non-ENSO conditions prevail, the opposite is the case. The capacity to survive breeding collapses to reproduce successfully later, appears as a major selective factor for this species. Values of λ indicate that this species is resilient to environmental variability. Evidence shows that oceans have been subject to wide fluctuations in their physical characteristics during the last geologic ages. Seabirds have adapted their life history strategies to cope with these conditions.

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RANGE-RESTRICTION AND CONSERVATION OF MEXICAN AVIFAUNA: IMPLICATIONS OF HIGH ENDEMISM AND FOCAL AREAS FOR SPECIES OF HIGH CONCERN.

Almost a third of all North American landbirds—276 species—are endemic to North America. Of these 96 species are found only within Mexican territory and 15 only in the U.S. At a broad scale, hotspots of endemism are the Transvolcanic Belt, the tropical dry forest of the Pacific Slope, the Balsas River Basin, Yucatan Peninsula, and the Southern Tropical Highlands in Mexico. In addition 93 species have a restricted distribution during their life cycle and depend on specialized habitats. The conservation vulnerability assessment indicates that 60 range-restricted species need of immediate conservation attention; most of these (50) are in México and 34 are country endemic. Main threats are forest fragmentation due to agriculture, logging and livestock, and their populations are unknown. For achieving conservation we still need research on basic natural history. Measures of habitat management need to address habitat degradation and protection, and strategies need to actively involve local land owners. In order to prevent extinctions of our shared North America avifauna conservation designs must address both highly range-restricted “micro”-endemics as well as broader-scale regional centers of endemism.

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RETROSPECTIVE ANALYSIS OF TROPHIC LEVEL IN A TROPICAL SEABIRD COMMUNITY OF THE EASTERN PACIFIC WARM POOL

Understanding mechanisms driving past population changes can help us interpret contemporary population trends. Therefore, gauging ecological effects of climate is of paramount importance to ecologists. With the goal of gauging effects of the Pacific Ocean's 1976-77 regime shift to a tropical and pelagic community of seabirds, we retrospectively analyzed historical specimens for stable carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) isotopes in a suite of ecologically and phylogenetically diverse group of seabirds from the eastern Pacific warm pool. We found significant declines in feather $\delta^{13}\text{C}$ (-1‰ over the 46 years), while feather $\delta^{15}\text{N}$ did not change with time. The changes in feather $\delta^{13}\text{C}$ were guild specific, with species dependent on subsurface predators decreasing while species that fed independently from subsurface predators did not. Without a concurrent change in $\delta^{15}\text{N}$ a prey-switching scenario is unlikely. Instead, our results suggest a decrease in average

phytoplankton growth rates over time. We hypothesize that phytoplankton growth rates declined with a drop in productivity in the eastern Pacific warm pool caused by a more stratified water column and reduced vertical mixing.

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MULTI-SCALE HABITAT CHARACTERISTICS OF SHOREBIRDS DURING SPRING MIGRATION IN SOUTHWESTERN LOUISIANA

We evaluated local and landscape factors affecting shorebird use of rice fields during spring migration in southwestern Louisiana. We created 5 habitat suitability zones (HSZs) based on rice density, canopy cover, and distance from marsh and then performed stratified random surveys in rice fields within each of the 5 HSZs. We surveyed 94 fields in 2008 and 85 fields in 2009, and surveyed each field 8 times. We quantified all landscape habitat types within 3 km of each rice field, recorded habitat conditions during each visit, and recorded all shorebirds observed. We used mixed modeling to determine the influence of habitat variables on shorebirds, and determined that shorebird density was primarily influenced by field conditions at each site: flooding condition ($p < .00001$), the length of the field perimeter bordered by trees ($p = 0.0075$), surveyed rice field area ($p < 0.0001$), and rice height ($p < 0.0001$). Shorebird density was less influenced by landscape habitat availability or HSZ. We determined that the highest shorebird densities occurred at sites with short rice and limited trees in the higher quality HSZs.

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CONSPECIFIC ATTRACTION AND POPULATION RECOVERY OF THE ENDANGERED CAPE SABLE SEASIDE SPARROW IN THE FLORIDA EVERGLADES

Many territorial avian species, including the federally-endangered Cape Sable seaside sparrow (*Ammodramus maritimus mirabilis*), tend to aggregate breeding territories often using conspecific cues to select habitat. Species that tend to have naturally low densities may benefit greatly by clustering territories by reducing potential Allee effects. We designed a conspecific song playback system to test if Cape Sable seaside sparrows use conspecific cues to select breeding habitat and to determine whether sparrows would respond to such a management manipulation. Our preliminary results were promising; we observed evidence that Cape Sable seaside sparrows used conspecific cues in the selection of breeding habitat and we documented that sparrows respond to song playback as an artificial conspecific cue. Our findings have important management implications since habitat restoration alone may not be enough to encourage recruitment and settlement by Cape Sable seaside sparrows into newly restored habitat in the Florida Everglades due to an absence of conspecifics.

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POST-FLEDGING SURVIVAL AND HABITAT USE OF WILLOW AND DUSKY FLYCATCHERS

Although many demographical studies focus on nest success, productivity estimates may be biased high because fledglings may not survive to the end of the breeding season. I examined fledgling survival and habitat use of willow flycatchers (*Empidonax traillii*) and dusky flycatchers (*E. oberholseri*) by locating color-banded fledglings daily during the dependence period. I resighted 81% ($n = 21$) of willow flycatcher fledglings from eight nests in 2008 and 46% ($n = 13$) from five nests in 2009. I resighted 69% ($n = 51$) of dusky flycatcher fledglings from 19 nests in 2008 and 67% ($n = 58$) from 19 nests during 2009. Mortality usually occurred within the first few days after fledging. I rarely located willow flycatcher family groups in vegetation other than mature willow, but I located dusky flycatcher family groups in immature willow, along the forest edge, or even ~30 m into the forest. My results suggest that post-fledging survival can vary widely among species and by year, therefore, using only nest success or an indirect estimate of fledgling survival may be misleading when examining population growth.

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SEASONAL SURVIVAL ESTIMATES OF HATCH YEAR AND ADULT
WRENTITS IN NORTHERN CALIFORNIA

We estimated apparent survival rates during the breeding season (May-September), and winter period (October-April), for adult and hatch-year Wrentits (*Chamaea fasciata*) using 15 years of constant-effort mist-net data in northern California. Previous studies of other resident songbirds suggest that hatch-year birds suffer high mortality during the post-fledging period and that survival rates approach those of adults at independence. Consistent with our expectations, annual survival estimates were higher for adults (0.57 ± 0.03) than hatch year birds (0.17 ± 0.04) across the entire period. However, contrary to our expectations, hatch-year birds had higher survival during the breeding period (0.68 ± 0.06) than through their first winter (0.22 ± 0.001). Adults also exhibited higher survival rates during the post-breeding period (0.84 ± 0.03) than through the winter (0.72 ± 0.01). These results demonstrate that both hatch-year and adult Wrentits are more limited during winter months than the breeding season and therefore weather conditions and resource availability during the winter months may have significant effects on this resident species.

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TRENDS IN AVIAN COMMUNITY STRUCTURE ACROSS A
GRADIENT OF NATIVE TO INVASIVE RIPARIAN VEGETATION
In riparian areas of the arid and semi-arid western North America, tamarisk (*T. amaris* spp.) and Russian olive (*Elaeagnus angustifolia*) threaten native cottonwood (*Populus fremontii*) and willow (*salix* spp.) habitats. These native woodlands are known to maintain among the highest avian densities and species richness in temperate North America by providing increased habitat heterogeneity that provides nesting substrates and cavities for many species relative to the surrounding landscape. Although resource managers are actively managing these invasive species, the effects of these invasives on bird communities are site and species specific. On the San Juan and Animas Rivers in northwest New Mexico, we used point count surveys, vegetation assessments, and prey surveys to address: (1) how avian communities respond to a gradient of native to invasive riparian vegetation, and (2) which life history characteristics and prey resources drive response patterns. Sites containing predominantly native vegetation had higher species richness and diversity than predominantly invasive sites. Our results suggest that responses to the vegetation gradient are species-specific. We will discuss the implications of varying degrees of native and invasive vegetation on avian community structure.

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A CENTURY OF CHANGE: BIRD COMMUNITIES OF ILLINOIS,
1906-1909, 1956-1958 AND 2006-2008

From 1906-1909, Stephen Forbes, Alfred Gross and Howard Ray conducted one of the first quantitative bird surveys in North America, documenting the numbers of all species they observed in all habitats across Illinois with a specific, repeatable method. Richard and Jean Graber repeated the study from 1956-1958, and we replicated their efforts from 2006-2008. Just as Illinois is now dominated by a few land cover types, the bird community has become highly skewed towards a few generalist species; four birds (Red-winged Blackbirds, European Starlings, American Robins and Common Grackles) comprised more than half of all birds we recorded. Shrubland and

grassland birds, which dominated the 1900s sample, have declined the most over the past 50 years. In contrast, forest communities have changed the least. Developed areas have the highest densities of birds, but the lowest diversity and the least variation among the northern, central and southern regions. Croplands support lower diversity than during the previous surveys. The combination of bird data, human dimensions surveys, and analysis of land use changes provides powerful insights for informing conservation decisions.

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INTRODUCTION TO SYMPOSIUM

The Yellow-billed Cuckoo (*Coccyzus americanus*) is a Neotropical migrant, breeding in wet habitats throughout North America and wintering primarily in South America east of the Andes. Documented population declines and local extirpations in the western United States prompted the US Fish and Wildlife Service in 2001 to determine that listing of the population west of the crest of the Rocky Mountains as endangered was warranted (but it was precluded by higher priority listing actions.) This symposium will serve as a venue for Yellow-billed Cuckoo researchers throughout the western United States to share their research addressing many pressing habitat, demographic, and behavioral issues of relevance to managing Yellow-billed Cuckoos and ensuring long-term survival of ecologically functional populations. The symposium will encourage dialogue, promote problem-solving discussions, and enable us an unprecedented opportunity to collaborate and improve our understanding of and management actions for the Yellow-billed Cuckoo. The symposium will also address goals and the direction of the Yellow-billed Cuckoo Conservation Plan, which is currently in development under the guidance of the US Fish and Wildlife Service and many other stakeholders.

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SPECIATION IN THE WHITE-BREADED NUTHATCH (*Sitta carolinensis*): A MULTILOCUS STUDY OF DIVERSIFICATION IN NORTH AMERICAN PINE AND OAK WOODLANDS

The pine/oak woodlands of North America were once continentally distributed forest that became fragmented by mountain uplifts and glacial cycles. The White-breasted Nuthatch (*Sitta carolinensis*), which inhabits this community, should reflect this dynamic biogeographic history. A previous phylogeographic study of the White-breasted Nuthatch used a single mtDNA gene that gave strong support for four geographically structured and well-supported clades. While single locus data is informative, it does not allow for a complete picture of species and population history. Multi-locus data is necessary to provide a clear representation of species and population demography. We will do this by constructing species trees estimated from multiple gene trees and by testing multiple models of speciation that will provide accurate estimates of population divergence time, rates of gene flow, and effective population sizes. The results from the pairwise Fst comparison revealed that the nuclear loci show significant structure. These data will be further analyzed to provide accurate models of speciation.

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EFFECTS OF GYPSY MOTH OUTBREAKS ON NORTH AMERICAN
WOODPECKERS

We examined how gypsy moths, an invasive species that adversely affects North American forests but potentially provides large pulses of food to predators, influences woodpecker populations in North America. Using spatial data on gypsy moth outbreaks between 1975 and 2008, we examined abundance data for 7 species of woodpeckers estimated from Christmas Bird Counts. Of the species tested, only Downy Woodpeckers appeared to exhibit little or no response to gypsy moth outbreaks. Hairy and Pileated Woodpeckers were found in significantly lower densities during outbreaks,

returning to normal levels immediately afterwards. Sapsuckers, Three-toed, Red-headed, and Red-bellied Woodpeckers exhibited little response during outbreaks but were recorded at significantly higher densities after the conclusion of outbreaks than they had been pre-outbreak. These analyses demonstrate that gypsy moths have considerable long-term effects on woodpecker populations and in some cases the effects may exhibit themselves for many years following the outbreak. The effects of pulsed resources such as insect outbreaks clearly deserve increased attention because of their likely effect on avian communities over a large geographic range.

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THE EFFECTS OF AMBIENT EXPOSURE ON MICROBIAL PROCESSES AND VIABILITY OF PASSERINE EGGS

The viability of freshly laid avian eggs declines over time when eggs are exposed to ambient conditions, although few in situ experiments have been conducted. We measured microbial loads on egg shells, the incidence of microbial penetration of egg contents, and changes in the viability of wild passerine eggs (*Sialia mexicana*, *Tachycineta bicolor*, *Tachycineta thalassina*) experimentally exposed to ambient conditions in situ in a Mediterranean climate in northern California. Initial microbial loads on eggshells were generally low at our study site (~10 CFU/egg). Eggshell microbial loads did not increase with exposure to ambient conditions, were not reduced by twice-daily disinfection, and were unaffected by parental incubation. The rate of microbial penetration into egg contents was low (2.9% in albumen, 7.9% in yolk) and unaffected by duration of exposure. Egg viability declined very gradually but significantly with exposure duration ($p < 0.001$). Delaying the onset of incubation until the penultimate or last egg of the clutch may maintain hatching synchrony without a large trade-off in egg viability at our temperate-zone study site.

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RANGE EXPANSIONS IN ILLINOIS BIRDS OVER THE LAST 100 YEARS

Stephen Forbes designed and conducted bird surveys for Illinois in 1906; these surveys were repeated in 1956. Using the same methods, we surveyed the same areas from 2006 to 2008 to gain a unique opportunity to investigate changes in Illinois bird distributions over the last 100 years. Using occupancy modeling to investigate changes in distributions over time, we assessed the range dynamics of 81 species. At least ten species expanded their range north and five expanded their range south. Preliminary analyses suggest most of the species expanding northward are resident forest species. The five species that expanded southward are open-country species. A common attribute of species with expanding ranges, beyond being mostly non-migrants, is many have expanded their habitat use to include urban or suburban habitats much more than 100 years ago. While many authors have suggested global climate change will dramatically alter species ranges, data over the last 100 years in Illinois suggests that habitat modification and behavioral changes have been a more important driver of range expansions.

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POST-RELEASE STUDIES OF OILED WILDLIFE: DO DATA SUPPORT REHABILITATION?

Whether to rehabilitate oiled wildlife has been a source of controversy in various countries, stemming from initial studies that indicated post-spill survival of rehabilitated oiled wildlife was poor. People still argue that, without knowing whether the rehabilitated animals return to normal biological functioning, the act of treating oiled animals results in a greater advantage to the human psyche than to the populations of animals they

serve. Post-release studies of rehabilitated oiled wildlife are still relatively rare, numbering less than 35 studies, most of them on birds. This presentation summarizes the results of post-release follow-up studies of rehabilitated oiled birds using three benchmarks for success: 1) percent of birds released, 2) survival past first months of release, and 3) evidence of successful breeding. Recent research demonstrates that oiled wildlife can be successfully rehabilitated and released back into the wild with population level effects.

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SOCIALITY AND DEMOGRAPHIC CONSEQUENCES OF RESOURCE USE FOR COMMON RAVENS IN A TEMPERATE RAINFOREST.

Thorough understanding of a population's ecology requires an understanding of habitat-specific demography. Variation in movements and resource use have been observed in numerous avian species based upon individual traits such as age, sex, and social class. We undertook an empirical investigation of movements, resource use, demographics, and sociality in a population of Common Ravens on the Olympic Peninsula of Washington State, USA. We detected no differences in survival between the sexes, but adults maintained higher survival rates than nonbreeders. Adults displayed strong site fidelity to their territories, while nonbreeders moved extensively. Broodmates and adults accompanied juveniles during some initial dispersal events, but family association ceased after juvenile independence. Nonbreeders were more gregarious, and their home ranges overlapped point subsidies more than adult home ranges overlapped point subsidies. Adults shared little space with their adult neighbors, but shared greater space with nonbreeders when communal food resources fell within their territories. Both adults and nonbreeder home ranges contained similar proportions of resources, but resource use varied between social classes. Raven use of mature forests and anthropogenic land use types was positively associated with survival. Adult use of clearcuts and patchy areas contributed to increased reproduction, but the use of clearcuts along with the use of roads was negatively associated with survival.

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SNOWY PLOVER NESTING HABITAT ON THE FLORIDA PANHANDLE

Snowy Plovers (*Charadrius alexandrinus*) are listed as threatened by the State of Florida, and have been a species of growing concern among wildlife management agencies. The population of Snowy Plovers breeding along the Gulf coast has a patchy distribution, and large stretches of private and public land go virtually unused. As coastal development and engineering progress into new areas, it is important to understand why these birds breed on some beaches and not others. We examined several possible topographical and anthropological effects on plover nest site selection; including human disturbance, coastal engineering, beach management and development. Preliminary analysis indicates that shoreline development and associated factors, particularly high human use, are main factors that discourage breeding. By understanding how these factors affect Snowy Plover breeding activity our results will assist in guiding habitat management for this species.

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SOCIAL STATUS SHAPES PHENOTYPE IN A PASSERINE BIRD

Social status is thought to determine breeding phenotype in a range of organisms, but this linkage has not yet been experimentally established in birds. We used a removal experiment to demonstrate that social status shapes phenotype in the red-backed fairy-wren (*Malurus melanocephalus*). In this cooperatively breeding Australian passerine, males exhibit three distinct types that differ in morphology and behavior: red/black breeders, brown breeders, and brown helpers. We experimentally created breeding positions for brown

helper males by removing red/black breeding males from their social groups, thereby inducing a shift in status from brown helper to brown breeder among the replacement males. Relative to controls, replacement males exhibited a rapid and pronounced increase in cloacal protuberance volume and bill darkness after this switch, and limited production of red/black plumage. Replacement males also exhibited significantly higher post-removal androgen levels, which are known to affect bill darkness, plumage color and cloacal protuberance volume in this species. These findings support the hypothesis that an individual's social status influences hormone-dependent morphological characters, and alterations of status can lead to rapid changes in these characters.

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USING STABLE ISOTOPE ANALYSIS TO EVALUATE BIASES IN CONVENTIONAL DIET SAMPLES

Conventional diet samples such as pellets are often easily collected, but their utility is limited due to biases resulting from varying prey digestibility. Stable isotope ratios of tissues are unbiased representations of an organism's diet and can be used to infer dietary contributions of potential prey. We collected and analyzed pellets and food remains from the chick-rearing period at six Glaucous Gull colonies in northern Alaska; we also collected gull chick feathers and analyzed them for stable carbon and nitrogen isotope ratios. We used these feather isotope ratios, prey isotope signatures from previous studies, and diet-feather isotopic discrimination values from the literature in a Bayesian isotope mixing model (MixSIR). Conventional estimates of prey contributions to diet at each colony did not fall within the modeled 99% confidence interval in 8% of cases, with contributions of birds, garbage, and rodents overestimated in some pellets and food remains. Conventional samples thus provided a reasonably accurate representation of gull diet in this system; they also provided more specific information than isotope analysis about the bird species and age classes present in gull diets.

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GARBAGE MAKES MORE GLAUCCOUS GULLS

Glaucous Gulls are abundant predators in northern Alaska and may benefit from garbage as a supplemental food source, but this benefit has never been quantified. In 2008 and 2009, we studied Glaucous Gull diet and reproduction at eight to ten breeding colonies in northern Alaska. Among colonies, garbage occurred in zero to 85% of pellets and food remains, and average fledging success ranged between zero and 2.9 chicks per pair. Random forest analysis indicated that garbage occurrence in diet samples produced during the chick-rearing was the most important of 22 variables considered in explaining variance in fledging rate. In both 2008 and 2009, there was a significant positive linear correlation between garbage occurrence during the chick-rearing period and fledging rate ($R^2 = 0.87$, $p < 0.001$; and $R^2 = 0.77$, $p < 0.001$, respectively). This demonstrates that Glaucous Gull reproductive output is enhanced by the garbage available in some developed areas. If more garbage becomes available with further development, gull populations may increase. This could negatively affect the gulls' natural prey species, including birds of conservation concern.

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RECOVERY OF A RIPARIAN MAPS STATION FOLLOWING WILDFIRE.

In 2004 a wildfire burned one of two MAPS stations in riparian habitat at Marine Corp Base Camp Pendleton, CA. We assessed the effect of fire by comparing (1) average species richness, and (2) average abundance of two dominant species, common yellowthroat (COYE) and song sparrow (SOSP), at each station during five pre-fire and four post-fire years. In addition, we compared annual changes in abundance of COYE and SOSP between the burned and unburned stations to isolate changes attributable to the fire.

Average species richness at the burned station was marginally higher during the post-relative to the pre-fire period ($p=0.07$), the result of high richness in the first two years post-fire. No change in richness was detected over the same periods at the unburned station ($p=0.55$). Average annual pre- and post-fire abundance of COYE and SOSP did not differ ($p>0.2$) at either station. Annual changes in abundance of the two species with regard to proportion and direction of change were similar at both stations with the exception of a dramatic increase followed by a steep drop in COYE at the burned station 2-3 years post-fire ($p=0.02$).

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AVIAN SEED DISPERSAL BY ENDOZOOCHORY AS AN ECOSYSTEM SERVICE

Seed dispersal by birds is geographically widespread and taxonomically diverse within both birds and plants. The interaction occurs in all types of terrestrial habitats and is one of the most important ecosystem services provided by birds. In the most common type of seed dispersal by birds, endozoochory, birds ingest fleshy fruit (or an analogous structure), followed by gut passage and defecation or regurgitation of the seed. Most plants dispersed by birds in this manner are trees, shrubs, or vines. In north temperate deciduous forests, plants dispersed by birds are generally understory species or shade intolerant successional species. In tropical forests the range of plants dispersed by birds is broader. In many woodland and forest biomes birds are primary drivers of plant succession and recruitment. Because the quality of dispersal differs among bird species, the loss of key dispersers affects plant recruitment and forest composition. The loss of avian seed dispersers and resulting consequences for plants they disperse will likely be most severe in the tropics and on oceanic islands.

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BUILDING PARTNERSHIPS FOR HUMMINGBIRD CONSERVATION

In April 2009, scientists, land managers, and conservationists from Mexico, the United States, and Canada came together for a multi-day workshop in Arizona to discuss the conservation needs of North American hummingbirds. Recent evidence from the Breeding Bird Survey and other sources suggest worrisome population declines in some hummingbird species that breed in the western United States and Canada. Adequate information is lacking for determining the causes of observed declines, assessing population trends of all but a few hummingbird species, or even providing a basic understanding of the range, movements, and natural history of most species (particularly Mexico-restricted species). The Western Hummingbird Partnership was begun to address these issues through monitoring, research, habitat restoration and enhancement, and education/outreach. It is a broad network of partners collaborating to develop an efficient and effective conservation program that investigates what hummingbirds need to survive, successfully reproduce, and sustain viable populations. In this poster, we will present information about our accomplishments and invite those interested in hummingbird conservation to join the partnership.

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HEMOSPORIDIAN PARASITE DIVERSITY AND PREVALENCE ACROSS AN ALTITUDINAL GRADIENT IN PERU

We surveyed the avian community for hemosporidian parasites at 6 sites in Peru that span elevation and humidity gradients. Samples comprised of dried blood smears were collected during 2007-2008 in tropical, upper tropical, subtropical, and temperate humid forests, tropical xeric scrub, and alpine puna. These represent the first systematic surveys for avian blood parasites in the Peruvian Andes. Blood samples were collected from 2650 individuals in 340 species among 20 families, including over 100 species that had never

been previously examined for hemosporidians. To date we have stained and screened 900 samples that span the elevational gradient. The proportion of individuals infected with one or more of the genera *Plasmodium*, *Haemoproteus*, or *Leucocytozoon* is strikingly higher than found previously in the Andean region, and is highly variable with elevation. Malaria prevalence and avian diversity patterns are discordant, casting doubt on the hypothesis that parasites drive diversification.

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A BRIEF HISTORY OF ECONOMIC ORNITHOLOGY

Economic ornithology launched in the United States in 1885 with a small Congressional appropriation to promote investigation of birds and agriculture, including consumption of insects by birds. Interest in the economic role of birds as pest control agents receded as agriculture became more mechanistic, large scale, and dependent upon pesticides. Interest in the functional roles of birds spurred renewed investigation in recent decades. For birds to control pest insects, they must positively affect the abundance and/or the fitness of the resource consumed by the pest. Quantifying the impact of bird predation on arthropods typically involves erecting exclosures that prevent access by birds to their foraging substrates, or deploying perches and nest boxes to increase their abundance. Over 30 published studies in a variety of terrestrial ecosystems, including tropical and temperate forest, grassland, and agricultural crops, have documented top-down control of insect pests. Many, though not all, of these studies show beneficial impacts on the plants consumed by affected herbivorous insects. Through their consumption of insect pests, insectivorous birds contribute valuable ecosystem services in both natural and agricultural systems.

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INDIVIDUAL VARIATION IN SONGS OF THE MANGROVE WARBLER (*DENDROICA PETECHIA CASTANEICEPS*) FROM BAJA CALIFORNIA SUR, MEXICO

During the springs of 1997-98 vocalizations of Mangrove Warblers were collected in all known mangrove stands within Concepción Bay, in south central Baja California Sur, Mexico. Comparisons between the songs of 13 males from 4 isolated locations, believed to be the entire adult territorial male population of the region, were analyzed spectrographically. Previous comparisons between the songs of these birds to western races of the Yellow Warbler (*D. p. spp*) indicated significant ($p < 0.0001$) differences in all measures of frequency, total song length, song element length and between-element gaps; apparent adaptations for sound transmission in dense habitat. Un-weighted pair group arithmetic average cluster analysis of an "Ochiai" similarity matrix compiled from a song element catalog (69 different element forms) differentiated all individual birds. Those from the same location sang songs that were more similar to each other than to those of other stands. This preliminary evidence supports the "Acoustic Adaptation Hypothesis" as well as the concept that songs are learned from nearby tutors. Since the study sites are widely scattered and the population densities are low, a new direction of investigation has been initiated and centers on the conservation implications of "cultural erosion" in fragmented habitats, as reported by Laiolo and Tella for Dupont's Lark (*Chersophilus duponti*) in northeastern Spain.

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SEABIRDS OF THE WESTERN TROPICAL INDIAN OCEAN: DISTRIBUTION, RELATIVE ABUNDANCE, AND COMPARISONS WITH THE SEABIRD COMMUNITY OF THE EASTERN TROPICAL PACIFIC

Seabird survey data from the oceanic western tropical Indian Ocean (WTIO) were collected during 91 days at sea, March - July 1995, using standard 300m

strip-transect methods. 4012 sightings were recorded of 54 species. Sooty Terns (*Onychoprion fuscatus*) were the most abundant (8319 individuals). The next three most abundant species were procellariids: Jouanin's Petrel (*Bulweria fallax*), Flesh-Footed Shearwater (*Puffinus carneipes*), and Wilson's Storm Petrel (*Oceanites oceanicus*). Pelecaniformes were much less abundant; the most abundant among them were Masked Boobies (*Sula dactylatra*; 246 individuals), Red-Footed Boobies (*S. sula*; 51 individuals), and Red-Billed Tropicbirds (*Phaethon aethereus*; 60 individuals). This species composition contrasts with the eastern tropical Pacific (ETP), where procellariids are the most abundant group and sulids are more diverse and abundant. Additionally, overall and species-specific densities were far lower in the WTIO. Relative to the ETP, the WTIO is characterized by lower surface productivity and low abundance of surface-schooling tuna. Because tropical seabirds rely heavily on tuna to make prey available at the surface, this factor alone may largely account for differences in diversity and density between the two ecosystems.

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CONSERVATION RELIANCE AMONG CALIFORNIA BIRD SPECIES OF SPECIAL CONCERN

Conservation-reliant species are imperiled species that will not be able to attain population recovery without continuing, long-term management. Our previous analysis has shown that fully 80% of federally listed species are conservation reliant, indicating the need to prioritize conservation efforts. To determine whether this finding holds true for a geographic and taxonomic subset of imperiled species, we evaluated the extent of conservation reliance among California birds that are listed under the federal or state Endangered Species Acts or are identified as Species of Special Concern. We identified the factors that threaten the persistence of these species and then evaluated whether these threats could be removed or mitigated through short-term measures or would require ongoing management to ensure population persistence. While the recovery of some species can be achieved through targeted management, the majority are conservation reliant by our criteria. It is unlikely that resources will be available to support the needed management for all of these species; conservation efforts must be prioritized.

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BREEDING-SEASON ABUNDANCE, DISTRIBUTION, AND BIOLOGY OF THE PUERTO RICAN BULLFINCH IN GUÁNICA, PUERTO RICO.

Guánica, a subtropical dry forest, is an important habitat for birds in Puerto Rico. Substantial research has occurred during the non-breeding season in Guánica, but less attention has been given to the breeding season. We studied the distribution and breeding biology of the Puerto Rican Bullfinch (*Loxigilla portoricensis*), a little-studied, frugivorous endemic. We conducted 79 point counts from 4 to 20 May 2009. We detected 218 bullfinches at 70 points and modeled detection probability as a function of detection distance, canopy cover and height, and understory cover. We estimated densities by habitat type and produced a population estimate for Guánica. We found 17 bullfinch nests during the spring breeding season: 10 failed and 7 had unknown fates but showed no evidence of fledging young. We related the lack of breeding and low nest survival to rainfall and fruit availability. Results suggest that bullfinches, a species with relatively high survival, may be opportunistic breeders who forego nesting when conditions are not suitable. These data will help us understand the abundance and distribution of bullfinches during the breeding season and help guide long-term management.

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DERIVING A VISION FROM THE BIRDS: CROSSING BOUNDARIES TO SHARE A SPECTACULAR AVIFAUNA, CONCERNS FOR ITS FUTURE, AND INNOVATIVE OPPORTUNITIES FOR ACTION

In defining a new vision for bird conservation, Partners in Flight Canada, Mexico, and the U.S. took its lead from the birds themselves—a spectacular avifauna of 882 native landbird species that disregards international boundaries, shares ecosystems across annual life cycles, is vulnerable to common anthropogenic threats, and inspires action on its behalf through shared beauty, cultural importance, ecosystem services, and value as an indicator of a healthy planet. The shape of the North American continent prescribes a unique avifaunal geography—spectacular abundance of breeding migrants across vast expanses of northern Canada and Alaska funnelling toward increasing species richness and local endemism where temperate and tropical systems meet in Mexico. PIF's conservation vulnerability assessment highlights the loss of bird diversity and habitats of greatest concern, the loss of spectacle as common birds continue to decline, and the need for trans-boundary action. The resulting tri-national vision calls for collective stewardship by all three countries of the entire continental avifauna through imaginative, integrated approaches that engage institutions, corporations, communities, policies, and land use to revitalize the space shared by birds and people.

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 THE ROLE OF GLARE AS A SELECTIVE PRESSURE ON THE EVOLUTION OF BILL COLOR AMONG NON-PASSERINES.

A bill that extends into the bird's visual field may create specular reflection that distracts the bird or reduces visual acuity. The widespread occurrence of dark bills may be an adaptation to reduce such glare. Among American wood-warblers (family Parulidae), those that forage in the sun have darker upper bills than those that forage exclusively in the shade. Willow Flycatchers (*Empidonax traillii*) forage significantly more often from shade after the bills are painted white. These data support the hypothesis that bill color is a factor in the ability of birds to forage in sun. We quantified foraging time in sun, shade and mixed light among species in North America, Belize, and Costa Rica from 1991–2010. We quantified the Munsell color value of bills on museum specimens. Most non-passerines have a darker upper than lower bill, with little variation between males and females. Among non-passerines light upper bills are more common than among passerines. Birds associated with water (e.g., egrets, gulls) have light bills more often than do land birds. We suggest that dark bills are an adaptation among land birds to reduce glare that disrupts vision, but welcome suggestions for the frequent occurrence of pale bills in water birds.

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MANIPULATING THE PATERNITY THREAT: IS MATE GUARDING FLEXIBLE IN THE AUSTRALIAN ZEBRA FINCH?

Mate guarding likely limits opportunities for extra-pair copulations (EPCs), thereby influencing individual fitness and mating strategies. Implicit within the functional explanations for mate guarding, there is a tradeoff between protecting within-pair paternity and pursuing EPCs. It is therefore generally predicted that the intensity of mate guarding behavior will increase as the threat to within-pair paternity increases and decrease as the opportunity for EPCs increases. This prediction lays at the foundation of most examinations of mate guarding, but it has not been explicitly tested experimentally. We examined the flexibility of mate guarding behavior in captive breeding pairs of Australian zebra finch (*Taeniopygia guttata*) by manipulating the perceived opportunity for EPCs within an experimental arena. Quantifying the changes in mate guarding behavior allows for the assessment of two important tradeoffs: 1) for males, the tradeoff between protecting within-pair paternity

and soliciting EPCs; and 2) for females, the tradeoff between avoiding undesirable EPCs and attaining desirable EPCs. Exploring the flexibility and optimization of mate guarding behavior will allow for a better understanding of the ecological factors that structure and limit promiscuous behavior.

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COMMON YELLOWTHROATS DO NOT CHANGE THEIR SIGNALING IN RESPONSE TO ANTHROPOGENIC DISTURBANCES

Urbanization has been shown to disrupt both visual and acoustic communication between organisms. In this study we test how human disturbance can affect acoustic and visual signals in the common yellowthroat (*Geothlypis trichas*). We characterized the properties of song, plumage and the signaling environment of males and their territories. We found that ambient noise increased in amplitude near urban development but the temporal and spectral properties of song did not change. In addition, we found that ambient light and the visual background of yellowthroat territories near urban development did not differ from those in more natural habitats. Likewise, plumage characteristics did not differ between urban and natural environments. Our results show that the signal design of yellowthroat song and plumage do not change with urbanization, suggesting the possibility that selection to conserve signal content may be stronger than selection for efficient signal transmission.

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BIOGEOGRAPHIC HISTORY PREDICTS BLOOD OXYGEN CARRYING CAPACITY AND CELL SIZE IN HIGH-ALTITUDE BIRDS

High-altitude hypoxia has profound impacts on animal respiratory systems and is a major driver of physiological adaptation and diversification. High-altitude animals are known to have adapted in diverse ways to meet oxygen uptake and transport demands. However, the extent to which the evolutionary time at high-altitude affects lineage-specific respiratory characteristics is poorly known. The avifauna of the tropical high-Andes includes a diverse set of species that have diverged from lowland relatives over thousands to millions of years. We examined the parameters that affect blood oxygen carrying capacity of blood, including hemoglobin concentration and erythrocyte size. In comparisons among twelve pairs of related high and low populations, four unique hematological patterns are evident. These parameters vary strikingly in conjunction with divergence times separating high-altitude lineages from their nearest low-altitude relatives, suggesting a time-lag to adaptation. However, the data also contain evidence of unique, lineage-specific patterns, suggesting that there may be multiple solutions to this physiological challenge.

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FINE-SCALE GENETIC POPULATION STRUCTURE OF CHESTNUT-BACKED ANTBIRDS IN A FRAGMENTED LANDSCAPE.

Continued dispersal among fragments is thought to play a key role in the persistence of forest-dependent species in fragmented landscapes. In contrast to other forest-dependent species, Chestnut-backed Antbirds (*Myrmeciza exsul*) are found in many of the forest fragments in our study area, suggesting high dispersal. We examined fine scale population genetic structure of Chestnut-backed Antbirds in a fragmented landscape in Costa Rica to infer the extent of gene flow between populations in contiguous and fragmented contexts. We used 16 microsatellite loci to describe population structure and to quantify relatedness within each population. We sampled 5 populations separated by 11–34 km and found significant genetic population structure overall, and also in all pairwise comparisons. We found no pattern of isolation by distance, but a significant pattern of isolation by resistance (putative connectivity) was evident. Relatedness in the most isolated fragment was significantly higher than in all other populations sampled. Gene flow in this species has apparently been reduced by deforestation in this landscape, but significant differentiation of putatively connected populations additionally suggests limited dispersal in general.

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THE USE OF IMAGE TEXTURE AS A TOOL FOR PREDICTING BIRD HABITAT

Measuring vegetation features that influence bird distributions across broad areas is not trivial. Procedures using remotely sensed data have been developed to map land cover classes. However resulting maps do not capture fine scale habitat information, such as vegetation structure that influences avian habitat occupancy. Here, we evaluate the usefulness of image texture analysis for predicting vegetation structure in a prairie-savanna-woodland continuum. Vegetation structure was measured in the field at Fort McCoy Military Installation, Wisconsin, USA. First and second-order image texture measures were calculated from two sources of remote data: an infrared air photo (1 m resolution) and a Landsat satellite image (30 m resolution). We related these measures of image texture to two vegetation indices representing vertical and horizontal structure. Texture measures calculated from the air photo best predicted vertical vegetation structure (second-order contrast at the 3x3 pixel scale; $r^2 = 0.79$, p -value < 0.001) and horizontal vegetation structure (second-order entropy at a 21x21 pixel scale; $r^2 = 0.61$, p -value < 0.001). Our results suggest that image texture is useful for characterizing vegetation structure over broad extents.

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SPEAKING TWO LANGUAGES: BILINGUAL HYBRID CHICKADEES AND THEIR RESPONSES TO PLAYBACKS IN SOUTHEASTERN PENNSYLVANIA

Black-capped (*Poecile atricapillus*) and Carolina (*P. carolinensis*) chickadee hybrids have occupied a narrow band stretching across the eastern United States for more than 40 years. As this hybrid zone moves northward, both the genetics and behaviors of these birds are changing. In only 11 years, resident birds at Nolde Forest in southeastern Pennsylvania have shifted from singing only Black-capped Chickadee song to a population of predominantly bilingual singers, individuals that can sing perfect versions of both parental song types. This change has lagged behind genetic changes as hybrid chickadees in this area have been shown to have fully Carolina Chickadee-like mtDNA since 2001. We conducted playback experiments in the chickadee hybrid zone to try to understand if the two parental song types are used differently among bilingual males. No difference in response was detected among four different repertoires broadcast to territorial males during the laying and early incubation periods of the breeding season. These results concur with previous genetic work indicating that there is no discernable pattern to the use of different song types in the repertoires of bilingual males.

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ECOLOGICAL LIGHT POLLUTION AND ITS EFFECTS ON NORTHERN MOCKING BIRD FEEDING BEHAVIOR AT NIGHT

Ecological light pollution is an artificial phenomenon produced by urban areas. Understanding the range of effects produced by ecological light pollution is vital to gaining insight into the inadvertent influence humans have on wildlife. I observed Northern Mockingbirds (*Mimus polyglottos*) in preserve, rural, suburban, and urban settings at night to determine if their feeding behavior is altered due to artificial lighting. I predicted that as artificial light levels increased mockingbirds would feed their nestlings later into the night. In 2009 live observations of urban nests were conducted and the time (min past sunset) of the last evening feeding trip was recorded. For the remaining habitats observations were conducted using nest videos from 2008 and 2009. Birds fed later in the urban areas in comparison to the suburban, rural and preserve areas. There were no significant differences between the other three habitats, suggesting there might be a threshold of light that alters the birds' behavior. Further studies should be done to determine if there are costs and/or benefits to the birds feeding later into the night.

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DIFFERENCES IN MALE AGGRESSION BETWEEN TWO POPULATIONS OF ORANGE-CROWNED WARBLERS WITH CONTRASTING LIFE-HISTORIES

Differences in male aggression between populations may reflect divergent life history strategies. Males with high adult survival and low reproductive investment should reduce aggression to minimize reproductive costs and increase future breeding opportunities. In such cases, males may reduce aggression by cooperating with familiar neighbors. Alternatively, high adult survival may entail strong density-dependent competition for limiting resources and thus increased aggression by recognizing neighbors as a threat. Here, we test these contrasting hypotheses using two populations of male orange-crowned warblers (*Vermivora celata*) with divergent life history strategies. The California population exhibits higher adult survival with smaller clutch sizes and breeds under higher densities and lower territory turnover rates relative to its counterpart in Alaska. We measure overall and directed aggression in territorial males by simulating territory incursions using neighbor-stranger song playbacks. Higher male aggression was found in California than in Alaska where California males responded more aggressively toward neighbors, whereas Alaska males responded less aggressively toward neighbors. Despite substantial differences in current reproductive investment, social environments appear to be largely responsible for the patterns of aggression observed among the populations.

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SURVIVAL ON THE ARK: LIFESPAN TRENDS IN CAPTIVE PARROTS

Psittaciformes is among the most long-lived and endangered avian orders. Comprehensive data on lifespan are critical to setting conservation priorities and managing captive populations. To meet these needs, we compiled 87,777 lifespan records of captive birds from the International Species Information System and calculated lifespan parameters for 262 species of parrots (72% of extant species). Species varied widely in lifespan, with larger species generally living longer than smaller ones. The highest maximum lifespan recorded was 92 years in *Cacatua moluccensis*, but only 11 other species had maximum lifespans over 50 years. Maximum lifespan across all species was 23.9 ± 13.8 years (mean \pm SD), while median adult lifespan (excluding juvenile mortality) was only 9.2 ± 3.8 years (mean \pm SD). These data indicate that while some captive individuals are capable of reaching extraordinary ages, median lifespans are shorter than generally recognized. Implications for conservation include closely monitoring individuals for survival before the age of four, when juvenile mortality appears to asymptote, and selecting species to propagate in zoos which have minimal differences between median and maximum lifespans, indicating that they tend to fare well in captivity.

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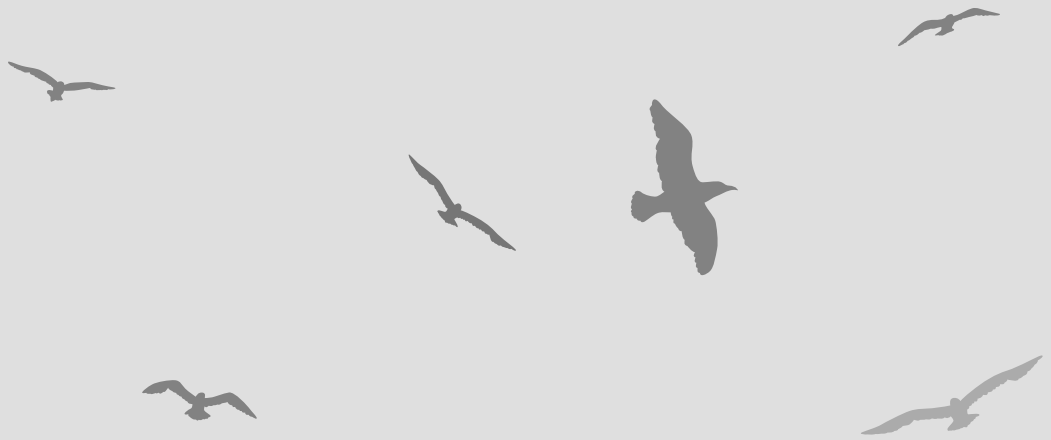
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