

One Hundred and Twenty-First Stated Meeting of the  
**American Ornithologists' Union**

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at

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# Abstracts

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## PLENARY TALKS

### Plenary 1. Balda

Linking life zones, life history traits and cognition in select southwestern seed caching corvids. **RUSSELL P. BALDA**, *Dept. Biol. Sci., Univ. N. Arizona, Flagstaff, AZ.*

This talk is dedicated to the memory of Dr. S. Charles Kendeigh who served as my graduate advisor. The slopes of the San Francisco Peaks served as a natural laboratory for C. Hart Merriam when he studied in n. Arizona. After intense documentation of the distribution of plants and animals both on the Peaks and in the e. U.S. he devised a scheme to explain the distribution of plants and animals throughout North America which was referred to as the Life Zone Concept. Because this mountain slope supports avian inhabitants from 5 different Life Zones, comparative studies on the behavior and ecology of select groups of birds are relatively easy. Such was the case with the harvest, transport, caching, and recovery of pine seeds by corvid inhabitants of the mountain. Each Life Zones presents different ecological pressures and constrains on the inhabitants, and this was translated into the behavior and ecology of the various species. A common denominator for the 4 corvids of interest (Clark's Nutcracker, Pinyon Jay, Western Scrub-Jay, Mexican Jay) is their intense effort to harvest seeds of the pinyon pine. The 4 species have different levels of dependence on the stored seeds to withstand the non-productive winter months, which varies by Life Zone. The morphological and behavioral adaptation of each species match closed with their dependence on cached seeds. The mental capabilities of the 4 species also match this dependence. We conclude that spatial cognition is a trait that has been selected for due the ecological pressures placed on each species by characteristics of the Life Zone they inhabit. Thus, nutcrackers and Pinyon Jays demonstrate highly developed spatial cognitive abilities but the other 2 jays have only modest abilities. Additional cognitive traits have been selected for by pressures placed on the birds by their social system. The more complex the social system, the more demands placed on the abstract cognitive abilities of the species. In this case we expect the Pinyon Jay and Mexican Jay to have superior cognitive abilities in areas associated with life in a complex group, but the nutcracker and scrub-jay will have only modest abilities in these areas. We propose that both the spatial and social cognitive traits, of the species we studied, are adaptively shaped by ecological and social factors just as morphological and physiological traits have been so shaped.

### Plenary 2. Beissinger

Theory and practice of recovering threatened birds: paradigms lost and found. **STEVEN R. BEISSINGER**, *Div. Ecosys. Sci., Policy & Manage., Univ. California Berkeley, Berkeley, CA.*

The growth of conservation biology over the past two decades has been concomitant with the growth of extinction theory and “tests” of that theory through repeated field applications with threatened species, especially with birds. Two paradigms shape the way conservation biology analyzes the risks, agents of decline, and recovery options for threatened species. The Small Population Paradigm is characterized by the role of population size and stochasticity (PVA), while the declining population paradigm attempts to identify and reverse the factors causing declines. The SPP is based on theory but testable hypotheses are difficult to create and falsify, while the DPP has little theory but more avenues to develop and test hypotheses. I examine the application of these approaches to two very different situations: (1) determining the causes of decline for a widespread, relatively large population of Marbled Murrelets; and (2) dissecting the anatomy of a severe population bottleneck in Puerto Rican Parrots. I conclude by examining how these paradigms are being used or ignored in other high profile, endangered bird recovery programs.

### **Plenary 3. Zink**

Tempo of avian diversity in the Quaternary. **ROBERT M. ZINK**, *Bell Mus., Univ. Minnesota, St. Paul, MN.*

Ornithologists have long viewed the Pleistocene as a period of active evolutionary change in birds.

Until recently, studies addressed evolutionary phenomena of Pleistocene using traditional methods of systematics. For example, John Hubbard provided hypotheses about how particular taxa evolved in space and time based on morphologically derived taxonomies. The revolution in molecular systematics has permitted testing these traditional views by providing robust phylogenetic hypotheses that can be calibrated. In many cases, speciation events assumed to be very recent were almost certainly much older. Apart from particular species pairs, results from molecular studies also contribute to the broader issue of the tempo of avian diversification. I address this issue using 2 types of analyses, log-lineage plots, and distributions of sister-taxon molecular distances. Log-lineage plots suggest that avian diversification decreased during the Pleistocene. To evaluate sister-taxon distances it is necessary to have a null model, which has been lacking in previous studies. My colleagues and I simulated the expected distribution of sister-taxon differences given 3 evolutionary models: constant speciation/extinction, a Late Pleistocene burst of speciation, and a Late Pleistocene burst of extinction. The empirical distribution does not differ significantly from a model of constant speciation/extinction, which is inconsistent with past theories about the role of the Pleistocene. Neither log-lineage plots nor analysis of sister-taxon distances support the hypothesis that the rate of speciation was elevated in the Pleistocene. Rather this is a perception that stems from the fact that this was the most recent period, and one expects more events to be preserved in the data of systematics.

## **SYMPOSIA PAPERS**

### **s01 James**

The legacy of S. Charles Kendeigh. **DOUGLAS A. JAMES**, *Dept. Biol. Sci., Univ. Arkansas, Fayetteville, AR.*

S. Charles Kendeigh (1904 - 1986) mentored a total of 57 doctoral students and over 100 master's degree students during a career spanning 7 yr at Western Reserve University (1930 - 1936) and 49 yr at the University of Illinois, Champaign-Urbana campus (1925 - 1973). Most of his graduate students conducted ornithological studies. This production of students rivals or surpasses other ornithologists and emphasizes his wide influence on American ornithology. He pioneered the study of both avian physiological ecology and avian community ecology, and was a strong advocate concerning the preservation of natural areas in Illinois. The symposium introduction will describe his life and accomplishments. The other symposium presentations are selected papers relating to his favorite topics.

### **s02 James**

Comparison of nesting and wintering bird populations in central Belize. **DOUGLAS A. JAMES**, *Dept. Biol.*

*Sci., Univ. Arkansas, Fayetteville, AR.*

Avian communities were studied in nesting and wintering seasons in the 7 terrestrial habitats found at Bermudian Landing in central Belize. Mist netting and census plots were employed. Both natural habitats (gallery forest, broken ridge, pine ridge savannah) and disturbance habitats (overgrown milpa, overgrown pasture, managed pasture, village grounds) were included. Except for managed pastures all the other habitats had more avian species in winter than in the nesting season, obviously because of the addition of wintering intercontinental migrants, but there was an increase in tropical residents too. Gallery forest led in number of species both seasons, managed pasture was last. Netting results did not show a consistent dominance species-wise between winter compared to nesting season. In terms of total populations, 4 habitats were essentially the same winter and nesting season, but 3 had higher populations during nesting than in winter, just the opposite trend from that shown by numbers of species.

### **s03 Scott, Devault, Bajema & Lima**

Grassland vegetation and bird abundances on reclaimed midwestern coal mines. PETER SCOTT, TRAVIS DEVAULT, ROBB BAJEMA and STEVEN LIMA, *Dept. Life Sci., Indiana State Univ., Terre Haute, IN.*

Reclamation of surface coal mines in the midwestern U.S. has produced large grasslands, which support both obligate and facultative grassland birds. We sought to characterize vegetation and determine whether birds breeding in these habitats responded to vegetation as they do in other kinds of grasslands. We measured vegetation characteristics on 9 Indiana mine grasslands and related those measures to abundance or occurrence of 6 common bird species. Eurasian grasses such as tall fescue and smooth brome, prominent in seed mixtures planted decades earlier, comprised 64% of canopy cover; forb cover averaged 27%. Despite a superficial appearance of homogeneity, mine grassland vegetation varied sufficiently to affect local abundances of birds. Abundances of 3 ubiquitous species (Red-winged Blackbird, Eastern Meadowlark, Grasshopper Sparrow) varied and were correlated with at least 1 vegetation characteristic. Occurrence of Henslow's Sparrow was positively associated with 5 variables, including percent cover by litter and grass. Blackbirds, Dickcissels, and yellowthroats did not differ in abundance between grass- and forb-dominated sites, whereas Henslow's and Grasshopper Sparrows and meadowlarks were more common on the former. Thus, obligate grassland birds benefitted from the present dominance of non-native grasses over forbs on reclaimed mines. Despite a lack of native vegetation and their artificial nature, mine grasslands supported a typical array of midwestern grassland bird species which differ in specific vegetation preferences, showing patterns similar to those observed in natural and agricultural grasslands.

### **s04 Hall & Shields**

Forest disturbance patterns and avian communities: effects of clearcut logging on avian community structure in temperate rainforests of Alaska. GAIL C. HALL, *Audubon California, Starr Ranch Sanctuary, Trabuco Canyon, CA;* and WILLIAM M. SHIELDS, *Dept. Environ. & Forest Biol., SUNY ESF, Syracuse, NY.*

There has been little investigation into the effects of anthropogenic disturbance on avian communities in coastal temperate rainforests of the Pacific Northwest, where commercial logging is occurring at some of the highest rates in North America. We compared avian species composition, abundance, species richness and diversity in old growth (never been cut) temperate rainforest patches with 5 age-classes of clearcut patches. We found significant differences in all aspects of avian community structure examined among old growth and clearcut patches. The greatest differences were between the youngest clearcut patch-types and old growth. Young clearcut patch-types had the highest species dominance and lowest species richness and diversity values. Species dominance decreased with patch-type age, and diversity and richness showed positive rank-correlations with patch age (ranked from youngest to oldest). Species composition among patch-types exhibited a nested subset pattern. 100% of the species identified in all second growth patches were found in old growth patches. Due to this pattern, converting old growth to early-successional patches significantly reduced landscape-scale avian diversity.

We conclude that these results are most likely due to the effects of differences in scale and intensity of the anthropogenic disturbance pattern (clearcutting) to the autogenic pattern of disturbance (gap-phase) on structuring temperate rainforest communities.

### **s05 Martin, Pless, Svoboda & Wikelski**

Climatic seasonality influences life history traits and immune function in tropical and temperate House Sparrows: a common garden experiment. LYNN B. MARTIN II, MONICA PLESS, JULIA SVOBODA and MARTIN WIKELSKI, *Dept. Ecol. & Evol. Biol., Princeton Univ., Princeton, NJ.*

Neotropical passerines typically lay smaller clutches and have longer breeding seasons, longer development periods, and greater longevity compared to North-temperate birds. We hypothesize that this pattern arises in part because reduced climatic seasonality in the Neotropics, which may lead to more persistent parasite threats, driving populations to increase investments in costly immune defense. We found that wild House Sparrows from New Jersey exhibited strong seasonal variation in parasite load and cell-mediated immune function, whereas wild birds from Panama exhibited relatively more stable levels of both year-round. In common gardens, we found that relative differences in immune activity between populations remained after 18 months in captivity; absolute levels of immune activity however increased for both populations. Climate had no short-term effects on immunological differences: north-temperate birds kept in simulated tropical conditions mounted similar immune responses as north-temperate birds kept in a simulated temperate climate. Climate did influence reproductive output however: North-temperate birds bred in a simulated tropical climate laid fewer viable eggs than North-temperate birds reared in a temperate environment and Neotropical birds bred in a simulated tropical climate. Our results thus support the hypotheses that immune activity is related to life history strategy, and that both are driven by climatic variation across latitudes.

### **s06 de los Santos & Stutchbury**

Physiological responses to habitat fragmentation in a threatened migratory song bird on its wintering quarters. J. FRANCISCO DE LOS SANTOS and BRIDGET J. M. STUTCHBURY, *Dept. Biol., York Univ., Toronto, ON.*

Migratory songbirds face negative effects due to forest fragmentation in both breeding and wintering grounds. These effects can be indirectly observed as physiological stress as a result of environmental changes, and measured using corticosterone levels as indicators of habitat quality. We studied wintering Hooded Warblers in 2 different habitats with different fragmentation degree, a well conserved forest in Belize Central America and a highly fragmented landscape in Mexico; to determine fragmentation-related stress among age and sex. We mistnetted 17 warblers in Central America and 22 in Mexico, and collected plasma samples that were stored frozen until assayed using a commercial <sup>125</sup>I Corticosterone Radioimmunoassay. A pool of random samples was made to validate corticosterone detection for this species and get a standard curve for corticosterone concentration at different dilutions that ranged from 1:5 to 1:400 obtaining a kit sensitivity of 1.25 ng/mL. Corticosterone concentration ranged from 3.85 ng/mL to 55.17 ng/mL respectively, in both sites. Average concentration was higher in the fragmented landscape (Mexico, 27.05 ± 1.2 ng/mL) than in the continuous forest (Belize, 9.85 ± 0.45 ng/mL). There was a significant difference between sites ( $P = 0.001$ ), but no significant difference was found between sexes ( $P = 0.438$ ). This information will be pooled with GIS habitat characteristics to determine a correlation between corticosterone levels and habitat fragmentation indexes in order to get a wider perspective of fragmentation effects on migratory bird populations.

### **s07 Brown & Roth**

Use of plant species for nests in relation to age in Wood Thrushes. WILLIAM P. BROWN and ROLAND R. ROTH, *Dept. Entomol. & Appld. Ecol., Univ. Delaware, Newark, DE.*

Numerous studies have shown that older (ASY) birds nest more successfully than young birds, e.g., second-year (SY) birds. Older birds may be able to secure territories with more cover or food, hide nests better, or be better foragers or defenders. Regardless of whether these differences reflect learning from experience or a winnowing of less effective, young individuals, we should see greater variety among SYs for such factors than among ASYs. We tested that prediction with respect to plant species used for Wood Thrush nests. The data were from a long-term study of individually marked birds in a Delaware woods. Because we only assume that female Wood Thrushes choose the nest site, we tested our

prediction for each sex. We also tested it among aged-based pair-types: ASY-ASY, SY-SY, and mixed pairs of both types. Our prediction was generally supported. SY females nested in a larger variety of species than ASY females did, while ASY males nested in a larger variety of species. SY-SY pairs nested in a wider variety of species than ASY-ASY pairs. SY-SY pairs that nested in species other than those chosen by ASY-ASY pairs had reduced success vs. ASY-ASY pairs. We also will discuss whether the data offered insight as to which sex chooses the nest substrate.

### **s08 Rosenberg & Blancher**

Conservation priorities for North American landbirds: the Partners in Flight perspective. KENNETH V. ROSENBERG, *Cornell Lab. Ornithol., Ithaca, NY*, and PETER J. BLANCHER, *Bird Studies Canada, Ottawa, ON*.

To develop a continental conservation strategy that ensures the persistence of all North American landbird populations, Partners in Flight (PIF) in the U.S. and Canada first assessed the conservation status of 448 landbird species, based on 6 measures of rangewide vulnerability. This assessment resulted in a "Watch List of 100 species most in need of conservation attention. Of these, 18 species of highest concern show a combination of small population size, high threats, and declining trend. 40 species are more widespread and abundant but show troubling rangewide threats and declines, whereas 42 "biome-restricted" species are not declining at present but are important to consider in long-term planning. Geographic patterns differed among vulnerability factors; e.g., species at risk due to small population size are concentrated in the sw. U.S. and Florida, whereas species with declining trends are most prevalent in the Midwest and prairie regions. We present numerical population targets for each Watch List species based on current population size and magnitude of historical decline, and we propose conservation actions for suites of species in each avifaunal region. Species requiring immediate or short-term management to reverse population declines are most prevalent in e. U.S., whereas species requiring longer-term planning and additional monitoring are most prevalent in the w. U.S. and Canada, especially in boreal and arctic regions. Future drafts of this North American PIF plan will include ongoing assessment of Mexican species and will highlight the urgent conservation needs of migratory and resident bird populations south of the U.S.

### **s09 Brewer**

Roles of science in land conservation by local land trusts. RICHARD BREWER, *Dept. Biol. Sci., W. Michigan Univ., Kalamazoo, MI*.

Land conservation was an important aspect of the professional and personal life of S. Charles Kendeigh. Among many other activities, he was a board member of The Nature Conservancy (TNC) and helped protect several natural areas in the state of Illinois. TNC is an example of what are now termed land trusts. About 1300 local land trusts with service areas ranging in size from a township to a state currently exist. More than half have been formed since 1980. Local land trusts protected by purchase, gift, or conservation easement almost 1,200,000 ha between 1990 and 2000. Despite this success at protecting land, the conservation impact of land trusts could be strengthened by additional scientific input which could, among other things, improve the targeting and selection of land and the application and evaluation of stewardship methods. Added scientific input could be achieved in 2 ways: (1) by a return to the tradition of scientists serving on governance boards, as exemplified by Kendeigh and (2) by educating students, especially at the master's level, to fill the rapidly increasing staff positions at land trusts.

### **s10 Hobson**

General introduction to stable isotope techniques: recent advances and future prospects. KEITH A. HOBSON, *Canadian Wildl. Ser., Saskatoon, SK*.

<no abstract>

### **s11 Faaborg, Dugger & Arendt**

Understanding survival and abundance in winter resident warblers: which rainfall matters? JOHN FAABORG, *Div. Biol. Sci., Univ. Missouri, Columbia, MO*, KATIE DUGGER, *Dept. Wildl., Oregon State*

*Univ., Corvallis, OR, and WAYNE J. ARENDT, USDA For. Ser., Luquillo, PR.*

We monitored resident and winter resident bird populations in Gunica Forest, Puerto Rico, for >30 yr; this 11,300 ha tropical deciduous forest reserve supports a primarily female population of warblers predominated by Black-and-white Warbler, Ovenbird, and American Redstart. Whereas resident population sizes and survival rates show clear correlations with local rainfall patterns, winter resident numbers and survival are apparently not strongly related to local conditions. Rather, periods with low warbler populations in winter always correspond to drought periods in the entire U.S., or northeastern or southeastern areas of the U.S. Here, we further explore relationships between Puerto Rican wintering populations and breeding season rainfall patterns in general. We then examine more detailed relationships for a subset of birds whose breeding location was determined isotopically. We also test for relationships between winter resident survival rates and breeding area rainfall patterns, using program MARK. Finally, we show how both long-term rainfall in the e. U.S. and wintering warbler numbers are showing similar patterns of long-term decline. We feel that the role of climatic factors in generating population fluctuations in migratory birds has not been adequately investigated.

### **s12 Bearhop, Furness, Fiedler & Waldron**

Potential fitness benefits resulting from the evolution of a new migratory behaviour in central European Blackcaps: a stable isotope approach. STUART BEARHOP, ROBERT W. FURNESS, *Div. Envir. & Evol. Biol., Univ. Glasgow, UK*; WOLFGANG FIEDLER, *Vogelwarte, Radolfzell, Germany*; and SUSAN WALDRON, *Scottish Univ. Envir. Res. Center, East Kilbride, UK*.

A recent shift in the migratory behaviour of European Blackcaps has presented a rare chance to investigate some of the processes underlying the migratory phenomenon. However, it is only now, with developments in the field of using stable isotope ratios in the tissues of animals as geographic markers, that we have the tools in place to take advantage of this opportunity. We have been using dD ratios in the toenails of blackcaps to infer wintering origins of birds on the breeding grounds. This is enabling us to assess whether individuals from the rapidly increasing UK winter population of blackcaps gain selection benefits over conspecifics that winter in Iberia. Moreover, since assortative mating (with respect to wintering area) on the breeding grounds (in s. Germany) has been predicted, we hope to gain an insight into the types of process that might lead to segregation of breeding populations and ultimately speciation.

### **s13 Cumming & Schmiegelow**

Modelling regional-scale population dynamics of boreal forest songbirds. STEVEN G. CUMMING, *Boreal Ecosystems Res. Ltd, Edmonton, AB*; and FIONA K. A. SCHMIEGELOW, *Dept. Renew. Res., Univ. Alberta, Edmonton, AB*.

In western boreal forests, interactions of large (~105 ha) wildfires with stand-level processes apparently maintain a naturally dynamic, heterogeneous and spatially structured habitat mosaic. Relative abundances of many species of habitat specialist forest songbird are correlated with measures of habitat structure and industrial activity at patch (e.g., 10 ha), stand (100 ha) and landscape (100,000 ha) scales. These forests are rapidly being restructured and homogenized by industrial development at regional (~108 ha) scales. We have developed a simulation modelling framework to explore how regional-scale population dynamics may be affected by these developments. Our approach is to embed landscape-scale demographic models coupled by natal dispersal within a regional-scale landscape-resolution model of forest dynamics (Cumming & Vernier, 2002, *Land. Ecol.* 17: 433-444). The demographic model is adapted from With & King (2001, *Biol. Cons.* 100: 75-88) by reparameterisation and the addition of density dependence. At present, most demographic parameters are taken from the literature, but we have developed methods to estimate the coefficients of density dependence from field data. Preliminary results suggest that 1) regional populations of some forest songbirds are dispersal limited under natural conditions; 2) industrial development will depress regional abundances by reducing habitat abundance and increasing habitat fragmentation; 3) demographic processes, especially dispersal limitation, amplify these effects by a factor of 2.

### **s14 Winkler, Wrege, Llambias, Ferretti, Hosner & Sullivan**

Dispersal by Tree Swallows: experiments and prospects. DAVID W. WINKLER, PETER H. WREGE, PAULO E. LLAMBIAS, VALENTINA FERRETTI, *Dept. Ecol. & Evol. Biol., Cornell Univ., Ithaca, NY*, PETER A. HOSNER and PATRICK J. SULLIVAN, *Dept. Nat. Res., Cornell Univ.*

Since 1985, we have been accumulating information on the natal and breeding sites of Tree Swallows in the vicinity of Ithaca, NY, and increasingly, around the whole of New York. In analyses of almost 800 natal dispersal events, the distribution of distances dispersed is substantially compressed relative to the distribution of potential recapture distances, and tests of different null hypotheses for dispersal distance distributions yield insights into the processes underlying dispersal. Recently completed large-scale brood-manipulation experiments further explore the biological basis of dispersal distance decisions, testing the hypothesis that birds raised in more crowded nests disperse farther than those from less crowded nests. These studies on natal dispersal have re-kindled our interest in dispersal movements among already breeding birds, and a series of nest-closure experiments yield insights into which adults move and why. Observations on males associated with >1 box/season indicate some surprising flexibility in the spatial ecology of these birds. These data taken together reinforce the distinction between natal and breeding avian dispersal, but they also suggest interesting contrasts in the ways that information is gathered and processed in birds of different ages and breeding stages.

### **s15 Nichols**

General introduction to CMR analyses: recent advances and future prospects. JAMES D. NICHOLS, *USGS, Patuxent Wildl. Res. Center, Laurel, MD.*

<no abstract>

### **s16 Kendall**

Modern statistical methods for the study of dispersal and movement of marked birds. WILLIAM L. KENDALL, *USGS, Patuxent Wildl. Res. Center, Laurel, MD.*

The study of movements of birds over large spatial scales is of interest to population and evolutionary ecologists, as well as managers of migratory bird populations. This movement might entail natal dispersal, movements between breeding and wintering areas, use of stopover areas, etc. These studies are achieved through the use of birds that are captured; marked with legbands, field-readable markers, or telemetry devices; and then recaptured, resighted, recovered, or detected via radio or satellite, in some future period. With the exception of satellite and in some cases radio telemetry, marked animals that are alive at a given point in time are not detected with certainty. This causes problems in attempting to estimate movement rates, separating them from survival and detection probabilities. Capture-recapture statistical methodology exists to separately estimate these parameters, and to model them as functions of hypothesized causal factors, assuming that studies are designed in the proper way. I will review methods for estimating permanent or temporary movements between breeding, wintering, or stopover areas, focusing on the type of data needed and model assumptions.

### **s17 Blums, Nichols, Hines, Lindberg & Mednis**

Factors affecting natal and breeding dispersal movement of female European ducks. PETER BLUMS, *Univ. Missouri, Columbia, MO*; JAMES D. NICHOLS, JAMES E. HINES, *USGS, Patuxent Wildl. Res. Center, Laurel, MD*; MARK S. LINDBERG, *Inst. Arctic Biol., Univ. Alaska, Fairbanks, AK*; and AIVARS MEDNIS, *Univ. Latvia, Salaspils, Latvia.*

We used up to 34 yr of capture-recapture data from about 22100 new releases of female ducklings banded at hatch and multistate modeling to estimate effects of ecological factors and management activities on natal and breeding dispersal probability of 3 species of ducks (Northern Shoveler, Common Pochard, Tufted Duck) within the 35 km<sup>2</sup> Engure Marsh, Latvia. We tested hypotheses about causes of movement that incorporated characteristics of sites of both origination and destination. Mean natal dispersal distances were very similar (ca. 0.6 - 0.7 km) for all 3 species and were on average about 3 times greater than breeding dispersal distances recorded within the marsh. Although we did not observe a relation between breeding success and dispersal distance, adult female diving ducks that dispersed >0.8 km between breeding attempts delayed timing of nesting. We found no evidence that young first-nesting females nested closer to their relatives (either mother or sister) than to the natal nest.

Rates of dispersal between breeding seasons were much higher for first year breeders than for older birds. General patterns of movement (e.g., in response to water conditions and management activities) of young were very similar to those of adults. Multistate modeling provided a useful format for testing hypotheses about dispersal.

## **s18 vacant**

### **s19 Mazerolle, Dufour, Hobson & den Haan**

Survival and productivity of a neotropical migrant songbird: effects of large-scale climatic fluctuations. DANIEL F. MAZEROLLE, *Dept. Biol., Univ. Saskatchewan, Saskatoon, SK*, KEVIN W. DUFOUR, KEITH A. HOBSON, *Canadian Wildl. Ser., Prairie & N. Wildl. Res. Centre, Saskatoon, SK*, and HEIDI E. DEN HAAN, *Delta Marsh Bird Observatory, Portage la Prairie, MB*.

Large-scale climatic fluctuations associated with El Niño Southern Oscillations (ENSO) can affect adult survival and reproductive success of songbirds via their influence on weather conditions in the tropics and outbreaks of arthropod prey on the temperate breeding grounds. We evaluated how a population of Yellow Warblers, a Neotropical migrant songbird, responded to ENSO from 1992 to 2001. Standardized mist netting was conducted in a riparian forest in s. Manitoba to estimate annual survival of adults and production of young. Our results demonstrate a strong positive correlations between the Southern Oscillation Index (SOI), a standardized atmospheric measure that closely tracks ENSO, with both adult survival and annual production of young. That is, values of both these demographic parameters were lowest during El Niño years and highest during La Niña years. Apparent adult survival also tended to be lower for females than for males during El Niño years. In sum, our findings underline the importance of considering the effects of climate on populations of migratory songbirds, and suggest that the increase in frequency of El Niño events predicted to result from future climate warming could have significant consequences for populations of Yellow Warblers and other migratory songbirds breeding in this region.

### **s20 Powell**

Integrating stable isotope information with multi-state modeling to estimate movement rates among geographic strata. LARKIN A. POWELL, *School Nat. Res. Sci., Univ. Nebraska, Lincoln, NE*.

Biologists commonly use multi-state capture-recapture models to estimate movement and survival rates of animals. Recent applications of stable isotope analyses have created the potential for determining the location of a captured animal in the current and previous year(s). I present a new multi-state model structure that incorporates animals' back-dated locations determined by stable isotope analyses. To generate data, I developed a computer simulation in which birds moved between 2 geographic strata during 3 time periods. Birds were assigned mortality and captured, and multi-state capture histories were recorded. Simulating stable isotope analyses, I also enhanced capture histories for birds. In the enhanced capture histories, the new strata assignments for year  $i$  were determined by backdating from year  $i + 1$ , not actual captures in year  $i$ . I then used a multi-state model to estimate survival, movement, and recapture probabilities. I evaluated the potential use of stable isotope data to provide greater accuracy and precision in estimation of movement probabilities for a range of recapture rates and movement rates. In 9 simulations, information from stable isotopes improved the accuracy of the movement estimate from program SURVIV, compared to the rate used in the simulation model; estimates of survival and recapture rates remained the same. As real stable isotope data sets become available, this estimation model has potential to assist biologists interested in improving estimation of movement rates between geographic strata.

### **s21 White & Main**

Habitat value of golf course wetlands to waterbirds. C. LEANN WHITE and MARTIN B. MAIN, *Dept. Wildl. Ecol. & Conserv., Univ. Florida, Gainesville, FL*.

As increasing human pressures continue to reduce the amount of wetland acreage nationwide,

alternative habitats such as created wetlands on golf courses may become increasingly important to wetland-dependent species. This study quantified waterbird use of 183 created wetlands (ponds) on 12 golf courses in sw. Florida. A total of 16 surveys were conducted of all wetlands on each course from Jan through Apr 2001 and 2002. Habitat and hydrological variables were quantified at the individual pond scale to determine the relationship between these components and abundance and species richness of waterbirds. Hydrological variables included trophic status (total phosphorus, total nitrogen, and chlorophyll a) and area of littoral zone. Habitat features included shoreline and littoral zone vegetation type and cover, and adjacent landscape features (e.g., golf course, residential housing, construction, etc.). Landscape scale features including distance to nearest active rookery and total waterbody surface area were also quantified to determine their influence on waterbird use of golf courses. Recorded observations included 10,474 birds representing 42 species. In general, the results from this study suggest that golf course wetlands are widely used and may be important habitat for waterbirds in urbanized areas. Results also indicated that management strategies that increase the diversity of available habitats associated with golf course wetlands could provide a local wetland complex suitable for multiple species of waterbirds.

## **s22 Zwartjes**

Avian diversity on desert golf courses. MICHELE MEROLA ZWARTJES, *USDA For. Ser. Rocky Mountain Res. Sta., Albuquerque, NM.*

I investigated the relationship between avian community composition and habitat characteristics on golf courses in the desert environment. Birds were surveyed year-round over a period of 2 yr using variable distance point counts on 5 golf courses and 5 reference areas. The golf courses were chosen to vary in landscape features to assist in the determination of habitat characteristics corresponding with high levels of avian diversity. Five reference sites were also surveyed. These sites were nearby natural areas that allowed me to identify those bird species unique to the golf course habitats, and, conversely, those native birds that had been excluded by the development of the golf course. My results indicate that some golf courses may mitigate the loss of riparian habitats to some extent by providing shade and water, 2 critical components of habitat for many birds, and particularly migratory species. The greatest numbers of native bird species were observed on golf courses that incorporated existing native vegetation into the design, and that provided supplemental water sources. Traditional, park-like courses without water sources and lacking any shrubby understory offered little in quality avian habitat. By combining my bird survey results with quantitative measures of vegetation, I developed management recommendations to increase quality avian habitat as well as save water on existing golf courses in desert environments by decreasing the area in turf and increasing the use of native plants, particularly shrubby species, in out-of-play areas.

## **s23 LeClerc & Cristol**

Attributes of golf courses that determine their conservation value. JOSHUA E. LECLERC and DANIEL A. CRISTOL, *Dept. Biol., Coll. William & Mary, Williamsburg, VA.*

We surveyed birds on 87 golf courses in Virginia during the 2002 breeding season. Courses varied greatly in bird abundance, richness and diversity, as well as representation by various avian guilds.

We focused on explaining the large differences between courses in their conservation value based on "Partners in Flight" conservation priority scores. To explain some of this variation in we used GIS and aerial photographs of the courses and surrounding landscape (1.5 km buffer). We found that larger courses with more open water had higher conservation value. Other factors, such as proportion of vegetated wetland or forest on the course did not to effect bird diversity or conservation value. Lack of development in the surrounding landscape actually explained more of the variation in conservation value of the courses than did attributes of the courses themselves. To assess the importance of these landcover/landscape factors in determining value of golf course habitat as part of bird conservation management plans, we ranked courses in terms of their open water, size and degree of development in the surrounding landscape, and then compared their conservation value to that of 27 non-golf course reference sites. The lowest ranking courses had conservation values comparable to urban habitats while the highest ranked courses were comparable to the most valuable reference habitats.

## **s24 Jones, Gordon & Phillips**

Avian community response to a golf course landscape unit gradient. STEPHEN G. JONES, *Clemson Univ., Clemson, SC*, DAVID H. GORDON, *U.S. Fish & Wildl. Ser., Charleston, SC*, and GARY M. PHILLIPS, *Clemson Univ., Georgetown, SC*.

Developing golf courses as an integral part of the natural landscape addresses concerns about the effects extensive landscape disturbance may have on ecological functions and values. How birds utilize golf course habitat is relatively unknown. 24 golf course landscape units (GCLUs) were sampled during the summer months of 2000 and 2001 to assess the value of GCLUs to the avian breeding community of coastal South Carolina. Sample units were stratified a priori with relation to their degree of landscape alteration using a geographic information system (GIS). Landscape metrics were generated at 2 spatial scales to examine the effects of landscape structure within GCLUs. Bird data were obtained through fixed-radius point count censuses using a systematic sampling method. Landscape alteration and landscape structure relationships were evaluated by analysis of variance/simple linear regression procedures and stepwise multiple linear regressions, respectively. Species richness, Neotropical migrant richness and abundance of woodland breeders significantly increased as landscape alteration decreased supporting our predictions, whereas unexpectedly, no significant relationships were detected with species diversity. Landscape structure models proved to be an effective means of evaluating avian community responses as high  $R^2$  values were achieved at both scales. Management implications are presented providing specific management and habitat enhancement recommendations for GCLUs synonymous with the study area.

## **s25 Pennington & Blair**

Multiple spatial scale assessment of the conservation value of golf courses for bird communities in southwestern Ohio. DERRIC PENNINGTON, *Dept. Zool., Miami Univ., Oxford, OH*, and ROBERT B. BLAIR, *Fish., Wildl. & Conserv. Biol., Univ. Minnesota, St. Paul, MN*.

Previous work on gradients of human-altered landscapes identified golf courses as potentially valuable areas for wildlife conservation. We identified 6 golf courses surrounded by landscapes of varying degrees of land-use intensity, and studied the bird communities within these courses to identify factors that promote diverse bird assemblages. We used GIS and aerial photography to estimate percentages of different land-cover types surrounding each course using buffers at scales of 100 - 1000 m. We also measured on-site vegetation characteristics within the same points used for bird sampling. We used simple linear regressions between each environmental variable and bird community statistics (abundance, species richness, Shannon diversity and evenness) to determine which variables had the most influence on bird communities. We found that the landscapes surrounding golf courses were the most important determinants of bird diversity, and on-site variables were relatively unimportant. Specifically, natural land-cover buffers (forests, riparian areas and open water) promote bird diversity, and residential cover reduces diversity especially in small buffers immediately surrounding courses. Results were similar when we limited the bird data set to Neotropical migrants or birds with declining population trends.

## **s26 Stanback, Conway, Seifert & Tuscano**

Do golf courses provide quality breeding habitat for Eastern Bluebirds? MARK STANBACK, NED CONWAY, MEG SEIFERT and AMBROSE TUSCANO, *Biol. Dept., Davidson Coll., Davidson, NC*.

Analysis of reproductive parameters of birds nesting on golf courses can provide valuable information on the biological effects of turf maintenance activities on wildlife. Because Eastern Bluebirds nesting along fairways consume and feed their chicks insects from managed turf, they may be especially vulnerable to the chemicals used there. For 4 seasons (1999 - 2002) we monitored 150 nestboxes in control habitat (hayfields and pastures) and 250 on golf courses near Davidson, NC, for first egg date, clutch size, brood size, and nestling condition. Non-golf habitats outperformed golf habitats for all measured variables, but significantly so only for first egg date and clutch size. Nestlings raised on golf courses were in poorer condition than those raised in non-golf habitat, though this effect was not significant when only a single chick from each brood was used in the analysis.

### **s27 Denman Smith & Conway**

Conservation of Burrowing Owls on golf courses. MATTHEW DENMAN SMITH and COURTNEY J. CONWAY, *Arizona Coop. Fish. & Wildl. Res. Sta., Univ. Arizona, Tucson, AZ.*

Burrowing Owls are declining throughout much of North America, yet large-scale conservation programs to reverse declines are lacking. Western Burrowing Owls depend on existing burrows for nesting and roosting, and populations of many fossorial mammals that create burrows have declined. Hence, limited burrow availability may contribute to population declines. Golf courses may have appropriate foraging habitat for Burrowing Owls, but lack suitable nesting burrows. Our study examined the efficacy of installing artificial nesting burrows on golf courses in e. Washington. In 2000 - 2001 we installed and monitored 130 artificial nesting burrows on 8 golf courses. We also installed and monitored 87 artificial nesting burrows off golf courses, and located and monitored 286 natural burrows. Occupied artificial burrows were in non-maintained areas (without regular mowing and watering). Occupied burrows ( $n = 8$ ) were closer to natural burrows than unoccupied burrows ( $P = 0.02$ ), and were further from the nearest maintained areas than unoccupied burrows ( $P = 0.05$ ). Nesting success (100% in 2001 and 2002) was high for artificial burrows on golf courses, and annual fidelity of owls using burrows on golf courses was higher than for owls using burrows off golf courses. The increasing number of occupied artificial burrows on golf courses (3 in 2001 to 6 in 2002) demonstrates that owls are continuing to locate burrows. This study shows that Burrowing Owls successfully locate and use artificial nesting burrows on golf courses. Participation of golf courses across w. North America in recovery efforts could aid in reversing population declines.

### **s28 Santiago, Rodewald & Rodewald**

Suitability of golf courses as breeding habitat for Red-headed Woodpeckers. MELISSA J. SANTIAGO, PAUL G. RODEWALD and AMANDA D. RODEWALD. *School Nat. Res., Ohio State Univ., Columbus, OH.*

Despite strong population declines throughout their range, conservation of Red-headed Woodpeckers holds promise because the habitats used by these birds are structurally similar to some human-dominated habitats, such as golf courses. The objectives of our study were to (1) identify habitat and landscape features of golf courses used by Red-headed Woodpeckers and (2) examine nesting success on golf courses and identify if microhabitat and landscape features are associated with nest fate. From May - Aug 2002 and 2003, we censused woodpeckers on >100 golf courses in Ohio using playback recordings along transects. In addition, we monitored nests, studied foraging behavior, and measured habitat characteristics of the golf course and the area immediately surrounding nests. Red-headed Woodpeckers were detected at 27% of courses, with most birds occurring in n. Ohio. Average number of birds on courses was 0.9 in central Ohio compared to 3.7 birds/course in the n. Ohio. Occurrence was related to both local habitat (e.g., oaks) and landscape-scale features (e.g., surrounding urban development). Preliminary nest-monitoring efforts confirmed that birds are nesting on golf courses and suggests that nesting success is high (100% successful in 2002).

### **s29 Parker**

Mississippi Kites on golf courses: conflicts with people, politics, and a universal management model. JAMES W. PARKER, *Aerie East Environ. Found., Farmington, ME.*

The Mississippi Kite nests, usually colonially, throughout much of the s. U.S. Since the 1970s the species has increased greatly in numbers throughout much of 3 prairie states, and has expanded into urban areas of other prairie and eastern forest states. Preferred habitats include residential areas, parks, wooded streets, and, most sensationally, on golf courses. Urban nesting density has often risen rapidly, and has commonly reached extremes such as 27 nests on one golf course. Mississippi Kite abundance in urban areas has resulted in abundant cases of attacks on people, and the greatest public relations conflicts between people and Mississippi Kites have occurred on golf courses in 4 states. In 1999, I wrote the only summary of raptor attacks on people, with special emphasis on management of kite diving in urban areas. Since then, the prominence of problems on golf courses and their management by state and federal agencies has increased. Unfortunately, management has often been uncoordinated, ineffective, and done without adequate public education and consultation with experienced professional advisors or

other resources. It has sometimes resulted in unnecessary wildlife mortality, and with limited disclosure of information. In this presentation I update the situation and offer a model for handling cases of kite attacks on people with special relevance to golf courses.

### **s30 Terman**

Habitats and birds of a naturalistic golf course and nearby natural area: a comparative study in landscape ecology. MAX R. TERMAN, *Biol. Dept., Tabor Coll., Hillsboro, KS.*

Prairie Dunes Country Club in Hutchinson, KS, is a highly regarded, intensively managed golf course that hosted the internationally televised 2002 U. S. Women's Open golf tournament. It also is one of the most habitat rich golf courses in the world with approximately 74% of the golf course consisting of native plants. Sand Hills State Park is a similar sand-dune-grassland natural area located approximately 6.4 km from Prairie Dunes. Like Prairie Dunes, the park is burned periodically to control woody plant invasions and maintain the dominant herbs and grasses. Compared to the park, the golf course has more patchy, less contiguous habitat and has much more human disturbance. For 6 yr, my students and I counted and recorded all birds seen in different seasons along transects in the park and golf course. Both the golf course and the natural area supported complex bird communities, sharing many species in common. Sand Hills had fifteen species that did not occur in Prairie Dunes and 9 species occurred in the golf course but not in the park. There were no significant differences in the numbers of different kinds (species richness) but there were significant differences in measures of relative abundance. The birds were more evenly distributed in the natural area than in the golf course. Measures of community similarity and species diversity also indicated noticeable differences between the 2 areas. Various aspects of landscape ecology theory (particularly habitat quality and source/sink phenomena) are discussed in view of these results.

### **s31 Ortega & Jones**

Brown-headed Cowbird management issues in the United States. CATHERINE P. ORTEGA, *Dept. Biol., Fort Lewis Coll., Durango, CO,* and STEPHANIE L. JONES, *USFWS, Denver, CO.*

According to the Breeding Bird Survey, over 100 songbird species, including Brown-headed Cowbirds have significantly declined since 1966. Some of these songbirds are endangered and are also cowbird hosts. While the underlying ultimate causes of their declines are habitat loss and anthropogenic changes, numerous cowbird control programs have been initiated to boost populations of endangered hosts. It is far easier to trap cowbirds than to address habitat loss. The Migratory Bird Treaty (MBTA) protects cowbirds, but the Depredation Order (DO) provides potential authorization of take without a permit. The DO states, "A Federal permit shall not be required to control ... cowbirds ... committing or about to commit depredations upon ... wildlife ..." Proof that cowbirds are about to depredate rarely exists. Further, take of females during the winter or males and juveniles is not authorized, nor is removing cowbird eggs from nests. The DO does not authorize trapping of non-target species; the MBTA prohibits possession of birds for use as decoys or lures. The language of the DO is vague and this has resulted in different interpretations throughout the U.S. Alternatives to the DO include Depredation and Special Purpose - Miscellaneous permits; these permits require thorough documentation and sound justification based on scientific data.

### **s32 Cruz, Lopez-Ortiz, Ventosa Febles, Wiley & Post**

Ecology and management of Shiny Cowbirds in the West Indies. ALEXANDER CRUZ, RICARDO LOPEZ-ORTIZ, EDUARDO A. VENTOSA FEBLES, JAMES W. WILEY and WILLIAM POST, *Biol. Dept. Univ. Colorado, Boulder, CO.*

Within the past century, Shiny Cowbirds (*Molothrus bonariensis*) have expanded into the West Indies. Because of small populations and lack of experienced with cowbirds by West Indian birds, cowbird contact is potentially more detrimental than in mainland areas. In Puerto Rico, parasitism was the most important factor in the reduced reproductive output of the Yellow-shouldered Blackbird (*Agelaius xanthomus*). Blackbirds declined in sw. Puerto Rico from 1663 individuals in 1974 - 1975 to 266 in 1981 - 1982. Cowbird trapping and the use of artificial nesting structures have resulted in fewer parasitized

blackbird nests. Parasitism of blackbirds has fallen from 100% in 1982 to a current rate of < 3%. Currently, brood parasitism has a negligible effect on blackbird nest success because parasitism either was not found or cowbird eggs were removed. Current roost counts suggest a blackbird population of 730 individuals. Cowbird removal programs have excellent potential to reduce the adverse impact of cowbird parasitism. However, it is vital that management attempts are begun as soon as the level of impact is ascertained. Efforts begun when hosts are in serious decline will be more expensive and less likely to succeed.

### **s33 Mermoz & Reboresda**

Cowbird management issues in South America. MYRIAM E. MERMOZ and JUAN CARLOS REBOREDA, *Departamento de Ecología, Genética y Evolución, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina.*

It is accepted that as a result of habitat transformation and expansion of agriculture and cattle raising, Shiny Cowbird *Molothrus bonariensis* has increased its range and the number of hosts it uses. The same causes may be responsible for the increase of its population in historical areas. We reviewed the frequency of Shiny Cowbird parasitism and the impact it produces on the reproductive success of its hosts. We analyzed the effect of parasitism on nest abandonment, egg survival, hatchability, and chick survival in hosts that varied from 20 to 80 g in size. In most hosts the frequency of parasitism was higher than 50% and multiple parasitism was common. The main cost associated to parasitism was the loss of eggs through egg punctures inflicted by the parasite. This cost increased with intensity of parasitism but it was also present in unparasitized nests. Nest abandonment depended on number of eggs punctured and it was more common in small hosts. Similarly, we only observed a decrease in host chick survival in hosts smaller than the parasite or when the number of parasite chicks was high. The most likely future scenario for South America is an intensification of habitat transformation. This may favor the survival and dispersion of Shiny Cowbirds resulting in a higher impact of parasitism on historical and new hosts.

### **s34 Arcese & Wilson**

Cumulative impact of cowbird parasitism on island Song Sparrow populations. P. ARCESE and S. WILSON, *Centre Appl. Conser. Res., Univ. British Columbia, Vancouver, BC.*

Annual variation in demographic rates measured within populations of birds is sometimes related to annual oscillations in climate (e.g., El Niño Southern Oscillation). Climatic drivers of reproductive rate can act regionally to synchronize the demography of adjacent populations within regional meta-populations. In contrast, variation in demographic rates and population performance might occur as a consequence of differences among sub-populations in predator or competitor communities, average abundance, or habitat quality. Over the past 43 yr, Song Sparrows on Mandarte Island, BC, have shown considerable variation in timing of breeding, related to the El Niño Southern Oscillation. Early breeding in El Niño years increased reproductive output. Breeding dates in sparrow populations on adjacent islands also varied more or less synchronously, suggesting a correlation in reproductive output at the regional level. However, we show here that reproductive output was unrelated among islands due to wide variation in the rate of nest failure and parasitism by Brown-headed Cowbirds. Because several islands that we study lack resident predators, and nest failure is about constant across populations and years without cowbirds, we suggest that cowbirds are the main factor disrupting synchrony in reproductive output regionally.

### **s35 Jensen & Cully**

Density-dependent habitat selection by Brown-headed Cowbirds in tallgrass prairie. WILLIAM E. JENSEN and JACK F. CULLY, Jr., *Kansas Coop. Fish & Wildl. Res. Unit, Div. Biol., Kansas State Univ., Manhattan, KS.*

Avian brood parasites showing habitat-specific host preferences should also exhibit density-dependent habitat selection if host nest availability or quality are reduced by increasing brood parasite density. We explored this possibility in the brood-parasitic Brown-headed Cowbird across a geographical gradient in cowbird abundance in the Flint Hills tallgrass prairie of Kansas and Oklahoma. Using isodar regression analysis, we compared cowbird relative abundance and brood parasitism of

Dickcissel nests among adjacent prairie-woodland-edge and prairie-interior habitats along this geographical cowbird-abundance gradient. Cowbird relative abundance, nest parasitism rate, and the number of cowbird eggs per parasitized nest were only higher in prairie edge than in prairie interior at study sites where local cowbird abundance and parasitism pressure were relatively low. However, rates of increase in these measures of cowbird activity were slightly higher in prairie interior than in prairie edge as cowbird abundance and parasitism level increased geographically. These patterns, and cowbird fledging success data, suggest that density-dependent effects of multiple parasitism on cowbird reproductive success are greatest in otherwise primary edge habitats. This pattern of density-dependent habitat selection in cowbirds could be explored elsewhere and experimentally tested using established cowbird removal programs. Management to reduce cowbird abundance may be effective only for reducing parasitism on hosts in secondary cowbird habitats.

### **s36 Curson, Goguen & Mathews**

Brown-headed Cowbird behavior in a bison-grazed landscape in New Mexico. DAVID R. CURSON, *Dept. Wildl. Ecol., Univ. Wisconsin, Madison, WI*, CHRISTOPHER B. GOGUEN, *School For. Res., Pennsylvania State Univ., University Park, PA*, and NANCY E. MATHEWS, *Dept. Wildl. Ecol., Univ. Wisconsin, Madison, WI*.

The foraging association between cowbirds and domestic cattle, and the effect of this association on cowbird behavior, has been well-documented. Little is known, however, about the relationship between cowbirds and their native foraging associate, American bison. During the summer 2002, we studied the behavior of cowbirds within a large (~27,000 ha) pasture in ne. New Mexico that was grazed by ~2500 adult bison. From May - Jul we monitored the distribution of bison, while simultaneously monitoring the movements and habitat use of 11 radio-tagged female cowbirds. Our objective was to determine how the anticipated large-scale movements of bison would influence cowbird breeding or foraging strategies. Female cowbirds exhibited a typical daily commuting pattern, breeding in forests at the edge of the pasture during mornings and commuting to open grasslands to feed with bison in afternoons. However, daily abundance and distribution of bison varied greatly. Afternoon counts of bison within 10 km of cowbird breeding sites ranging from >1000 to <10. Cowbirds did not respond to this variation by varying their breeding habitat use, but did exhibit considerable variation in daily commute distances, and in their choice of feeding sites. A comparison of these findings relative to our research in an adjacent cattle-grazed landscape will be discussed.

### **s37 Summers & Eckrich**

Evolution of Brown-headed Cowbird management at Fort Hood, Texas. SCOTT G. SUMMERS, *The Nature Conservancy of Texas, Fort Hood, TX*; and GILBERT H. ECKRICH, *Nat. Res. Manage. Branch, Fort Hood, TX*.

Brown-headed Cowbird control at Fort Hood, TX, began in 1988 to aid recovery of the Black-capped Vireo. Success of the control program was not immediate. Cowbird removal by trapping and limited shooting in breeding areas initially failed to reduce parasitism within study areas to a level (38%) capable of sustaining the vireo population. Parasitism rates ranged from 63 - 91% from 1988 - 1990. Beginning in 1991, trapping effort was initiated in cowbird foraging areas. Subsequently, parasitism rates dropped to sustainable levels. To increase efficacy of control once trap success decreased post-migration (early May), afternoon shooting was initiated in 1998 to target cowbirds foraging within actively grazed areas. Since 1997, parasitism rates have been <10%. Between 2000 and 2002, Fort Hood's control program was supplemented by trapping in adjacent, off-base areas. Although vireos on Fort Hood likely benefitted from off-base trapping, these benefits are difficult to quantify. In 2001, we initiated a rapid-response cowbird removal strategy. As field staff reported occurrences of potentially breeding, individual cowbirds within endangered species habitat, we removed these birds by shooting. In 2002, cattle presence on the western half of the base was reduced by 72%. However, captures have not sharply decreased, suggesting that cattle removal may not necessarily reduce efficacy of traps. Effective cowbird control is a dynamic process requiring the application of adaptive management principles.

### **s38 Chace, Walsh, Cruz, Prather & Swanson**

Spatial and temporal activity patterns of the brood parasitic Brown-headed Cowbird at an urban/wildland interface. JAMESON F. CHACE, JOHN J. WALSH, ALEXANDER CRUZ, JOHN W. PRATHER and HEATHER M. SWANSON, *Dept. Environ., Pop. & Org. Biol. Dept., Univ. Colorado, Boulder, CO.*

We examined the impact of the urban environment on the spatial and temporal activity of brood parasitic Brown-headed Cowbirds in Boulder Co., CO. We found that cowbirds used the urban areas for foraging and roosting and traveled into the 3,240 ha wildland preserve of ponderosa pine in the mornings to parasitize songbird hosts. Cowbird abundance decreased with distance from the urban/wildland boundary, and Plumbeous Vireo nests closer to the urban/wildland boundary were more likely to be parasitized by cowbirds than those farther away. A linear regression accurately predicted the relative abundance of cowbirds based on parameters of distance from residential areas, and distance from roads and trails within the wildland preserve. For species of concern that are known cowbird hosts, creating larger preserves, reducing residential encroachment, and reducing preserve perforation by roads and trails might alleviate high frequencies of parasitism for a portion of the host population. However, even large preserves such as found in Boulder, CO, cannot insulate all focal nesting species from the urban effect of increased brood parasitism. Efforts to reduce food resources and cover for cowbirds in the urban areas might prove to ameliorate host reproductive success close to the urban/wildland boundary through decreases in cowbird abundance.

### **s39 Robinson & Brawn**

Landscape ecology of cowbirds: recent advances and future research directions. SCOTT K. ROBINSON and JEFF BRAWN, *Dept. Anim. Ecol., Univ. Illinois, Champaign, IL.*

Cowbirds have long been the ideal study organism for ornithologists interested in studying landscape ecology. Cowbirds depend on the juxtaposition of different landscape elements for their feeding, nesting, and roosting. We now know a great deal about the distances cowbirds travel between breeding and feeding sites, edge effects on cowbird abundance and levels of parasitism, effects of regional land cover on parasitization, and on the effects of cowbirds on spatially structured host populations. Nevertheless, recent studies have revealed new levels of variation in how cowbirds use complex landscapes and diverse bird communities. In the Midwestern U.S., for example, cowbird host preferences appear to vary a great deal among bird communities and at different distances from edges. Composition of the landscape matrix surrounding habitat patches, which should be an excellent predictor of levels of parasitism, often correlates only weakly or not at all with cowbird abundance and levels of parasitization. In this paper, we review some of the possible explanations for these conditional responses of cowbirds to landscape variables. Likely topics include the importance of studying the agricultural practices that do and do not create good cowbird feeding habitat, the role of different host communities in creating possible cowbird sources and sinks, whether or not calcium limits reproduction, and on the extent to which cowbirds prefer and avoid different habitats.

### **s40 Kus & Whitfield**

Managing cowbird parasitism in endangered hosts: management success or co-dependency? BARBARA E. KUS, *U.S. Geol. Sur., San Diego, CA*, and MARY J. WHITFIELD, *Southern Sierra Res. Sta., Weldon, CA.*

Cowbird control is the major focus of recovery-oriented management of 2 endangered riparian species, the Least Bell's Vireo and Southwestern Willow Flycatcher. Annual trapping of cowbirds at vireo and flycatcher breeding sites during the last 16 yr has eliminated or reduced parasitism relative to pre-trapping rates, and thereby increased seasonal productivity of nesting pairs. Enhanced productivity, in turn, has resulted in an 8-fold increase in numbers of Least Bell's Vireos, although Willow Flycatcher abundance has changed little and at some sites has declined despite cowbird control. While generally successful by these short-term measures of host population response, cowbird control poses potential negative consequences for long-term recovery of endangered species. As currently employed, cowbird control lacks pre-determined biological criteria to trigger an end to the control, creating an open-ended dependency of these species on human intervention for their persistence. In addition to the economic, political, and ethical issues associated with this practice, cowbird control interferes with the evolution of

natural antiparasite defenses required for self-sustaining host populations. Prolonged reliance on cowbird control to manage endangered species can shift attention from identifying and managing other factors limiting populations; in particular, habitat availability. We suggest that cowbird control be reserved for short-term crisis management, to be replaced by practices emphasizing restoration and maintenance of natural processes upon which species depend.

#### **s41 vacant**

#### **s42 Peer, Rothstein, Kuehn, Fleischer, McIntosh & Delaney**

Cowbirds versus hosts: the outcome of long-term host-parasite cycles. BRIAN D. PEER, *Dept. Ecol., Evol. & Marine Biol., Univ California, Santa Barbara, Santa Barbara, CA and Molecular Genetics Lab., Smithsonian Inst., Washington, DC*, STEPHEN I. ROTHSTEIN, MICHAEL J. KUEHN, *Dept. Ecol., Evol. & Marine Biol., Univ. California, Santa Barbara*, ROBERT C. FLEISCHER, CARL E. McINTOSH, *Molecular Genetics Lab., Smithsonian Inst.*, and KATY SEMPLE DELANEY, *Dept. Organismic Biol., Ecol. & Evol., Univ. California, Los Angeles, CA*.

We investigated how long birds retain host defenses in the absence of brood parasitism and related implications for host-parasite cycles by testing bird populations for anti-parasite defenses (e.g., egg rejection, nest defense) where brood parasites are absent. These populations were closely related to species known to demonstrate anti-parasite behaviors. We also determined the amount of mtDNA sequence divergence between populations, which allowed us to estimate the length of time these populations have been free of brood parasitism. Populations tested included the Island Scrub-Jay on Santa Cruz Island, CA, Gray Catbird on Bermuda, and American Robin, Yellow Warbler, Rusty Blackbird, and Bohemian Waxwing in Alaska. All species demonstrated anti-parasite defenses, with the exception of the Rusty Blackbird. We also report time periods for which host defenses are maintained. These results indicate that anti-parasite defenses are not costly to maintain in the absence of the selective pressure of brood parasitism. This suggests that over time, as more hosts evolve anti-parasite adaptations and retain them, brood parasites may be forced to evolve specific adaptations that limit their success to relatively few host species.

#### **s43 Hauber & Dearborn**

Measuring the costs of brood parasitism paid by hosts: mechanisms and lifetime fitness consequences. M. E. HAUBER, *Dept. Integrat. Biol., Mus. Vert. Zool., Univ. California, Berkeley, CA*, and D. C. DEARBORN, *Dept. Biol. and Progr. Anim. Behav., Bucknell Univ, Lewisburg, PA*.

Brood parasitism by definition implies costs paid by foster parents raising parasitic young. The mechanisms of these costs may include actions of the adult parasite (e.g. host egg removal), actions of the nestling parasite (e.g. competition for parental resources), and costly host responses (e.g. greater nest vigilance following the appearance of a parasitic egg). The costs of parasitism differ not only in magnitude but also in the extent to which they covary with other ecological factors. We detail and evaluate the relative contribution of these costs to fitness loss among hosts of Brown-headed Cowbirds within single breeding cycles and across reproductive bouts. Understanding the mechanisms and the lifetime fitness consequences of the specific costs of parasitism is informative for both modeling coevolutionary selection pressures associated with avian brood parasitism and predicting the possible implications of specific management decisions regarding cowbird control options.

#### **s44 Klippenstine & Sealy**

Acceptance in grassland songbirds: evolutionary lag or equilibrium? DWIGHT R. KLIPPENSTINE and SPENCER G. SEALY, *Dept. Zool., Univ. Manitoba, Winnipeg, MB*.

The response of 8 grassland hosts in s. Saskatchewan to cowbird and non-mimetic eggs was examined. Four treatments consisting of both real and artificial cowbird (mimetic) and immaculate blue (non-mimetic) eggs were added to the nests of each species and whether they accepted or rejected the

different egg-types was recorded. No difference was found between host reactions to real and artificial cowbird eggs, whereas real non-mimetic eggs tended to be rejected more often than artificial non-mimetic eggs, although only Chestnut-collared Longspurs differed significantly in this respect. All observed cases of natural parasitism were accepted. Seven of the 8 species also consistently (75% - 100%) accepted real and artificial cowbird eggs, whereas Western Meadowlarks ejected them at an intermediate frequency (8/12). Attempted (7/13) and successful (6/13) ejections of real and artificial non-mimetic eggs were recorded infrequently (13% - 20%) in 5 hosts, whereas 2 hosts exhibited no rejection. Western Meadowlarks ejected non-mimetic eggs almost exclusively (11/12), but 0.27 host eggs/ejection were lost. Only Baird's Sparrows significantly rejected non-mimetic (4/21) eggs more often than cowbird eggs (0/21). Consistent with the Evolutionary Lag Hypothesis, most grassland songbirds have not sufficiently evolved the required behaviours to distinguish and eject cowbird eggs, while the Evolutionary Equilibrium Hypothesis best explains the mixed reactions of Western Meadowlarks towards experimental cowbird eggs.

#### **s45 Ellison & Sealy**

Sympatric brood-parasites: consequences for host use and enemy recognition. KEVIN ELLISON and SPENCER G. SEALY, *Dept. Zool., Univ. Manitoba, Winnipeg, MB.*

Sympatric brood parasites may interact to affect each other's use of hosts and, hence, alter costs incurred by hosts. Meanwhile, enemy recognition by hosts may be affected by the added complexity of identifying brood parasites, their eggs and/or young. Sympatric Brown-headed (*Molothrus ater*) and Bronzed (*M. aeneus*) cowbirds present an opportunity to examine host use by closely related species that differ in size (15 g), eggs (maculated vs. immaculate), and nestlings (integument coloration, vocalizations, growth rate). Theoretically, the recent overlap of *M. ater* and *M. aeneus* breeding ranges exposed hosts to a novel enemy for which they may exhibit fewer defenses. Likewise, the cowbirds, as potential competitors for nests, may act agonistically toward one another. Sympatric *M. ater* and *M. aeneus* infrequently use the same hosts, therefore, we tested whether cowbirds and/or hosts differentially directed agonistic behaviors at one another. We observed few agonistic interactions between cowbirds, including during egg-laying. In contrast, hosts often defended their nests from cowbirds and caused cowbird egg deposition failure (n= 5). Thus, the lack of overlap in host use may reflect differential success of host nest defense. Because *M. aeneus* hosts attack a larger cowbird during nest defense, we suggest that these species have become more capable at defeating *M. ater* laying attempts.

#### **s46 Rothstein & Kus**

Finding solutions for threatened and endangered hosts and is that all there is to cowbird research? STEPHEN I. ROTHSTEIN, *Dept. Ecol., Evol. & Marine Biol., Univ. California, Santa Barbara, CA* and BARBARA E. KUS, *USGS Western Ecol. Res. Center, San Diego, CA.*

We will discuss 2 important but disparate issues related to cowbird management and research. First, while it is valuable to assess cowbird impacts from theoretical perspectives, real world managers need explicit guidance. The recently completed USFWS Recovery Plan for the endangered Southwestern Willow Flycatcher presents clear guidelines for the initiation of cowbird management and for specific management actions that can be taken to reduce parasitism. We will share insights from the Recovery Plan with special emphasis on ways to assess the efficacy of cowbird management. The latter is particularly important because no cowbird management program has so far been conducted with a design sufficiently rigorous to prove that the management has aided recovery of an endangered species, although some programs have provided suggestive evidence to that effect. The second issue we will address is to stress that there is a great deal more to cowbird research than finding solutions for threatened and endangered hosts. While the latter objectives are important, research on cowbirds has made major contributions to key areas in biology. Previous talks in this symposium have demonstrated how cowbird research has contributed to the study of evolution. In addition, cowbirds play a central role in studies of behavioral development, physiology and neurobiology, something regulators lose sight of when they require that all cowbirds captured be euthanized rather than returned to nature for further study.

#### **s47 Anders**

Post-fledging ecology of migrant landbirds: where we've been and where we're going. ANGELA D. ANDERS, *Prog. Ecol., Pennsylvania State Univ., University Park, PA.*

The post-fledging period has the potential to greatly affect the population dynamics of migrant landbirds, and our understanding of post-fledging ecology may greatly affect our conservation and management decisions. Studies over the past decade have addressed many aspects of migrant post-fledging ecology, including age-specific survival rates, relative effects of food availability and predation on juvenile survival, habitat use before and after juvenile independence, potential effects of forest fragmentation on dispersal and habitat use, and temporal and spatial patterns of juvenile dispersal from adult breeding territories. Species of migrant landbirds in which these topics have been studied to date include Wood Thrushes, Swainson's Thrushes, Gray Catbirds, Ovenbirds, Hooded Warblers, Yellow-breasted Chats, and Song Sparrows. Information from these species and from future studies of additional species will provide an understanding of the role of the post-fledging period in population limitation through the use of empirical juvenile survival data in population modeling, and through the identification of the relative roles of predation, food availability, habitat availability, and abiotic factors in limiting juvenile survival. Such information will provide us with a better understanding of population limitation in migrant landbirds and will allow us to better identify potential targets for conservation and management actions.

#### **s48 Maxted**

Post-fledging survival and habitat use of two shrub-nesting neotropical migratory bird species in southern Indiana. ANGELA M. MAXTED, *Dept. For. Nat. Res., Purdue Univ., West Lafayette, IN, and Coll. Vet. Med., Iowa State Univ., Ames, IA.*

Little is known about the post-fledging ecology of shrubland birds. In this study, I investigated the survival rates, movement, and habitat use of 2 migratory shrubland bird species, the Yellow-breasted Chat and the Gray Catbird. I found the probability of a fledged Yellow-breasted Chat surviving to 8 wk was 0.39, and of Gray Catbirds surviving to 12 wk was 0.60. Risk of death was not constant through the post-fledging period for either species. Yellow-breasted Chat survival was positively affected by age of the female parent and negatively affected by fledging date. Gray Catbird survival was positively affected by both brood size and rank within the brood suggesting that the mechanisms that limit post-fledging survival differ for the 2 species. All Yellow-breasted Chats established post-dispersal home ranges, but only half of the Gray Catbirds did so. Both species dispersed into clearcut and early-successional habitats after leaving natal territories. In general, Yellow-breasted Chat post-dispersal sites contained more small shrubs, fewer large shrubs, and a higher small shrub species richness than did nest sites. Gray Catbird post-dispersal sites contained fewer large trees, more large snags, and a lower canopy height than did nest sites. I hypothesize that juvenile Yellow-breasted Chats and Gray Catbirds probably dispersed to seek habitats with high insect and food plant abundance as well as concealment from predators.

#### **s49 White & Faaborg**

Post-fledging habitat use of juvenile Swainson's Thrushes: the importance of upland habitats. JENNIFER D. WHITE and JOHN FAABORG, *Div. Biol. Sci., Univ. Missouri, Columbia, MO.*

We used radio telemetry and GIS to study post-fledging habitat use of juvenile Swainson's Thrushes at 2 sites in coastal California from 2000 to 2002. We found nests only in willow/alder riparian habitat. However, during the first 2 wk post-fledging, 26.7% of parents (n = 30) brought their broods to upland vegetation types of mixed hardwoods and north-slope coastal scrub at least once. On average, broods were found in upland vegetation types 37.8% of the time. Independent juveniles readily used uplands: 74.3% of individuals (n = 35) used uplands at least once and, on average, used upland vegetation types 55.7% of the time. Broods and independent juveniles never used upland vegetation types of annual grasses/grazed pasture or eucalyptus (*Eucalyptus* spp.) and only used south-slope coastal scrub when it contained a seasonal stream. Vegetation and fruit measurements will be compared between sites used by juveniles versus random sites. Most juveniles (70%, n = 29) stayed in the watershed where they hatched for at least 95% of the expected transmitter life (50 - 60 d). The remaining 30% stayed in the natal watershed an average of 41 d post-fledging before the radio signal failed or they

dispersed from the study area. This study shows that juveniles remained in their natal watershed for up to 60 d post-fledgling yet used vegetation types different from those typically used by breeding adults.

### **s50 King & DeGraaf**

Post-fledgling survival, movements and behavior of radio-marked Ovenbirds in the White Mountains, New Hampshire. DAVID I. KING and RICHARD M. DeGRAAF, *Northeastern Res. Sta., USDA For. Ser., Univ. Massachusetts, Amherst MA.*

We studied the post-fledgling ecology of Ovenbirds in n. New Hampshire during 1999 and 2000 using radio telemetry. Thirteen of 37 radio-tagged fledglings were depredated. Of these, 7 were found dead on the ground or pulled into burrows or under the leaf litter, and were likely killed by small mammals. Four other transmitters were found removed from fledglings with blood or remains on them, which suggested depredation by raptors. The survival rate of fledglings was 0.57 for the first 34 d postfledgling, and was significantly lower for the first 10 d (0.64) than the subsequent 24 d (0.89;  $P < 0.05$ ) of the post-fledgling period. The remaining birds were tracked until either their transmitters failed or they left the study area, a period that ranged from 10 - 34 d. Some individuals restricted their movements to a discrete area, however approximately the same proportion left their natal territory. This is probably evidence of brood-splitting, which has been reported in this and other species of wood-warblers. Adults were seen attending even the oldest fledglings we observed (34 d), and neither the proportion of visits during which adults were observed with young, nor the proportion of attending adults who scolded observers or performed distraction displays in the presence of fledglings, diminished with fledgling age ( $P > 0.05$ ). The high mortality experienced by fledglings during the first 10 d out of the nest, as well as the apparently high diversity of predators responsible for fledgling mortality, underscore the potential importance of events during this period of avian life history.

### **s51 Powell & Lang**

What causes variation in Wood Thrush fledgling dispersal? LARKIN A. POWELL, *School Nat. Res., Univ. Nebraska-Lincoln, Lincoln, NE*, and JASON D. LANG, *Inst. Ecol., Univ. Georgia, Athens, GA.*

Fledgling songbirds may disperse as a response to population density or predation risk, as well as seeking critical post-dispersal habitat. Lang et al. (2002, *Auk* 119: 109-124) reported that Wood Thrush fledglings in Georgia dispersed an average of 2,189 m from their nest site; dispersal distance ranged from no dispersal to 6,524 m. In this paper, we address the variation in dispersal rates and distances within this population and within broods. In addition to fledgling dispersal data, we simultaneously estimated adult survival and dispersal rates, as well as adult male density. In our study, fledglings dispersed at higher rates and longer distances from denser adult populations; fledgling survival was lowest in these dense adult populations. Also, average fledgling dispersal distance was lowest when weekly adult dispersal rate was highest. Weekly fledgling emigration rates from our study sites were lowest when fledgling survival was highest; however, there was no correspondence between either female survival or nest success (both indicators of predation risk to fledglings) and fledgling emigration rate. Thus, our study provides very little evidence that fledgling wood thrushes disperse to avoid predation risk. Although fledglings appear to respond to general population density, variance in dispersal distances within study groups was still high. In this paper, we will present results from a landscape-level simulation model in which population density and habitat arrangements are varied in an attempt to produce the variance in dispersal distances documented in our field study.

### **s52 Prigoda**

Effects of food and predators on the survival of Song Sparrow fledglings. ELENA M. PRIGODA, *Dept. Biol., Univ. W. Ontario, London, ON.*

The observed reductions in avian populations that occur with forest fragmentation have been the basis for many studies over the past 20 yr. Reductions in food availability and increases in predator pressure have been found to have negative effects on avian populations. Previous studies have shown that food abundance and predator pressure have a synergistic effect on the number of offspring fledged by

Song Sparrows. Through the application of a bi-factorial experimental and mensurative design, this study examines the effect of food abundance and predator pressure on the survival of Song Sparrow fledglings to independence. High mortality occurs in the pre-independence fledglings, thus increases in survival with decreased predator pressure and/or food abundance may have an important role to play in halting population declines due to forest fragmentation. Three hypotheses about the effect of food and predators on fledgling survival are tested, including whether 1) food abundance or 2) predator abundance is the dominant factor influencing fledgling survival, or 3) food and predator abundance show a synergistic effect on fledgling survival. Preliminary results will be discussed.

### **s53 Rush & Stutchbury**

The effects of forest fragmentation on post-fledging survival and dispersal of Hooded Warblers. SCOTT A. RUSH and BRIDGET J. M. STUTCHBURY, *Dept. Biology, York Univ., North York, ON.*

Many studies have addressed the effects of forest fragmentation on the breeding behavior and fecundity of forest songbirds but have left the post-fledging period largely understudied. Using radio-telemetry I tracked adult Hooded Warblers attending fledglings from nests within large (> 100 ha), and small (< 15 ha) forest fragments. We used Cormack-Jolly-Seber models to test for the effects of forest fragment size, sex and age of the attending adult, fledge date and brood size on the survival of young during the ~4 wk post-fledging, and prior to cessation of parental care. We found fledgling survival did not differ between large and small forest fragments but may be influenced by the sex and age of the attending adult. Nesting habitat was structurally similar to that used during the post-fledging period while neither forest fragment size nor sex of the attending adult influenced post-fledging habitat use. While results of this study suggest that forest fragmentation does not overtly affect post-fledging survival and habitat use of Hooded Warblers, many species of songbirds do not use similar habitat throughout the nesting and post-fledging periods and as a result these species may face limitations in the availability of critical resources during the post-fledging period. As such, the effects of forest fragmentation on songbird post-fledging ecology must be considered during the development of conservation plans for neotropical migrant songbirds.

### **s54 Erwin & Williams**

Introduction to program. M. ERWIN and B. K. WILLIAMS  
<no abstract>

### **s55 Kelling**

Avian Knowledge Network: organizing the data resources of the bird monitoring community. STEVE KELLING, *Lab. Ornithol., Cornell Univ., Ithaca NY.*

We will unite recent advances in information and data management technology with a unique assemblage of natural history data by creating an Avian Knowledge Network (AKN) that federates North American bird-monitoring projects. Through a new synergy between high-performance computing and Grid technologies we will develop integrated data analysis and presentation capabilities initially involving 23 diverse bird-monitoring data sets. Potentially 100s of other data sets can be added, and this federation will constitute the largest and longest-running resource of environmental time-series data in existence. Our larger goal is to advance conservation and management of biodiversity at many ecological scales by making these unique data accessible for researchers, conservation practitioners, educators, and citizens. We will extend existing information management protocols and data standards to accommodate complex sampling units, to account for variable sampling efforts and protocols, and to permit peer review of census data for quality control. We will develop a monitoring-centric data-exchange schema that conforms to existing biological metadata standards, thus opening the integrated database to many disciplines in the environmental sciences. We will generate statistical descriptions and tests of long-term population trends, geospatial abundance patterns, and seasonal or irruptive movements, all via optimized parallel applications running in a high-performance computing environment - a revolutionary infrastructure for the environmental community. Web services and intuitive interfaces will present a variety of intelligent information visualizations and data query functions, facilitating use of both raw data and interpreted results

by a broad spectrum of users.

### **s56 Koneff**

The role of monitoring in implementation of the North American Waterfowl Management Plan. MARK D. KONEFF, *U.S. Fish & Wildl. Ser., Laurel, MD.*

Foundational to the North American Waterfowl Management Plan (Plan) are its continental population objectives linked to regional habitat objectives and conservation strategies. Regional objectives and strategies are developed by public-private partnerships known as Joint Ventures (JVs). Long-term waterfowl monitoring databases, designed originally for harvest regulation, were crucial in crafting the Plan's initial objectives, and monitoring remains an integral aspect of Plan delivery. Lacking a complete understanding of limiting factors, seasonal physiological requirements, or regional resource dynamics, JVs made assumptions to associate conservation actions with population objectives. Faced with uncertainty, Plan delivery proceeds as an iterative cycle of planning, implementation, and evaluation. Assumptions can be codified as testable hypotheses. Monitoring can be targeted to compare the predictions of hypotheses with observations, evaluate assumptions, and adjust planning models and habitat objectives. General monitoring needs have been identified in the draft 2003 Plan Update. These include: improved abundance monitoring for some species; enhanced monitoring of demographic rates; coordinated environmental monitoring; cross-scale integration of monitoring; implementation of emerging tracking technologies; and improved data management and accessibility. Opportunities exist to monitor highly visible non-waterfowl species during some waterfowl surveys. Likewise, the Plan may benefit from improved bird monitoring programs in regions presently un-surveyed for waterfowl or for species difficult to detect during aerial surveys. A seemingly obvious opportunity for collaboration among initiatives is habitat inventory, however, multi-agency consortiums already provide access to nation-wide land cover databases of coarse thematic resolution, and the commonality of need for finer resolution data for different taxa is unclear.

### **s57 Donaldson, Andres, Estrada & Brown**

Using national plans to conserve shorebirds on an international scale: the North American model. GARRY DONALDSON, *Canadian Wildl. Ser., Hull, QC*; BRAD ANDRES, *U.S. Fish & Wildl. Ser., Arlington VA*; AUREA ESTRADA, *Ducks Unlimited de México, Fracc. Bosques de Aragón, EdoMex*; and STEPHEN BROWN, *Manomet Center Conser. Sci., Manomet, MA.*

Canada and the U.S. have developed separate shorebird conservation plans which allow for country-specific conservation goals and actions to be developed and implemented. This approach allows for the establishment of partnerships for implementation of activities at national and local levels. It was also recognized early in the plan development process that many aspects of shorebird conservation would benefit from an international approach. A solid communication link between the 2 plans was established and maintained to facilitate a harmonized international approach to implementation where needed. International conservation now occurs through cooperation with international partners at the implementation stage. Developing programs for monitoring and research, along with established programs such as the Western Hemisphere Shorebird Reserve Network are designed to work with the participation of multiple countries. Although these initiatives are largely Canada-U.S. efforts at present, they are designed to include other countries should they choose to participate in the future. A national shorebird conservation strategy is currently nearing completion in Mexico and it is hoped that Mexican needs and priorities can be effectively integrated into these international programs thus forming coordinated continental conservation efforts. Further development of international conservation efforts on an even larger geographic scale may require the establishment of a hemispheric shorebird facilitating body that would coordinate efforts to ensure that shorebird conservation is efficiently implemented throughout their ranges.

### **s58 Steinkamp & Peterjohn**

An overview of the monitoring goals and objectives for the Waterbirds for the Americas Initiative. MELANIE STEINKAMP, *Wetlands Internatl., Arlington, VA*, and BRUCE PETERJOHN, *USGS Patuxent*

*Wildl. Res. Center, Laurel, MD.*

Monitoring waterbird populations, distributions, and their habitats across the continent and throughout the Americas is required to determine conservation status, detect population trends and distributions throughout the year, assess habitat values, and gauge the influence of environmental changes and management actions on waterbird populations. Much of the data collected on waterbird populations over the past few decades are difficult to compare because (1) surveys are conducted by multiple organizations with different goals and at different scales, (2) data are collected using different survey or census methodologies, (3) the definitions used to define colonies differ, (4) the relationship between colony counts or trends in colony counts and total population or trends in total population are not well understood, and (5) the relationship between trends or population numbers and habitats is difficult to decipher based on monitoring designs. There is a scarcity of information on waterbird distributions and habitat needs, especially those outside of the breeding season. In this talk we present the long-term plan for a comprehensive waterbird monitoring program that includes centralizing data storage and management, agreeing upon a set of common monitoring goals, developing standardized survey protocols for multiple types of data, developing standardized colony definitions, developing biologically and statistically feasible waterbird sampling schemes, developing standardized models for analyses of waterbird data, and identifying and filling gaps in continental waterbird monitoring programs.

### **s59 Dunn**

Monitoring needs from the PIF North American Landbird Conservation Plan. ERICA DUNN, *Canadian Wildl. Ser., Ottawa, ON.*

Partners In Flight recently completed a continental conservation plan that summarizes the status of the 448 landbird species that breed in the U.S. and Canada, and sets the stage for future inclusion of the approximately 1000 additional landbirds that breed in Mexico. For the first time, landbird status is summarized on a continental scale, estimates of total population size are presented for all species, and concrete population targets are proposed for all species of conservation interest. Breeding Bird Survey data were used extensively to assess population trends and in estimating population size, but data were inadequate for many species. The plan identifies 3 groups of species that need better monitoring. In the first group are species for which we have essentially no information on population trends (concentrated in n. Canada and Mexican border areas). The second group includes species for which data are too imprecise to inspire confidence in the trend signal (including more than a quarter of the avifauna of Canada and the w. U.S.). Finally, there are many species for which there is good information, but only from two-thirds or less of the continental range. (This group includes more than half the avifauna of the boreal forest). Monitoring priorities include improved sampling for species that are sparsely distributed or have limited ranges, and monitoring outside the breeding season for northern-nesting migratory species.

### **s60 Pashley, Ford, Martell & Berlanga**

The North American Bird Conservation Initiative. DAVID N. PASHLEY, *American Bird Conservancy, The Plains, VA*, ROBERT FORD, *NABCI Coordinator for the U.S., U.S. Fish & Wildl. Ser., Arlington, VA*, ART MARTELL, *NABCI Coordinator for Canada, Surrey, BC*, and HUMBERTO BERLANGA, *NABCI Coordinator for Mexico, CONABIO, Mexico, DF.*

The North American Bird Conservation Initiative (NABCI) grew in the late 1990's as a forum for interaction among bird conservation initiatives (such as the North American Waterfowl Management Plan, Partners in Flight, and efforts aimed at shorebirds, waterbirds, and upland game birds), among the nations of North America (Canada, the U.S., and Mexico), and among those attempting to increase resources for bird conservation. NABCI is foremost a vision of regionally based, biologically driven, landscape-oriented partnerships delivering the full spectrum of bird conservation. This vision relies on the objectives of bird conservation plans, such as those written through Partners in Flight, and Joint Ventures, originally devised for waterfowl and wetlands conservation, as delivery vehicles. NABCI is secondarily a structure that involves commitment to its principles by key federal agencies, the network of state wildlife agencies, and non-governmental organizations dedicated to the conservation of birds. Because anyone who is working to advance the vision is a participant in the process, the structure is less interesting than the purpose. NABCI exists because of the huge obstacles against the conservation of the birds of this continent. These obstacles include inexorable changes in land use practices and resultant habitat deterioration,

anthropogenic mortality factors, the need to think hemispherically and beyond for our birds, huge knowledge gaps, socio-political apathy toward conservation, and grossly insufficient funding. Those committed to the vision of NABCI are working to overcome these formidable obstacles.

### **s61 Sauer & Nichols**

Why count birds, and why bother to do it right? JOHN R. SAUER and JAMES D. NICHOLS, *USGS Patuxent Wildl. Res. Center, Laurel, MD.*

NABCI provides an important opportunity for the ornithological community to revitalize monitoring as a science-based activity that provides relevant information for management. To achieve this goal, monitoring must be viewed as a component of larger programs involving either science or management. In particular, the role of monitoring in both science and management needs to shift from the vague goal of providing trend estimates to the specific goal of evaluating alternative predictions about population change. These predictions are based on models (explicit or implicit) that connect environmental features to population change. Many avian monitoring programs have lacked this connection, and hence have suffered from poorly defined objectives and poor implementation. Monitoring is best integrated into science when it provides data with which to confront predictions of competing models about system dynamics. In management, reasonable monitoring goals are to: (1) provide estimates of system state for state-dependent management decisions, (2) assess the degree to which management objectives are being met, and (3) provide data with which to confront predictions of competing models about system response to management. To implement surveys to meet these goals, we argue that defensible monitoring programs must deal with 2 fundamental sampling issues, spatial sampling and detectability. Although no credible scientific survey would neglect these fundamental issues, recent ornithological literature still provides examples of surveys in which they are ignored. We suggest that selection pressures associated with actual use of survey data will provide a strong disincentive for the use of flawed survey methods. These points are illustrated with examples of use of avian monitoring data in science and management, including recent discussions of value of monitoring data that appeared in Federal Register documents and the scientific literature.

### **s62 Otto**

Aspects of monitoring in the North American Waterfowl Management Plan. MARK C. OTTO, *U.S. Fish & Wildl. Ser., Laurel, MD.*

Most of the long-term, large-scale monitoring databases used by the North American Waterfowl Management Plan (NAWMP) were developed to support harvest management. Statistical surveys cover the main demographic parameters for waterfowl populations: The May Waterfowl Breeding Population Survey for breeding population, U.S. Fish and Wildlife Service Harvest Surveys for harvest and reproduction, and banding for harvest rate and non-hunting survival. The only estimate of habitat are numbers of ponds in the Breeding Population Survey. Since 1995, these data have been used in the Adaptive Harvest Management (AHM) process. Predictive population models for Mallards are used to inform decisions on hunting regulation and to learn about the system. The NAWMP bases most of its continental population goals on Breeding Population Survey estimates. These statistical surveys also provide measures of uncertainty associated with estimates. The variances are as important as the estimates themselves. They tell how to weight the estimates in the AHM models. Other surveys giving counts of species at locations but no measures of uncertainty are the July Production Survey, the Seaduck Survey, the U.S. and Mexican Mid-Winter Inventories. In the Breeding Population Survey, detection probabilities are estimated from ground or helicopter truthing of aerial counts from fixed-wing aircraft. These account for most of the variance in the survey. Surveys are designed to estimate changes over time well. I will also discuss the scales at which existing monitoring efforts are most applicable.

### **s63 Bart, Andres, Brown, Donaldson, Morrison, Johnston, Jones & Skagen**

The Program for Regional and International Shorebird Monitoring (PRISM). JONATHAN BART, *USGS, Boise, ID*, BRAD ANDRES, *USFWS, Arlington, VA*, STEPHEN BROWN, *Manomet Center for Conserv. Sci., Manomet, MA*, GARRY DONALDSON, R. I. G. MORRISON, *Canadian Wildl. Ser., Ottawa, ON*,

VICKY JOHNSTON, *Canadian Wildl. Ser., Yellowknife, NT*, STEPHANIE JONES, *USFWS, Denver, CO*, and SUSAN SKAGEN, *USGS, Fort Collins, CO*.

PRISM provides a single blueprint for implementing the shorebird conservation plans recently completed in Canada and the U.S. PRISM is being implemented by a committee formed in 2001 by the Canadian Shorebird Working Group and the U.S. Shorebird Council. The goals of PRISM are to: (1) estimate the size of breeding populations of 74 shorebird taxa in North America; (2) describe the distribution, abundance, and habitat relationships for each of these taxa; (3) monitor trends in shorebird population size; (4) monitor shorebird numbers at stopover locations, and; (5) assist local managers in meeting their shorebird conservation goals. PRISM has 3 main components: breeding surveys in arctic, boreal, and temperate regions, migration surveys, and wintering surveys. The most important major tasks for immediate action are completing survey design work and carrying out the arctic breeding surveys, conducting regional analyses to design the program for migration counts, and evaluating aerial photographic surveys for migration and winter counts.

#### **s64 Peterjohn & Steinkamp**

Design considerations for a large-scale monitoring program for the Waterbirds for the Americas Initiative. BRUCE PETERJOHN, *USGS Patuxent Wildl. Res. Center, MD*, and MELANIE STEINKAMP, *Wetlands Internatl., Arlington, VA*.

New legislative mandates and increased public interest in migratory birds are sparking the need to coordinate bird conservation planning throughout the Americas. Large-scale bird conservation planning efforts require reliable data on population trends, species distributions, and population numbers. Coordinated waterbird monitoring programs with common goals, standardized protocols, and commonly defined spatial boundaries will be necessary to achieve waterbird data that can be analyzed at multiple geographic scales. A large-scale waterbird monitoring program will require problems associated with survey designs, observers, colonies, and sampling designs to be identified and dealt with through program design. In this talk, we present a plan for a coordinated large-scale waterbird monitoring program. We will describe the challenges that have been identified in designing large-scale programs, present information on the error reported with past waterbird surveys, discuss the advantages and disadvantages to different types of survey methods, including index counts and density estimates and consider the use of new methods for surveying waterbirds at the large scale. We will address the need to shift from monitoring programs that attempt to count every bird at every colony to programs using sampling frameworks that allow data collected at local scales to be combined and extrapolated to provide population information at larger geographic scales.

#### **s65 Bart**

Progress on monitoring landbirds. JONATHAN BART, *USGS For. & Rangeland Ecosys. Sci. Center, Boise, ID*.

The PIF Monitoring Working Group has completed a comprehensive "Landbird Monitoring Strategy" (accepted by the Joint Steering Committee in 2001) and has recently begun work on a position statement that describes how to select a monitoring method for long-term landbird monitoring programs. Many of the recent efforts by WG members, especially in the w. U.S., have been devoted to "coordinated bird monitoring" (CBM). CBM is an approach for insuring that appropriate coordination between different bird initiatives is accomplished (but CBM does not mean counting all birds on all surveys). Much progress has been made on CBM during the past year: (1) a default standard for the accuracy of long-term monitoring programs has been established, (2) a list of all (659) North American species that warrant monitoring has been produced, (3) procedures have been developed for incorporating estimates of potential bias (in trend estimates) into power calculations, (4) species well-monitored by the BBS and other similar surveys have been identified, (5) the number of BBS or similar routes needed to meet the accuracy target for 80% of this group of species has been identified for the continent and for every State and Province, (6) 3 general survey objectives have been identified and surveys have been recommended for each objective for each of the 659 target species, (7) substantial progress has been made on a "Design of Bird Surveys" reference work, on a CBM Overview, and on a Strategy for implementing CBM in the w. U.S., and (8) comprehensive plans for CBM are being developed in Idaho and Nevada and are under discussion in several other States.

### **s66 McLean**

West Nile Virus in North American Birds: emergence of a disease threat. ROBERT G. McLEAN, *Natl. Wildl. Res. Center, Fort Collins, CO.*

The introduction of West Nile virus (WNV) into New York, NY, in 1999 and its rapid establishment and expansion throughout North America was remarkable for a mosquito-borne virus. A number of environmental and biological factors influence the transmission of mosquito-borne viruses of birds and these viruses have similar host infection and epidemiological patterns. The WNV strain introduced had increased virulence and some species, particularly Corvidae, were especially susceptible to infection and experienced significant mortality. This avian mortality was used for public health surveillance to detect the presence of the virus and monitor its spread. Within 4 yr, WNV spread across the U.S. and Canada reaching the West Coast by the end of 2002, affecting 44 states and 5 Canadian provinces. The disease spread and intensity was even more dramatic in 2002 causing nearly 4000 human cases, 15,000 equine cases, and >100,000 wild bird deaths. The virus has expanded into Latin American and Caribbean countries and will present new problems for those countries. As WNV spread into new habitats, different host species and vectors became involved in primary transmission cycles and additional vertebrate hosts were affected. New routes of transmission among humans and animals became apparent and present new challenges for prevention and control. The pattern and rapidity of spread indicates that migratory birds could be disseminating the virus.

### **s67 Novak, Lampman, Gu & Ringia**

Mosquito avian interactions: key factors to understanding the transmission cycle of West Nile virus. ROBERT NOVAK, RICHARD LAMPMAN, WEIDONG DONG GU and ADAM RINGIA, *Illinois Nat. Hist. Sur., Champaign, IL.*

The West Nile Virus is considered the most significant insect-borne disease affecting the health of humans and animals, in recent U.S. history according to the Centers for Disease Control. Unlike mosquito-borne diseases native to the U.S., this virus not only endangers humans but also causes severe illness and death in horses and wildlife, especially birds. It has been found in > 150 bird species, including, endangered species, game and non-game species, and domestic species. The invasion of this virus is further complicated since it has been isolated from 37 species of mosquito, 2 species of ticks and other parasitic flies. This group of mosquitoes includes both flood-water species – primarily pest species that occur in high numbers throughout the summer months in as well as permanent and foul-water mosquitoes known to transmit viral and other pathogenic diseases to both humans and animals. The principal themes of this presentation will be to discuss: 1) seasonal and regional variation in mosquito vector natural history, 2) epidemic, enzootic and alternative transmission cycles 3) mosquito and viral over-wintering and maintenance, and 4) strategies to protect wildlife.

### **s68 Redig, Wunschman & Saggese**

West Nile virus infection in raptors at The Raptor Center, University of Minnesota. PATRICK T. REDIG, ARNO WUNSCHMAN and MIGUEL SAGGESE, *Coll. Vet. Med., St. Paul, MN.*

Between 14 Aug 2002 and 20 Oct 2002, The Raptor Center at the University of Minnesota received 62 raptors with clinical signs referable to infection with West Nile virus. One species of owl and 7 species of diurnal raptors were admitted, including 39 Great Horned Owls, 12 Red-tailed Hawks, 4 Cooper's Hawks, 2 Goshawks, 1 European Sparrowhawk, 1 Merlin, 1 Red-shouldered Hawk, 1 Gyrfalcon, 1 Golden Eagle, and 1 Bald Eagle. Not all birds died and of those that did, not all were submitted for laboratory confirmation. Of those that were submitted, results have not been obtained. To date, West Nile virus was detected by WNV-specific reverse transcriptase polymerase chain reaction (RT-PCR) on brain and various visceral organs in 17 of the Great Horned Owls with 10 cases pending and 3 not submitted. Two cases with clinical signs of WNV infection were negative by this method. Four of the owls with mild clinical signs, but not tested specifically for WNV, recovered and were released in 3 - 6 wk post-admission. PCR results were positive in 8 of the 10 Red-tailed Hawk cases submitted at post-mortem, with 2 pending. 2 Red-tailed Hawks with clinical signs (mild) recovered and released. Among the other species, all died

or were euthanized, save for 1 Goshawk (a captive breeding bird) which was rendered blind but was saved as a breeding bird. Differential findings of inflammation and antigen localization between the owls and the diurnal birds appear to be evident and these differences have implications for making confirmatory diagnoses.

### **s69 McGowan, Clark, Robinson, Caffrey, Weston & Smith**

The impact of West Nile virus on American Crow populations. KEVIN J. MCGOWAN, *Lab. Ornithol., Cornell Univ., Ithaca, NY*, ANNE B. CLARK, DOUGLAS A. ROBINSON, Jr., *Dept. Biol. Sci., Binghamton Univ., Binghamton, NY*, CAROLEE CAFFREY, *Audubon Science, Ivyland, PA*, TIFFANY J. WESTON, and SHAUNA C. R. SMITH, *Zool. Dept., Oklahoma State Univ., Stillwater OK*.

Unusually high numbers of dead American Crows heralded the appearance of West Nile virus (WNV) in North America in the summer of 1999. Although crow mortality is a hallmark of the disease in America, the actual impact of WNV on crow populations is difficult to monitor. Preliminary indications were that the disease could have a significant effect. All experimentally infected American Crows died within 6 d, and few wild survivors have been found. 43% of all dead crows tested in New York State since 1999 tested positive for WNV. In populations of individually marked crows in New York and Oklahoma, 34 and 40% of all crows within areas of high WNV occurrence died during outbreaks in 2002. The localized nature of the disease, however, suggests that impacts on a larger population may be much less. Continued exposure to WNV over several years could cause significant population declines and even local extinctions. Adults and juveniles died at the same rate. Increased mortality of adults may have a significant impact on the cooperative breeding social system of the American Crow.

### **s70 Yaremych, Warner, Mankin, Brawn, Raim & Novak**

West Nile virus causes high mortality in a free-ranging population of American Crows. SARAH A. YAREMYCH, RICHARD E. WARNER, PHIL C. MANKIN, *Dept. Nat. Res. & Env. Sci., Univ. Illinois, Urbana, IL*; JEFF D. BRAUN, *Dept. Nat. Res. & Environ. Sci. and Animal Biol.*, ARLO RAIM, *Dept. Nat. Res. & Environ. Sci.*; and ROBERT J. NOVAK, *Illinois Nat. Hist. Survey, Champaign, IL*.

The effects of West Nile Virus (WNV) on naive, free-ranging host populations of North American wild birds are unknown, but potentially significant. We monitored survival of a cohort of American Crows in central Illinois from May through Oct 2002, at the leading edge of the WNV outbreak in North America. Over two-thirds of our radio-marked crows were recovered dead and confirmed to have WNV. This mortality caused a significant drop in survivorship for this species. Serology revealed that WNV antibody rate in the free-ranging crows is low, yet not all crows succumb to WNV. The high rate of crow mortality corresponded with the onset and prevalence of the disease in local mosquitoes that were sampled near crow roosts. This study is the first report of a direct link between the occurrence of WNV and high mortality in a free-ranging North American wildlife population.

### **s71 Hochachka, Bonter, McGowan & Dhondt**

Assessing the spatial extent and impact of West Nile virus outbreaks with winter bird monitoring data. WESLEY M. HOCHACHKA, DAVID N. BONTER, KEVIN J. MCGOWAN and ANDRÉ A. DHONDT, *Lab. Ornith., Cornell Univ., Ithaca, NY*.

Outbreaks of West Nile disease in Europe are typically patchy and isolated, with only low levels of mortality of birds. In North America the spatial extent of outbreaks of WNV has not been quantified, and while high rates of mortality of some corvid species are known to occur the actual impacts on wild bird populations are poorly documented. We used data from 2 winter bird monitoring projects, the Christmas Bird Count and Project FeederWatch, to describe the spatial extent of outbreaks of West Nile disease, and quantify impacts of the disease on sizes of populations of several widespread species of birds. While WNV is widespread in e. North America, severe outbreaks (suggested by large bird population declines) have been limited in extent and patchily distributed. Species also appear to have been affected to varying degrees, with some showing no detectable changes in population size. However, within outbreak areas and for susceptible species, mortality rates have been extremely high with disappearances of over half of wintering populations.

## **s72 Marra & Sauer**

Using the North American Breeding Bird Survey to document the consequences of West Nile virus on bird populations. PETER P. MARRA, *Smithsonian Environ. Res. Center, Edgewater, MD*, and JOHN R. SAUER, *USGS, Patuxent Wildl. Res. Center, Laurel, MD*.

The North American Breeding Bird Survey (BBS) is a continent-wide monitoring program that provides information on >400 species of birds. We used BBS data to determine whether (1) bird populations changed after the introduction of West Nile Virus in 2000, (2) populations show spatial patterns in population change associated with West Nile Virus exposure, and (3) whether population change is associated with covariates associated with West Nile Virus. Populations declined on affected routes in 2000 - 2001, but populations did not show consistent declines over 2000-2002. Human population density was not strongly associated with patterns of population change in American Crows. Effective use of BBS data for these purposes requires (1) better information on spatial patterns of prevalence of West Nile Virus; and (2) construction of models to predict the consequences of West Nile Virus on bird populations. Our analyses were limited by the lack of prevalence information at relevant temporal and spatial scales, and by a lack of covariates related to exposure to the virus. Improvements in survey design could increase the quality of information from the BBS for use in assessing the impacts of events such as an invasive disease.

## **s73 Garvin, Tarvin, Smith, Ohajuruka & Grimes**

Patterns of West Nile virus infection in Ohio Blue Jays. MARY C. GARVIN, KEITH A. TARVIN, *Dept. Biol., Oberlin Coll., Oberlin, OH*, JENNIFER SMITH, *Coll. Vet. Med., Ohio State Univ., Columbus, OH*, OJIMADU A. OHAJURUKA, *Vector-Borne Disease Prog., Ohio Dept. Health, Columbus, OH*, and SHEILA D. GRIMES, *Ohio Dept. Agriculture, Animal Disease Diagnostic Lab, Reynoldsburg, OH*.

Understanding age-related, temporal, and geographic patterns of WNV infection in populations of wild birds is key to our ability to understand the impact of this virus at the population level. Furthermore, understanding the mechanisms by which the virus overwinters and is annually initiated in avian populations increases our understanding of, and ability to predict, epizootics. Unfortunately, even the most basic data on the impact of WNV and other diseases on wild birds are difficult to acquire because sick and dead birds are often preyed upon or scavenged prior to discovery by researchers. We examined the influence of age, region and date on the prevalence of WNV in Blue Jay carcasses submitted for testing to the Ohio Department of Health West Nile virus monitoring program during May - Aug 2002. We found that the proportion of carcasses infected with WNV increased from 3% in May to over 90% by Aug. Throughout this period, prevalence did not differ among regions or between young of the year and older jays, as would be predicted if jays initially infected in 2001 initiated the 2002 cycle. Therefore, Blue Jays infected in 2001 were not likely to have been the most important overwintering mechanism for WNV in Ohio in 2002.

## **s74 Grubb, Zuwerink, Marshall, Neubig, Kimball, Kuenzli, Doherty & Restifo**

Demographic responses of Ohio woodland birds to West Nile virus. THOMAS C. GRUBB, Jr, D. ANDREW ZUWERINK, JAMES S. MARSHALL, JEFFREY P. NEUBIG, SCOTT A. KIMBALL, JOHN KUENZLI, *Dept. Evol., Ecol. & Organ Biol., Ohio State Univ., Columbus, OH*, PAUL F. DOHERTY, Jr, *Dept. Fish. & Wildl. Biol., Colorado State Univ., Fort Collins, CO*, and ROBERT A. RESTIFO, *Vector-Borne Disease Prog., Ohio Dept. Health, Columbus, OH*.

West Nile virus (WNV) was first detected in Ohio in 2001 and by the end of 2002 had been detected in all 88 counties in birds, mosquitoes, horses or humans. We present incidence of WNV antibodies in the blood of approximately 800 individuals of 14 permanent-resident and winter-resident woodland species sampled during the winter of 2002 - 2003 in n.-central Ohio. We relate presence of WNV antibodies in birds and WNV in mosquitoes to habitat characteristics and isolation of 47 woodlots and 7 riparian-corridor sites in our study landscape. We compare numbers of young-of-year birds and adult annual survivorship during the second year of WNV presence in the state with similar records from 8 pre-WNV years for Carolina Chickadee, Tufted Titmouse, White-breasted Nuthatch, and Downy

Woodpecker, and from 3 pre-WNV years in screech owls. We also examine reproductive success of previously infected birds.

### **s75 DuPuis & Marra**

The distribution and spread of West Nile virus as detected from live bird surveillance. ALAN P. DUPUIS II, *Arbovirus Lab., Wadsworth Center, New York Dept. Health, Albany, NY*; and PETER P. MARRA, *Smithsonian Environ. Res. Center, Edgewater, MD*.

To track the distribution and spread of West Nile virus (WNV), we began an intensive 4 year avian monitoring effort in spring 2001 in the mid-Atlantic region and on the overwintering grounds of Neotropical migrants. Locations in the Caribbean basin included Jamaica, Puerto Rico and the Yucatan Peninsula of Mexico. Additionally, we collected dead birds at telecommunication towers in Gainesville and Tallahassee, Florida. To date, over 6000 samples have been collected in the mid-Atlantic sites including Jug Bay Wetlands Sanctuary and Patuxent Wildlife Research Center; over 3000 samples were collected from migrants and residents in the Caribbean; and tissues from approximately 100 dead birds were collected in Florida. Serum samples were screened by an indirect ELISA for flavivirus antibody. ELISA reactive specimens were tested further by plaque reduction neutralization tests against St. Louis encephalitis and West Nile viruses. Bird tissues were subjected to virus isolation attempts and RT-PCR. Antibody results from spring 2002 indicate 3 WNV infections in migratory birds captured in the tropics, 1 each in Jamaica, Mexico, and Puerto Rico. In addition 17 resident birds collected in Jamaica were positive for neutralizing antibody specific to WNV indicating active transmission on the island. Fall 2002 and spring 2003 results are pending.

### **s76 Owen, Moore & Komar**

Migrating birds as West Nile virus dispersal vectors. JENNIFER C. OWEN, FRANK MOORE, *Dept. Biol. Sci., Univ. S. Mississippi, Hattiesburg, MS*, and NICHOLAS KOMAR, *Centers for Disease Control & Prevention, Fort Collins, CO*.

Whereas migratory birds are considered one of the primary sources of West Nile Virus (WNV) infection, there is little direct evidence of a bird's motivation and ability to migrate while infectious (i.e. viremia titers capable of infecting biting mosquitoes). We asked whether intercontinental landbird migrants infectious with WNV display nighttime activity characteristic of migratory behavior. Gray Catbirds (n = 7), Swainson's Thrushes (n = 14), and Wood Thrushes (n = 16) were captured at a fall banding station on Fort Morgan Peninsula, Alabama, and individually housed in activity cages within the University of Southern Mississippi's ABSL3 facility. Birds were assigned to control and treatment groups. Nocturnal migratory activity was induced by manipulating photoperiod. After birds began to display migratory activity, treatment birds were inoculated subcutaneously with 1000 pfu of the 1999 NY strain of WNV. Levels of viremia were monitored for 6 d following inoculation by taking 50  $\mu$ l blood/d. Virus titers were analyzed according to Komar et al. (2003, **Emerging infectious diseases** 9 [No. 3]). If birds infectious with WNV display migratory behavior, that result would be consistent with the hypothesis that migratory birds may be the primary source of new WNV infection and could be responsible for the re-initiation of the WNV cycle each spring.

### **s77 Hayden & Eberly**

Challenges and opportunities for avian conservation and research on military lands. TIMOTHY J. HAYDEN, *Construction Engineering Res. Lab., Champaign, IL*; and CHRISTOPHER W. EBERLY, *Dept. Defense Partners in Flight, Plains, VA*.

The Department of Defense (DoD) has >10,000,000 ha under its management authority across all physiographic regions of the continental United States, Hawaii and Alaska. Twenty-eight DoD installations have been designated as state or global "Important Bird Areas." This introduction focuses on the research and conservation programs and opportunities on DoD lands for graduate students and other non-governmental organizations. Although military training and testing activities can have significant impacts on habitats and populations, military installations often support higher avian diversity and numbers of endangered species than surrounding landscapes because of protection from resource extraction,

agriculture, and urban development. A variety of programs exist with DoD that support a wide range of avian research and conservation initiatives including the Strategic Environmental Research and Development Program (SERDP), the Legacy Program, collaboration with DoD labs, and installation supported programs. DoD currently works in partnership with over 300 federal and state agencies and nongovernmental organizations for the conservation of Neotropical migratory and resident birds and their habitats. DoD's significant involvement in the Partners in Flight Program provides a gateway for students and researchers to learn about and participate in avian research, management, and conservation activities on DoD installations.

### **s78 Burst, Fleming, Westbrook & Forsythe**

Migratory bird work at southeastern Navy and Marine Corps installations. THOMAS L. BURST, RODNEY L. FLEMING, OLIVIA J. WESTBROOK, *S. Div., Naval Fac. Eng. Command, N. Charleston, SC*, and DENNIS M. FORSYTHE, *Dept. Biol., The Citadel, Charleston, SC*.

The work includes monitoring and management. Both are funded by the local installations with the installations doing the bulk of management and NAVFAC doing the majority of monitoring. Monitoring has been primarily by point counts with 6 yr of data at 3 Florida properties and for shorter periods at 3 South Carolina properties. Additional work has included baseline surveys to determine which species are present on a property and which areas receive high use by migratory birds, especially species of management concern. Management includes increasing diversity by emphasizing uncommon species, general forest management emphasizing the impacts to bird species of concern, and direct management such as food plots and prescribed fire. The idea is to integrate forest and wildlife management. One example of integrating bird surveys into management is the planned restoration of a longleaf pine wiregrass community after our point counts determined that Bachman's Sparrows were not utilizing the existing slash pine plantations. Another example is where an Integrated Natural Resources Management Plan has been modified to both alter food plots for support of wintering sparrows and to restore longleaf pine to provide for more early successional bird species such as the Prairie Warbler.

### **s79 Murray, Lee, Stanton & Kirkpatrick**

Avian communities and their habitat relationships at Fort Chaffee-MTC. REBECCA L. MURRAY, DANIEL J. LEE, TYLER P. STANTON, *Conserv. Manage. Inst., Virginia Tech, Coll. Nat. Res., Blacksburg, VA*; and SABRINA M. KIRKPATRICK, *Environ. Branch, Fort Chaffee, AR*.

During the breeding seasons of 2001 and 2003, the Conservation Management Institute (CMI) in partnership with Fort Chaffee - Maneuver Training Center (MTC), initiated a project to investigate the relationship between breeding bird distribution and habitat. Fort Chaffee-MTC is located in nw. Arkansas in the Ouachitas Bird Conservation Region. Military training activities result in landscape level impacts that mimic the historical disturbance regimen (e.g. fire). These habitats include native little bluestem (*Schizachyrium scoparium*) grasslands, mature bottomland forests, and upland hardwood forests. Species diversity and density will be compared between and within habitat types based on physiognomic structure of vegetation and level of disturbance. Preliminary data indicate that there are differences in species richness between habitat types. We found that Bachman's Sparrow, Dickcissel and Bell's Vireo are common in the shrubland and grassland habitats, while Red-eyed Vireos and Ovenbirds are common in the forest and woodland habitats.

### **s80 Melton, Jetté, Hayden & Beaty**

Hurricanes and the population viability of Red-cockaded Woodpeckers on Fort Stewart, Georgia. ROBERT H. MELTON, *USACE/ERDC/CERL, Champaign, IL*, LESLIE A. JETTÉ, *Sterling, VA*, TIMOTHY J. HAYDEN, *USACE/ERDC/CERL, Champaign, IL*, and TIMOTHY A. BEATY, *Fish & Wildl. Branch, DPW, Ft. Stewart, GA*.

This study examines the influence of including hurricane catastrophes in a population viability analysis (PVA) of the Red-cockaded Woodpecker, on Fort Stewart, Georgia. Population viability analysis program PVAves was used to test whether inclusion of hurricane catastrophes substantially altered the results of the PVA. Over a wide range of carrying capacities and starting population sizes, omission of hurricanes seriously biased the PVA outcome on a 100 yr time scale. Probability of extinction within 100

yr was underestimated, as was the probability of classification into the IUCN-based extinction risk class VULNERABLE [defined as  $\text{Pr}(\text{extinction within } 100 \text{ yr} * 0.1)$ ]. The probability of achieving a minimum population size of 250 breeding pairs (based on U.S. Fish and Wildlife Service recovery criteria) was overestimated. Minimum population carrying capacity was underestimated by 70%, and minimum viable population size was underestimated by 50% - 64%. All of these effects were statistically distinguishable, given uncertainty variation arising from sampling errors of the survival and reproductive parameters. Bootstrapped medians, and statistics based on proportions, were more informative than means for probabilities of extinction and target population achievement, because the underlying sampling distributions were extremely skewed or U-shaped.

### **s81 Eckrich**

Management of endangered Black-capped Vireos and Golden-cheeked Warblers on Fort Hood, Texas. GIL ECKRICH, *Fish & Wildl. Branch, Fort Hood, TX*.

Fort Hood, an 88,500 ha military installation in central Texas, has the largest breeding populations of 2 endangered songbirds, the Black-capped Vireo and the Golden-cheeked Warbler under single management authority. Habitat loss and brood parasitism by Brown-headed Cowbirds have been cited as critical factors in the decline of both species as well as many other songbirds. Brood parasitism has been controlled by an effective cowbird removal program that has kept parasitism rate of vireo nests below 10% for the past 6 yr. We manage warbler habitat by protecting existing mixed oak-juniper woodlands from clearing and fire. We take a more active approach to management of vireo habitat through the use of fire, mechanical manipulation, and the shaping and maintenance of vegetation by military vehicles conducting training. As a result of our management practices, the number of warblers has doubled since 1992, and the number of vireos has increased from an estimated 85 pairs in 1987 to an estimated 3,000 - 5,000 pairs in 2003. The Fort Hood populations alone exceed regional recovery goals for both species.

### **s82 Ortega, Skoruppa, Woodin & Eberly**

Artificial burrows for Burrowing Owls on Navy lands in southern Texas. JENNIFER L. ORTEGA, MARY K. SKORUPPA, MARC C. WOODIN, *U.S. Geol. Sur., Corpus Christi, TX*; and CHRISTOPHER W. EBERLY, *Dept. Defense Partners in Flight, Plains, VA*.

The U.S. Navy and the U.S. Geological Survey are investigating wintering grassland birds, with a focus on the Burrowing Owl, at Navy facilities in s. Texas. Burrowing Owls and other grassland birds have undergone profound declines while grassland habitat in s. Texas has been invaded by exotic grasses. Native to grasslands of western North America, Western Burrowing Owls (*Athene cunicularia hypugaea*) rely on mammal burrows for nesting and shelter. To assist in Burrowing Owl conservation, an artificial burrow project was initiated on Navy airfields in s. Texas. 36 burrows of 6 types (3 different diameters, with 2 or 3 openings) were constructed and monitored 15 Oct - 15 Mar for 2 years (2001 - 2003). Of the 3 burrow sizes, 83% of all burrows used by Burrowing Owls were small (15 cm diameter) and 17% were medium (20 cm diameter). None of the large (25 cm diameter) burrows was used. Other grassland species occurring on Navy properties include Savannah Sparrow, Sprague's Pipit, American Goldfinch, Lincoln's Sparrow, Grasshopper Sparrow, and meadowlarks. Further studies on exotic grasses and grassland birds at Navy installations will begin later this year.

### **s83 Anderson**

Alternatives future analysis for the Southwestern Willow Flycatcher and other neotropical birds in southeastern Arizona. ROBERT L. ANDERSON, *U.S. Army Training and Doctrine Command, Fort Monroe, VA*.

The Upper San Pedro River Basin in southeastern Arizona is well known for its avian diversity; however, water use by the town of Sierra Vista, Fort Huachuca, and agriculture in the basin threatens to lower its water table. This in turn could alter the vegetation in the basin in a way that negatively impacts habitat currently supporting nesting of the endangered Southwestern Willow Flycatcher (*Empidonax traillii extimus*) and foraging for a large number of resident and neotropical migratory birds during the breeding season and migration. In 1997, the Army Training and Doctrine Command's Environmental Division

obtained a grant for Carl Steinitz at Harvard Design School (assisted by University of Arizona and Desert Research Institute) to apply his Alternative Futures planning approach to the basin. We determined the range of potential alternative future growth patterns for the basin and compared them for their relative impacts on a suite of environmental parameters including hydrology, biodiversity, and landscape vegetation pattern. The intent is to inform decision makers of which potential alternative futures will have the greatest and least impacts on those parameters. This paper has been adapted from ***Alternative Futures for Changing Landscapes: The Upper San Pedro River Basin in Arizona and Sonora*** by Steinitz and others (2002, Island Press, 800.828.1302).

#### **s84 Hayden, Melton, Willis & Beaty**

Effects of maneuver training activities on the Red-cockaded Woodpecker population on Fort Stewart, Georgia. TIMOTHY J. HAYDEN, ROBERT H. MELTON, *U.S. Army Construction Engineering Res. Lab., Champaign, IL*; BETH WILLIS, and TIMOTHY A. BEATY, *Fish & Wildl. Branch, Ft. Stewart, GA*.

Research was conducted during 1997-1999 to determine effects of military maneuver training activities on the Red-cockaded Woodpecker population on Fort Stewart, Georgia. Data were collected on types and occurrence of military maneuver training activities in proximity to Red-cockaded Woodpecker clusters, habitat characteristics of clusters, and demographic characteristics of Red-cockaded Woodpecker groups. Analyses of demographic variables showed a significant association between number of young fledged and group size in 1998 and 1999 and between number of young fledged and nesting success of the cluster in the previous year in all 3 yr, 1997 - 1999. Logistic regression analysis of principal components for habitat data found no relationship between habitat characteristics and demographic variables for the sample clusters. Spearman rank correlations found no relationship between number of young fledged and measures of human activity including total activity observed, military activity observed and proximity to roads and trails. However, a post-hoc test showed the mean number of young fledged from successful nests at the 3 clusters with the highest level of human activity (mean = 1.3889 young/nest) was significantly lower than for all other nests (mean = 2.2379 young/nest) during the 3 yr of the study. Population simulations indicate local extinction risk is low at current disturbance levels on Fort Stewart.

Number sequence skips s85

#### **s86 Larkin**

Patterns of birds on radar: a primer. RONALD P. LARKIN, *Illinois Nat. Hist. Sur., Champaign, IL*.

This short talk is designed to lay common ground and introduce methods and concepts speakers will use in the rest of the symposium. It will include the basics of interpreting radar images, relating pretty colors to numbers of birds, and avoiding misleading conclusions about flying animals as observed with radar.

#### **s87 Mabey & Mizrahi**

Protecting landbird migrants en route: the role of radar in the Mid-Atlantic region. SARAH E. S. MABEY, *Research Coop Unit, Dept. Zool., North Carolina State Univ., Raleigh, NC*, and DAVID S. MIZRAHI, *New Jersey Audubon Soc./Cape May Bird Observatory, Cape May Court House, NJ*.

Although migratory birds occupy a central position in the realm of conservation, their mobile lifestyles present considerable ecological and political challenges to conservation scientists and practitioners. The recent growth in terrestrial bird conservation planning, e.g., Partners-in-Flight (PIF) physiographic plans, has been accompanied by a recognition of the importance of high-quality stopover habitats to the viability of migrant populations. However, the development of effective conservation plans for stopover habitat has been hindered by the difficulties inherent in identifying and characterizing important stopover sites for landbird migrants. Doppler weather surveillance radar (WSR-88D) holds great promise as a conservation tool for addressing our needs to coarsely identify and classify landbird migrant stopover sites at a regional scale. We present an overview of two on-going studies designed to help direct

the conservation planning efforts of governmental and non-governmental organizations within the Mid-Atlantic region by integrating data obtained from the WSR-88D network with GIS.

### **s88 Diehl**

The influence of scale and habitat selection in determining bird density during migratory stopover.

ROBERT H. DIEHL, *Dept. Animal Biol., Univ. Illinois, Urbana, IL.*

Protecting habitat for birds during migration has received relatively little attention despite that stopover can account for two-thirds of energy consumption during a migratory journey (Wikelski et al. 2003, **Nature** *in press*). Identifying the characteristics of important stopover habitats, however, is complicated by the large spatial scales over which migration occurs and the relatively short periods of time birds spend in specific habitats. Using radar observations of migrating birds combined with GIS-based land cover data, I identify some characteristics of important stopover habitats at landscape and patch scales. In addition, I explore 3 hypotheses describing post-migratory habitat patch selection. Higher habitat-specific densities occurred in landscapes where stopover habitat was scarce. Considerable post-migratory bird movements may occur at the landscape but not regional scale. Spatial models of habitat selection based on migrant proximity to a patch (proximity hypothesis) explained nearly as much variance in the number of migrants occupying patches as selection models based on migrant interception of patches during flight (interception hypothesis). Although small highly isolated patches exhibited highest migrant densities, these high densities were the consequence of biological processes operating at larger spatial scales. Sound conservation strategies for migrating landbirds should consider the landscape context of stopover habitats that are potential targets for preservation.

### **s89 Larkin**

Radar and habitats: resolving a conundrum. RONALD P. LARKIN, *Illinois Nat. Hist. Sur., Champaign, IL.*

Radar is our only available tool to observe large numbers of birds day and night over great distances, in fact, even at regional scales. But seeking to study land cover or regional associations of migrating birds with radar poses a conundrum: during migratory stopover birds are on the ground ("stopped") yet radar can observe them only in flight. The ephemeral period when birds rise up and show themselves on radar, just after dusk for most migrants, is the basis for most research in this field. I present results permitting unambiguous understanding of bird movements out of diverse well-delineated areas, but the path to interpretation of such results for migration ecology and energetics is not yet so clear. Nor is the descent of migrating birds at the end of a night's migration, for which statistical and case-study results are presently the state of the art. In the midwestern U.S. and at large bodies of water we also see some detailed, geographically-related, persistent nighttime patterns on radar; some of these are mysteries or poorly understood.

### **s90 Black**

The response of nocturnally migrating birds to Lake Erie and Lake Ontario. JOHN E. BLACK, *Brock Univ., St. Catharines, ON.*

Bird migration on weather radars located at Buffalo and Cleveland was examined during both spring and fall migration. The weather radar data were supplemented by data gathered on a 3-cm marine radar operated at Long Point, St. Catharines and Toronto. Ground observations of warblers in spring migrations were also incorporated. The results reveal an interesting variety of responses of birds to the presence of the lakes.

### **s91 Gauthreaux, Belser & van Blaricom**

Radar ornithology and conservation biology: a continent-wide perspective. SIDNEY A. GAUTHREAUX, Jr., CARROLL G. BELSER, *Dept. Biol. Sci., Clemson Univ., Clemson, SC*, and DONALD VAN BLARICOM, *Strom Thurmond Inst., Clemson Univ.*

The national network of 151 Doppler weather surveillance radars (WSR-88D) provides a unique

opportunity to monitor bird migration continent-wide on an almost continuous basis. Although we gather data from all sites, we use only about half of the sites (those near stations that measure winds aloft) when generating maps of continent-wide migration patterns. We use winds aloft information to threshold radial velocity data from radar in an effort to evaluate the extent of insect contamination in the velocity and corresponding reflectivity data. The velocity data above threshold (in keeping with bird velocities) are matched to the corresponding reflectivity data that are used to estimate mean density of migration. The resulting maps show the density and direction of migration for each station for a selected time after sunset. Maps are generated for 4 altitudinal bands sampled by the 1° beam elevated ½° between the radar and a range of 160 km. Analysis of the maps suggests that considerably more nocturnal migration occurs in the eastern and central U.S. than in the West, and the maximum density of migration increases from northern to southern latitudes. The density of migration is important for the detection of migration stopover areas within 120 km of a radar.

## GENERAL PAPER SESSIONS

### 001 Smith & Benkman

Ecological speciation in Red Crossbills (*Loxia curvirostra* complex). JULIE W. SMITH and CRAIG W. BENKMAN, *Dept. Biol., New Mexico State Univ., Las Cruces, NM.*

A prominent hypothesis to explain macroevolutionary patterns of diversity is that of a coevolutionary arms race between predators and their prey. A crucial prediction of this hypothesis is that coevolution can promote speciation. We investigated whether a coevolutionary arms race between Red Crossbills and Rocky Mountain lodgepole pine is promoting reproductive isolation and hence speciation in Red Crossbills. Coevolution between crossbills and lodgepole pine in the South Hills, ID, has resulted in cones with enhanced crossbill defenses that in turn have favored crossbills with deeper bills. This selection is divergent from that experienced by crossbills in the Rocky Mountains and is hypothesized to have caused ecological speciation; the South Hills Crossbill is resident, and has a distinct bill structure and vocalizations. We found that mate choice was highly assortative in the South Hills. South Hills Crossbills begin pairing in late-Feb when other crossbill call types were very rare or absent suggesting that temporal isolation is responsible in part for the reduction in gene flow. Other call types were uncommon at this time because they may have difficulty surviving in winter on the well-defended cones in the South Hills. Temporal isolation, however, is not the only factor contributing to reproductive isolation because assortative mating remained strong later in the spring and summer when other call types were more common. Our results indicate that coevolution can promote speciation.

### 002 McGill, Margulis & Oiler

Ultraviolet light and mate choice in tanagers. PATTY MCGILL, SUSAN W. MARGULIS and ANNE OILER, *Chicago Zool. Soc, Brookfield Zoo, Brookfield, IL.*

Birds have the ability to see ultraviolet (UV) as well as visible light and a variety of functions have been documented in association with this ability. In some captive housing situations, however, standard lighting conditions may exclude light in the UV spectrum. Given that plumage reflectance in the UV may be sexually dimorphic and vary among individuals and given that many taxa of small birds breed poorly in captive situations, we examined the potential role of ultraviolet light in shaping mate choice in 6 species of tanagers. Measurements of UV reflectance from museum skins of these species showed UV-reflectance in certain patches of plumage; in some species the magnitude of the reflectance varies among individuals and between sexes. During 2 breeding seasons, 16 trios of unpaired tanagers were tested at the Brookfield Zoo. Each female was exposed simultaneously to 2 conspecific males, 1 with UV-present and 1 with UV-absent conditions. Female location and behavior were scored at each minute during the 2-hr trials. Results indicate that there is considerable interspecific variation in response to UV. However, females do prefer to spend time near the male in the presence of UV light although some females were strongly affected by particular individual males. When established pairs of birds, previously not exposed to UV conditions, were provided with UV light, behavioral changes included increases in affiliation, courtship and nest-building, but not in incubation and parental care.

### 003 Guers & Curry

\* Effects of forest fragmentation on the reproductive success of Black-capped Chickadees in eastern Pennsylvania. SUSAN L. GUERS and ROBERT L. CURRY, *Dept. Biol., Villanova Univ., Villanova, PA.*

Much research has focused on the negative effects of forest fragmentation and induced edge effects on migratory bird populations (Murcia 1995, *Trends Ecol. & Evol.* 10: 58-62; Robinson et al. 1995, *Science* 267: 1987-1990). In contrast, little is known about the reproductive success of resident, cavity-nesting birds in relation to fragmentation (but see DeSanto et al. 2002; *Condor* 104: 482-495; Hinsley et al. 1999, *J. Avian Biol.* 30: 271-281). My project tests whether woodlot size influences nesting success of Black-capped Chickadees. Additionally, it tests if edge effects induced by forest fragmentation affect Black-capped Chickadee populations by reducing reproductive success. Dougherty & Grubb (2001, *J. Avian Biol.* 32:77-82), found that Carolina Chickadees, nesting at edges were more likely to be usurped by House Wrens, thus reducing reproductive success. I am measuring Black-capped Chickadee reproductive success during this 2 yr project by monitoring active nests during the breeding season. One large study plot (>10,000 ha) surrounding Hawk Mountain Sanctuary (Kempton, PA) denotes contiguous forest. Fragmented forest is represented by 19 privately-owned woodlots of varying sizes (0.4 - 68 ha), located in the area. In 2002, 16 Black-capped Chickadee nests were monitored. Of these, 63% were successful in producing at least 1 fledgling. Hatching success was 80%, and fledging success (birds fledged/egg laid) was 54%. Preliminary analyses of demography data indicate that woodlot size and edge effects can reduce reproductive rates for Black-capped Chickadees.

### 004 MacDougall & Montgomerie

\* Reproductive correlates of carotenoid-based plumage coloration in American Goldfinches. AMY K. MACDOUGALL and ROBERT MONTGOMERIE, *Dept. Biol., Queen's Univ., Kingston, ON.*

We investigated the role of plumage coloration as a sexually selected signal in male and female American Goldfinches. Using reflectance spectrometry, we objectively measured the plumage coloration of breeding goldfinches and derived carotenoid color scores using Principal Components Analyses. We found no evidence of assortative mating by body condition or 3 body size measurements. However, we found a significant positive relation between mates with respect to Carotenoid PC1 score, such that males with intense carotenoid coloration were paired with intensely colored females. Moreover, plumage coloration indicated aspects of both phenotypic quality and reproductive potential. Females with intense carotenoid coloration bred earlier in the season and laid more eggs than duller females. Males displaying intense yellow plumage had larger cloacal protuberances, a testosterone-related, sperm-storage organ indicative of reproductive condition, as well as lighter mass corrected for body size, a trait correlated with social dominance in other seed-eating passerines. In addition, intensely colored males raised heavier nestlings, even when controlling for the effects of breeding onset, parental body size, female coloration, and clutch size. Our research documents assortative mating based on carotenoid color intensity and provides evidence that both male and female American Goldfinches benefit from choosing mates based on these color signals. Clearly, carotenoid-based plumage coloration can signal important aspects of male and female quality to potential mates and thus coloration has important reproductive consequences in terms of mate and offspring quality.

### 005 Schrader

\* Parental effort and parasite resistance in the Red-bellied Woodpecker. MATTHEW S. SCHRADER, *Dept. Biol. Sci., Florida State Univ., Tallahassee, FL.*

Recent studies suggest that a trade-off between parental-effort and parasite resistance may mediate the cost of reproduction in birds. Although such a trade-off has been demonstrated in a few nest-box studies, whether this trade-off results in decreased residual reproductive value is unclear. In addition, the importance of such a trade-off in a population of birds nesting in natural cavities has not been assessed. I used a brood manipulation experiment to test whether a trade-off between caring for an enlarged brood and resisting a haematzoan parasite mediates the cost of reproduction in a population of Red-bellied Woodpeckers nesting in natural cavities. I found evidence for a trade-off between caring for an enlarged brood and resisting haematzoa in male Red-bellied Woodpeckers, however this trade-off

was not associated with an increase in parental feeding effort. In addition, while there appeared to be a trade-off in males, this trade-off was not associated with a decrease in the success of second or third broods. Unlike the results of other studies, these results suggest that a trade-off between caring for an enlarged brood and resisting parasites may not be explained by a simple energy allocation model.

## **006 Torti & Dunn**

\* Effects of climate change on the breeding biology of North American birds. VANESSA M. TORTI and PETER O. DUNN, *Dept. Biol. Sci., Univ. Wisconsin-Milwaukee, Milwaukee, WI.*

Air temperatures are increasing globally and across North America, and these changes are affecting plants and animals in a variety of ways. Their effects have been documented in several species of birds, but no large-scale studies have examined multiple species. I examined the effects of temperature on 6 ecologically diverse species of North American birds using 50 yr of nest record data on laying dates and clutch sizes. As predicted, laying dates for most species advanced with higher temperatures, and laying dates advanced over time for 2 species, Red-winged Blackbirds and Eastern Bluebirds. Neither laying date nor clutch sizes changed significantly over time in the remaining species, an unsurprising result given the lack of increase in temperatures over time for 3 of the species. Other factors also affected the changes in breeding of birds, including latitude, longitude, elevation, and density. However, all of these factors affecting laying date and clutch sizes acted differently upon different species. This study indicates that the relationship between climate change and breeding in birds is more complicated than previously believed. It is therefore important to consider all of the environmental and ecological factors influencing the responses of different species to climate.

## **007 Kappes & Stutchbury**

\* Does ornamental pigmentation correlate with pairing success in the American Redstart? PETER J. KAPPES and BRIDGET J. M. STUTCHBURY, *Dept. Biol., York Univ., Toronto, ON.*

Pigment-based ornamental plumage, whether derived from melanin or carotenoid pigments, plays an important role in the mating success of males displaying these ornaments. However, little is known about the relative importance of these 2 different ornaments in species possessing ornaments derived from both pigments. Since the proximate mechanisms controlling the production of melanin- and carotenoid-based ornaments differs, the information these ornaments signal to potential mates has been hypothesized to be different. Melanin-based ornamental plumage is typically thought to signal social status and is maintained through social mediation. Carotenoid-based ornaments are thought to be reliable signals of the quality of the bearer that require no subsequent mediation to maintain their honesty. If so, one would predict that if a male possesses both types of ornamental plumage carotenoid-based ornaments would be the more reliable signal and therefore would be a better predictor of mating success. I investigated the interaction of these 2 ornament types on the pairing success of male American Redstarts, a species possessing highly variable forms of both types of ornaments. As predicted, a carotenoid-based ornament was responsible for all significant models of pairing success.

## **008 Wilson & Arcese**

\* El Niño drives timing of breeding but not population growth in the Song Sparrow. SCOTT WILSON and PETER ARCESE, *Center Appl. Conserv. Res., Univ. British Columbia, Vancouver, BC.*

Increasing evidence suggests that climate change affects the timing of breeding in birds, but there is less evidence to show how such changes affect the population dynamics of birds overall. We studied the effects of the El Niño Southern Oscillation on timing of breeding of Song Sparrows on Mandarte Island in British Columbia. We also examined what effect variation in timing of breeding had on reproductive output and population growth. Timing of breeding was closely correlated with the Southern Oscillation Index. Birds bred earlier in warmer El Niño years and later in colder La Niña years. Early breeding strongly increased reproductive output, primarily because females made more nesting attempts as the length of the breeding season increased. However, annual variation in timing of breeding had little effect on population growth because the population is strongly regulated by the rate of recruitment by juveniles. Juvenile recruitment rates declined with increasing population density but showed little response to

climate. These findings suggest that populations will vary in response to climate change depending on how climate affects the demographic parameters that contribute most to population growth.

### 009 Safran, McGraw & Evans

\* Geographic differences in the function of sexual ornaments: plumage coloration, not tail-streamers, is a sexually selected trait in North American Barn Swallows. REBECCA J. SAFRAN, *Dept. Ecol. & Evol. Biol., Cornell Univ., Ithaca, NY*, KEVIN J. MCGRAW, *Dept. Neurobiol. & Behav., Cornell Univ.*, and MATTHEW R. EVANS, *Dept. Biol., Univ. Stirling, Stirling, UK*.

Sexual adornments often vary markedly across a species' range, which presumably is due to differences in local environmental conditions and the associated selection pressures, such as natural versus sexual selection or the relative signaling value of different ornamental traits. However, there are only a few reported examples where the information content of mating signals varies geographically, and even fewer where a set of secondary sexual traits serves different signaling functions in different populations. Classic studies of sexual selection in the European Barn Swallow (*Hirundo rustica rustica*) demonstrate that elongate tail-streamers provide several reproductive advantages to males and females and are used as reliable signals of mate quality. Here, we show that tail-streamers do not confer these same benefits in a population of Barn Swallows from North America (*H. r. erythrogaster*). Instead, ventral plumage coloration, which is more exaggerated in North American swallows compared to their European counterparts, predicts patterns of assortative mating and annual reproductive success in *H. r. erythrogaster*. These observations support the idea that ornamental traits can serve different functions among animal populations and suggest that geographic variation in different sexual signals may facilitate population divergence, which may ultimately lead to speciation.

### 010 Haussmann & Vleck

\* Switch it on, switch it off: telomerase may provide a rescue effect at the end of life. MARK F. HAUSSMANN and CAROL M. VLECK, *Ecol., Evol. & Organ. Biol., Iowa State Univ., Ames, IA*.

The senescent decline in survival and reproductive performance that individuals experience with advancing age is nearly universal in the life history of animals. Cellular senescence caused by telomere shortening has been suggested as a causal agent of aging. In some tissues telomeres are maintained by telomerase. Telomerase's presence promotes tumor formation however, suggesting a trade-off between aging and cancer. Evolutionary strategies may vary with lifespan. Species with a short lifespan that lack telomerase are protected from tumor formation until the end of life, when critically short telomeres are rescued by forced telomerase expression, possibly leading to a high incidence of cancer. I investigated telomerase activity in different tissues from hatchling, young adult and old Zebra Finches (*Taeniopygia guttata*) to determine when and where telomerase was expressed. Telomerase activity varied with age. In old birds, telomerase activity exhibited a "rescue effect" in muscle, liver and gonadal tissue. These results are in agreement with the short-lifespan strategy. In the short-lived Zebra Finch, telomerase expression is reduced after fledging, but as individuals approach their maximum lifespan, telomerase activity is switched on to rescue tissues with short telomeres. How the telomerase profiles of Zebra Finches compare to species with longer lifespan will be of great interest in determining whether age-specific selection on telomerase activity influences the evolution of variation in lifespan.

### 011 Olson, Vleck & Vleck

\* Transient thermal fluctuations in eggs and their implications for development, ontogeny of metabolism, and hatchability. CHRISTOPHER R. OLSON, CAROL M. VLECK and DAVID VLECK, *Dept. Zool. & Genetics, Iowa State Univ., Ames, IA*.

In nature, bird eggs experience frequent thermal fluctuations from their optimal developmental temperature when the adult leaves the nest to forage. Eggs of many species vary thermally throughout the day as parents leave the nest to forage for themselves, but how episodic cooling during incubation affects development, post-hatching fitness, and phenotype are unstudied. We conducted artificial incubation experiments to examine how these cooling events affect incubation period, metabolism, and hatchability. We incubated Zebra Finch (*Taeniopygia guttata*) eggs at constant egg temperature (37.6°C),

or regularly fluctuated egg temperature to 32°C and 25°C from an incubation temperature of 37.6°C, to simulate cooling during a parental absence. Ontogeny of metabolism was delayed in the 25°C cooling treatment, but metabolism in the more moderate 32°C cooling treatment did not vary from eggs kept at constant incubation temperature. Mean incubation period of constant temperature eggs was 13.5 d. Eggs experiencing episodic cooling to 25°C survived to 16 d, and then failed to hatch. Episodic cooling to 32°C resulted in a mean daily egg temperature of 36.5°C (1.1°C decline), whereas episodic cooling to 25°C decreased the mean temperature to 34.1°C (3.5°C decline). Decreases in mean temperature, and/or the periodic cooling to 25°C, suggests persistent adult nest attentiveness is important to keep eggs above a certain threshold temperature.

### **012 Nicolai, Sedinger & Wege**

Regulation of development time and hatch synchronization in precocial birds. C. A. NICOLAI, *Ecol., Evol. & Conser. Biol., Univ. Nevada Reno, Reno, NV*; J. S. SEDINGER, *Dept. Environ. & Res. Sci., Univ. Nevada Reno*, and M. L. WEGE, *Yukon Delta Natl. Wildl. Refuge, U.S. Fish & Wildl. Ser., Bethel, AK*.

Eggs of precocial bird clutches hatch more synchronously than they are laid. The accepted hypothesis to explain hatching synchrony has been that vocalizations from earlier laid embryos accelerate development of later laid embryos. We assembled experimental clutches comprised of Black Brant (*Branta bernicla nigricans*) eggs laid on the same day from the same position in the laying sequence (PILS) to eliminate the effects of earlier laid eggs. In a separate experiment, we manipulated clutches so that the full complement of laying sequences was maintained in each clutch, but each egg originated from a different female. We measured metabolic rates of eggs from each PILS at mid-incubation and the day before hatch. We detected no difference in incubation period between control and manipulated clutches. These data suggests that sounds produced by brood mates and/or female incubation patterns are not the principal mechanisms for hatching synchrony. Both genetic and host mothers influenced overall developmental time, indicating that genetic-maternal effects and incubation behavior and nest environment also influenced developmental time. Embryonic metabolic rate was negatively correlated with number of days before hatch, but there was not a positive relationship between PILS and metabolic rate.

### **013 Huber**

Coordination of vocal production and flight in the cockatiel (*Nymphaticus hollandicus*). SARAH K. HUBER, *Organ. & Evol. Biol., Univ. Massachusetts, Amherst, MA*.

The evolution of communication signals in animals may be limited by proximate mechanisms underlying signal production. Flight song in birds is one such signal that may be constrained by morphological adaptations of the respiratory system. The respiratory system of birds delivers oxygen to flight muscles, removes waste products, and aids in ventilation. These demands on the respiratory system may result in locomotor-respiratory coupling. The respiratory system of birds also is adapted for the production of vocalizations. Inhalations and exhalations are precisely synchronized with syringeal function to produce songs, resulting in respiratory-vocal coupling. I hypothesized that flight might facilitate vocal production, resulting in locomotor-vocal coupling. Forceful exhalations of air through the vocal apparatus may be assisted by thoracic compressions and lift generated by the pectoralis muscle during down stroke. I predict thoracic compression should correlate with maximum air flow and, thus, the maximum amplitude of the call. I looked at the relationship between flight vocalizations and wing beat cycles in cockatiels. I flew cockatiels in a wind tunnel and recorded their vocalizations and wing movements. I find that call onset and maximum amplitude of a call occur halfway through the upstroke, when there is no thoracic compression.

### **014 Ringia, Koo, Blitvich, van de Wyngaerde, Brawn & Novak**

Seroprevalence of West Nile virus in Illinois birds, 2002. ADAM M. RINGIA, HYUN-YOUNG KOO, BRADLEY BLITVICH, MARSHALL VAN DE WYNGAERDE, JEFF BRAWN and ROBERT NOVAK, *Med. Entomol. Lab., Illinois Nat. Hist. Surv., Champaign, IL*.

Sera were obtained from 1733 wild and domestic birds (representing 26 families and 81 species)

in Illinois between May and Nov 2002. Sera were tested for antibodies to West Nile virus (WNV) by epitope-blocking enzyme-linked immunosorbent assay. Overall, 56 (3.2%) individuals from 12 (46.2%) families and 17 (21.0%) species had evidence of past WNV infection. The species with the highest incidence (>3 positives) were Gray Catbirds, House Sparrows, Northern Cardinals and Chucker Partridges. Seropositive birds were detected from 1 Aug to 26 Nov. Seroprevalence rates were higher in birds in northern and central Illinois compared to those in the southern regions of the state. There was no significant difference in seroprevalence between resident and migratory birds. Captive birds and those collected from urban and forest fragment habitats had higher seroprevalence than birds in contiguous forest and wetlands. Seroprevalence in adult and immature birds was not significantly different.

### **015 Lee, Martin, Wikelski & Hasselquist**

A role for the immune system in biological invasions? KELLY A. LEE, LYNN B. MARTIN, MARTIN WIKELSKI, *Dept. Ecol. & Evol. Biol., Princeton Univ., Princeton, NJ*; and DENNIS HASSELQUIST, *Dept. Animal Ecol., Lund Univ., Lund, Sweden*.

The adaptive immune system requires more time and nutritional resources to develop than the innate immune system. However, adaptive immune responses are relatively inexpensive while the innate immune system is costly to operate in terms of metabolic changes and risk of autoimmunity. We hypothesized that invasive animals should rely more on adaptive than innate immunity relative to poor invaders in order to minimize the costs of defending against the diversity of new pathogens encountered in new habitats. We compared inflammation and antibody responses in House Sparrows and its less successful congener, the Eurasian Tree Sparrow. As predicted, House Sparrows formed more antibodies to a novel antigen, keyhole limpet hemocyanin, than did Eurasian Tree Sparrows. During the breeding season wing-web inflammation in response to phytohaemagglutinin injection did not differ between species, but in the autumn the inflammation response in Eurasian Tree Sparrows was significantly greater than in House Sparrows.

### **016 Steiger, Kelly, Cochran & Wikelski**

Nightly torpor and daily slothfulness in a tropical rainforest bird. SILKE STEIGER, J. PATRICK KELLEY, *Princeton Univ., Princeton, NJ*; WILLIAM W. COCHRAN, *Univ. Illinois, Urbana-Champaign, IL*; and MARTIN WIKELSKI, *Princeton Univ., Princeton, NJ*.

Many tropical birds seem to have a slow pace of life compared to their temperate zone relatives, as indicated by comparatively low clutch sizes, delayed reproductive maturity, and increased longevity. We tried to understand physiological mechanisms underlying these unique life history differences. We measured energy expenditure and behavioral activity of free-ranging neotropical Spotted Antbirds (*Hylophylax naivoides*) via newly developed heart rate radio telemetry which we calibrated against respirometry measurements. Behavioral activity data indicate steady and low rates of flights and hops throughout the day. Heart rate data demonstrate that spotted antbirds regularly enter metabolic torpor at night and do not maintain their body temperature at normotherm levels when ambient temperature drops below 29° C. Low nocturnal (torpid) and diurnal (low activity) metabolic rates result in a daily energy expenditure ~40% of the value expected of a similarly sized passerine. We suggest that the low metabolic rate of spotted antbirds is causally related to increased longevity, a characteristic that distinguishes many tropical rainforest from temperate forest birds.

### **017 Revis & Waller**

Anting behavior in birds: an evaluation of ant selection and abiotic conditions prevalent during these displays. HANNAH C. REVIS, *U.S. Pacific Basin Agri. Res. Center, Hilo, HI*, and DEBORAH A. WALLER, *Dept. Biol., Old Dominion Univ., Norfolk, VA*.

Active anting behavior occurs when songbirds apply ants to their feathers. During anting displays, a bird draws its wings forward in front of the head and swings its tail around to the far right or left. Wing and tail feathers are then rubbed with ants held in the bird's beak. Although this behavior is cosmopolitan in distribution and occurs in a wide variety of passerine birds, it remains poorly understood. This research addressed hypotheses testing factors affecting the selection of ants during active anting behavior, the

effects of abiotic conditions (temperature, cloud cover, and humidity) on behavioral displays and assessed correlations between anting behavior and the location of Wild Turkey dust-bathing bowls to identify the possible functionality of anting behavior as a method of preening. Movement among ants displayed to songbirds elicited significantly more anting behavior during choice trials than the non-active and dead ants. A significant difference exists among songbird responses to ants in paired combinations of ant genera. *Aphaenogaster* and *Camponotus* ants elicited the greatest number of anting interactions. Sky conditions affected the relative frequency of anting behavior; however, temperature and relative humidity were not significantly related to anting behavior. Additionally the selection of dust bathing locations was not related to ant species commonly preferred in anting behavior displays.

### **019 Deluca, Studds & Marra**

Developing and testing a marsh bird community index for the Chesapeake Bay. WILLIAM V. DELUCA, COLIN E. STUDDS and PETER P. MARRA, *Smithsonian Environ. Res. Center, Edgewater, MD.*

As the Chesapeake Bay watershed becomes increasingly altered by anthropogenic disturbances, it becomes more urgent to gauge and monitor the ecological integrity of coastal habitats. The index of biotic integrity model was used to develop a marsh bird community index (MBCI) for the mid-Atlantic region. MBCI scores were based on species attributes that vary from specialist to generalist. We censused marshes in the mesohaline section of the bay for 2 yr (2002 - 2003) using double-observer point counts. MBCI scores were not significantly affected by land use at the watershed, 2000 m, or 1000 m scales. We did, however, detect a threshold at approximately 15% urban/suburban development within 500 m of the marsh, after which marsh bird community integrity declined. Finally, high integrity marsh bird communities can exist in multiple wetland plant community types. The results of this study imply that marsh bird community integrity is scale dependant and wetland managers should consider local land use surrounding estuarine wetlands when making management decisions.

### **020 Burke, Elliott, Holmes, Friesen & Dadman**

Effects of partial harvest on reproductive success of forest birds in a fragmented landscape. DAWN BURKE, KEN ELLIOTT, *Office Min. Nat. Res., London, ON*, STEPHEN HOLMES, *Canadian For. Ser., Sault Ste. Marie, ON*, LYLE FRIESEN and MICHAEL D. CADMAN, *Canadian Wildl. Ser., Guelph, ON.*

Relatively little is known about the effects of partial harvesting on the nesting success of birds in eastern deciduous forests, particularly in fragmented landscapes. We compared forest fragments that had been recently logged at a range of intensities, to uncut sites to determine the impacts of selection harvest on nesting success of forest bird communities. We found a total of 739 nests of 39 species across 32 sites in 3 yr. For all species combined, standard cut sites had significantly lower rates of nest predation and nest parasitism compared to the other treatments. However, heavy cut sites had significantly higher rates of multiple parasitism, which reduced the number of fledged young produced. Mayfield analysis for individual target species (Wood Thrush, American Robin, Rose-breasted Grosbeak, and Northern Cardinal) indicated no significant differences in nest success between treatments. Heavy logging had the greatest impact on nest parasitism, which reduces fecundity, but does not have a significant impact on nest failure, in this region. Over the long term, heavy logging in these woodlots may negate the ability of birds to produce enough young to maintain populations, but at present we see no significant effect on rates of nest success.

### **021 Jimenez, Londono & Parra**

How (not) to count curassows. IVAN JIMENEZ, *Dept. Biol., Univ. Missouri-St. Louis, St. Louis, MO*, GUSTAVO A. LONDONO, *Calí, Colombia*, and JUAN L. PARRA, *Dept. Integrative Biol., Univ. California-Berkeley, Berkeley, CA.*

Curassows are among the most threatened Neotropical birds, so reliable methods for estimating their abundance are needed to discern their distribution patterns and manage their populations. Yet, little research has been conducted to develop such methods. Based on line transect surveys of Great and Razor-billed Curassows conducted in tropical forest of Costa Rica and Peru, we demonstrate that surveys of aural cues sample curassows over large areas, provide precise estimates of their abundance, but are

biased towards detecting males. In contrast, surveys of visual cues sample small areas of forest, and are imprecise, but appear not to be biased towards any sex/age class. Thus, visual and aural cues can be combined to assess sex/age population structure. We also show that models based on distance sampling theory adequately describe detection functions for aural cues, but not for visual cues due to the effect of trails on the detection process. We argue that trails are unavoidable constraints for humans performing long (> 1 km) line transect surveys in Neotropical forests, and present a variation of distance sampling models that accounts for their effect on the detection process and appropriately describes detection functions for visual cues. Our results bear consequences for the methods used to estimate abundance of curassow and other large terrestrial vertebrates in the Neotropics.

## **022 Doherty, Sorci, Royle, Hines, Nichols & Boulinier**

Sexual selection affects local extinction and turnover in bird communities. PAUL F. DOHERTY, Jr., *Dept. Fish. & Wild. Biol., Colorado St. Univ., Ft. Collins, CO*, GABRIELE SORCI, *Lab. Parasit. Evol., CNRS, Univ. Pierre et Marie Curie, Paris, France*, J. ANDREW ROYLE, *USFWS, Laurel, MD*, JAMES E. HINES, JAMES D. NICHOLS, *USGS, Laurel, MD*, and THIERRY BOULINIER, *Lab. Ecol., Univ. Paris, Paris, France*.

Predicting extinction risks has become a central goal for biologists interested in population and community dynamics. Several factors have been proposed to explain extinction risks, including sexual selection. Populations under strong sexual selection experience a number of costs ranging from increased predation to enhanced sensitivity to environmental and demographic stochasticity. These findings have led to the prediction that local extinction rates should be higher for species/populations with intense sexual selection. We tested this prediction by analyzing the dynamics of natural bird communities at a continental scale over a period of 21 yr. In agreement with the theoretical prediction, we found that sexual selection increased local extinction risks (dichromatic birds had on average a 23% higher local extinction rate than monochromatic species). However, in spite of higher local extinction probabilities, the number of dichromatic species did not decrease due to higher local turnover rates of dichromatic species.

This resulted in relatively stable communities for both groups of species. Our results suggest that these communities function as meta-communities, with frequent local extinctions followed by colonization. Anthropogenic factors impeding dispersal might therefore have a significant impact on the global persistence of sexually selected species.

## **023 Almeida, Oring & Lanctot**

Abundance patterns of Buff-breasted Sandpipers in three Brazilian wintering sites. JULIANA B. ALMEIDA, *Ecol. Evol. & Conserv. Biol. Prog., Univ. Nevada, Reno, NV*, LEWIS W. ORING, *Environ. Res. Sci. Dept., Univ. Nevada, Reno, NV*, and RICHARD B. LANCTOT, *USFWS Migratory Bird Mgmt, Anchorage, AK*.

Wintering sites are ideal for monitoring surveys of Buff-breasted Sandpipers (BBSA) because of the clumped and predictable distribution they assume in South America. Having in mind that any conservation initiative towards this species, classified as "high concern" by the U.S. and Canadian shorebird conservation plans, demands monitoring of its population dynamics, we monitored BBSA abundance at 3 major wintering sites in Brazil, Parque Nacional da Lagoa do Peixe (A), Ilha da Torotama (B) and Estação Ecológica do Taim (C). At the beginning of Jan 2003, 261 BBSA were observed at site C, while at site A they numbered 83. By the end of Feb site A had 259 sightings and site C none. Abundance at site B changed in the same direction as in site A. Additionally, 2 (out of 30) BBSA banded in Dec 2001 at site C were resighted in Jan 2003. These results suggest that each site plays a different role on BBSA life cycle, being important as wintering or stop over sites. Further study is needed to better understand movement patterns between the sites and to appropriately design future surveys that will enable biologists to accurately estimate the population size of this declining species.

## **024 Brown, Schulte, Harrington, Winn, Howe & Bart**

Population size, winter distribution, and habitat associations of the eastern subspecies of American Oystercatcher. STEPHEN BROWN, SHILOH SCHULTE, BRIAN HARRINGTON, *Manomet Center for*

*Conser. Sci., Manomet, MA, BRAD WINN, Georgia Dept. Nat. Res., Brunswick GA, MARSHALL HOWE, Patuxent Wildl. Res. Center, Laurel, MD, and JONATHAN BART, USGS Forest & Rangeland Ecol. Sci. Center, Boise, ID.*

We completed the aerial survey proposed in the U.S. Shorebird Plan to determine population size, winter distribution, and habitat associations for the eastern subspecies of American Oystercatcher (*Haematopus palliatus palliatus*), covering coastal areas from New Jersey to Texas during Nov 2002 to Feb 2003. We included virtually all sites with suitable habitat for the subspecies, partitioned into 3 survey strata: known roost sites, high-use habitat, and intercoastal tidal habitat. Partner organizations conducted simultaneous ground counts in most states. We used high resolution still photography to validate estimates of the size of particular flocks, and locations were recorded by GPS. We used ground counts to determine detection rates of flocks, which were high in most areas, but much lower in 2 locations where birds often flushed. We observed 9,252 birds in aerial surveys, and 1,161 were observed only in ground surveys for a total estimate of 10,413. We will discuss various approaches to establishing an upper bound on the population size estimate. Most birds used roost sites on shell rakes (40%) and sand islands (21%). Aerial surveys are an important technique that, when combined with ground counts in high density areas, can determine population size and trend for this subspecies, and possibly for other coastal shorebirds and waterbirds.

## **025 King, Collins & Petersen**

Distribution and reproductive success of early-successional shrubland birds nesting in powerline rights-of-way in western Massachusetts. DAVID I. KING, *U.S. For. Serv. Northeast Res. Sta., Univ. Massachusetts, Amherst, MA*, JEFFREY M. COLLINS and WAYNE R. PETERSEN. *Massachusetts Audubon Soc., Lincoln, MA.*

Powerline rights-of-way (ROWS) are a potentially important source of habitat for shrubland-nesting birds, a group of bird species that is in decline throughout the Northeast. Previous research has been conducted on breeding birds in ROWs, but no published studies have included analyses of the effect of ROW width on bird distribution, and none has included analyses of the effect of ROW characteristics on bird reproductive success. During the spring and summer of 2002, we surveyed birds at 50 point count stations on 10 ROWs in w. Massachusetts, resulting in 983 detections of 59 bird species. There was no relationship between ROW width and bird species richness, however the abundance of several species of regional conservation concern such as the Prairie Warbler were significantly positively related to right-of-way width ( $P < 0.05$ ). We located 216 nests of 28 species. Although nest success was low overall, with only 35.7% of nests successfully fledging young, this level of nest success is similar to reports from other studies of shrubland birds. Most failures were due to predation (83.4%). There was no relationship between nest predation and the distance of nests from the ROW edge, however nest survival increased with ROW width ( $P < 0.05$ ). These results indicate that ROWs provide breeding habitat for shrubland birds, including some of special conservation concern, and that the distribution and reproductive success of is affected by ROW width.

## **026 James**

The Red-cockaded Woodpecker and sustainable forestry. FRANCES C. JAMES, *Dept. Biol. Sci., Florida State Univ., Tallahassee, FL.*

According to the United Nations' Food and Agriculture Organization, "sustainable forestry" involves management of forests to assure the continuing availability of products like timber, food and fuel, protection of the environment, and preservation of biodiversity. To satisfy this definition in the longleaf pine/wiregrass ecosystem of the s. U.S., such management would have to use prescribed fire and timber harvest that encourages the development of multi-aged stands of trees. Application of the habitat management guidelines recommended in the 2003 recovery plan for the Red-cockaded Woodpecker, should both improve the habitat quality for the bird and contribute to maintenance of biodiversity in general. However, our data from the Apalachicola National Forest in n. Florida suggest that, without more specific attention to how trees are harvested, the long-term sustainability of the ecosystem will not be assured.

## 027 Barraclough

The application of distance sampling techniques on a range of New Zealand forest bird species. ROSEMARY K. BARRACLOUGH, *School Geog. & Environ. Sci., Univ. Auckland, New Zealand.*

Estimates of absolute bird density are a common necessity in conservation, ecological study, and wildlife management. Nevertheless, obtaining these estimates can be a difficult exercise. Distance sampling (described by Buckland et al. 1993, **Distance sampling**. Chapman & Hall, London) offers a range of frequently useful techniques for achieving reasonable estimations of abundance. However, these techniques need to be applied with careful consideration of species and habitat specific characteristics. These include species mobility; positive or negative responsive movement by birds to observers; species conspicuousness; habitat structure; density of foliage; and topography. Results taken primarily from New Zealand mixed broadleaf and podocarp forest, for a range of bird species, illustrate the difficulties and some solutions for dealing with such characteristics. Issues relating to spatial and temporal scale are also discussed. It is recommended that line-transects should be used whenever possible in preference to point-transects. However, where point-transects are the most appropriate option, a snap-shotcount should be adopted. This is a counting style designed to combine the ideal of the count representing a single moment in time, and the visual searching necessary to meet the primary assumptions of distance sampling. The time span of a snap-shot count has to be species specific. The outcomes of these surveys also highlighted the importance of both piloting when adapting distance techniques for target species and observer training.

## 028 Hill, McGraw, Stoehr & Duckworth

Why are drab male House Finches socially dominant to bright males? GEOFFREY E. HILL, *Dept. Biol. Sci., Auburn Univ., AL*; KEVIN J. MCGRAW, *Dept. Neurobiol. & Behav., Cornell Univ., Ithaca, NY*; ANDREW M. STOEHR, *Dept. Biol., Univ. California-Riverside, Riverside, CA*; and RENEE A. DUCKWORTH, *Biol. Dept., Duke Univ., Durham, NC.*

Despite abundant evidence indicating that plumage coloration is a reliable indicator of male health and condition in the House Finch, drably colored males are socially dominant to brightly colored males. Color-manipulation experiments, however, indicate that carotenoid-based plumage coloration does not function as a status signal in the House Finch. In captive flocks of finches, measured levels of circulating testosterone of males did not predict the dominance rank of males, but hormone manipulations had a strong affect on dominance status. Males that were gonadectomized dropped in social dominance rank while males implanted with testosterone rose in social dominance rank. In wild males, elevated testosterone increased song rate but decreased parental care. Males with elevated testosterone also grew drabber plumage than males with low levels of circulating testosterone during molt. Finally, circulating testosterone was associated with high body condition, and males that were infected with parasites had lower levels of circulating testosterone than males that were not parasitized. These observations suggest that drab males adopt an aggressive, risk-taking strategy to compensate for their poor plumage ornamentation. The relationship between plumage coloration, dominance, immunocompetence, and testosterone remain to be fully resolved in this or any species.

## 029 LaFleur & Rubega

\* American Robins, European Starlings, and novel foods: a comparison between a native and invasive bird. NANCY LaFLEUR and MARGARET RUBEGA, *Dept. Ecol. & Evol. Biol, Univ. Connecticut, Storrs, CT.*

The capacity to colonize new habitats is strongly influenced by the ability to respond appropriately to new situations, and one testable trait that may provide insight on such behavioral flexibility is the response to novelty (Greenberg 1990, **Stud. Avian Biol.** 13: 431-437). We compared the responses of introduced European Starlings and native American Robins when presented with a novel food (maintenance diet altered by the addition of food coloring), using visually isolated captive birds for all tests. In choice tests, birds were offered equal amounts of novel food and familiar food. All starlings selected the familiar food ( $P < 0.01$ ,  $n = 22$ , binomial test), but 4 of 16 robins chose the novel food ( $P < 0.05$ , binomial test). We also tested the latency of individually held birds to feed on novel food when presented in the absence of familiar food. We found starlings ate the novel food in an average of 16.7 min ( $\pm 13.29$  SD,  $n$

= 9) and robins in 112.9 min ( $\pm$  200.39 SD, n = 7), a result that was not statistically significant. Our results suggest starlings are more significantly more conservative in their food choices than robins when a known food is present; however, when presented with only an unfamiliar food, starlings tended to eat the novel food sooner than robins.

### **030 Brylawski**

\* An experimental study of mate guarding and paternity in House Wrens. ALICE M. Z. BRYLAWSKI, *Dept. Biol. Sci., Univ. Wisconsin-Milwaukee, Milwaukee, WI.*

Extra-pair paternity, in which the female's social mate does not sire all her offspring, has been documented in many species of birds. As a result, males have evolved paternity assurance mechanisms such as frequent copulation and mate guarding. However, the effectiveness of these mechanisms can vary. Mate guarding is the most common mechanism found in birds, but there are few studies that examine its effectiveness in protecting paternity. This study shows evidence that, in House Wrens, mate guarding by males is an effective paternity guard. Males that were experimentally prevented from guarding (via short-term detention during the early part of the female's fertile period) had lower paternity. Additionally, certain behaviors were associated with the presence of extra-pair young. The length of time male intruders spent on a male's territory was associated positively with, and the length of time the female spent away from the territory was associated negatively with, a greater proportion of extra-pair young. Although experimental males were more likely to be cuckolded, they did not reduce the amount of their parental care (feeding) to nestlings.

### **031 vacant**

### **032 Rose**

\* Do overwintering Semipalmated Plovers select habitats with the most invertebrates? MELISSA A. ROSE, *Watershed Ecosys. Prog., Trent Univ., Peterborough, ON.*

The degradation of estuarine systems in North America and consequent dwindling of high-quality winter habitats has raised concern for populations of migratory shorebirds. Overwintering Semipalmated Plovers adopt a foraging strategy that aims to maximize profitability (food intake per unit time) by selecting habitats with the greatest invertebrate availability. Foraging habitat quality and behaviour was examined in a large estuarine system on and surrounding Cumberland Island Natl. Park in se. Georgia during the years 2000 - 2003. Foraging plovers displayed a strong correlation between foraging rates (pecks/min) and rate of defecation (defecations/min;  $r = 0.75$ ). Both peck rates and defecation rates increased as birds moved further away from the barrier island into the mudflat and estuarine systems. While foraging rates were highly correlated to the number of invertebrates found at each site ( $r = 0.63$ ), invertebrate densities between all sites were not significantly different. Prey items in the estuarine sites were closer to the surface and hence more available than on the barrier island. Observations of foraging plovers indicate that they timed their movements to coincide with the greatest prey availability, but used a variety of sites in both the estuary and on the island throughout the day.

### **033 Fernández & Lank**

\* Flocking and vigilant behavior in Western Sandpipers during the non-breeding season. GUILLERMO FERNÁNDEZ and DAVID B. LANK, *Centre Wildl. Ecol., Simon Fraser Univ., Burnaby, BC.*

Individuals often compromise foraging efficiency or intake rate to decrease predation danger when deciding where or how to feed. Antipredator behavior of wintering Western Sandpipers was studied in 3 habitats with different predation danger in Bahia Santa Maria, nw. Mexico. Habitats may vary not only in terms of their foraging profitability, but also in terms of predation danger. In addition, individuals may vary in their vulnerability to predation due to state-dependent differences. Mean flock size, flock cohesiveness, and vigilance behavior were higher in cattail marshes (less profitable, higher-danger, and lower-bird density habitat) than in brackish flats (more profitable, lower-danger, and higher-bird density habitat). Antipredator responses of sandpipers were intermediate in mangrove habitat, which consists of smaller

sites with vegetation cover. Bird density is likely to have an effect in the antipredator behavioral decision-making process. Controlling for flock size, female sandpipers decreased their nearest-neighbor distance as predation danger increased and had higher vigilance behavior than males. Sex-related differences in antipredator behavior suggest that females invest more due to their higher intrinsic vulnerability. Although raptor and attack rates did not differ between habitats, Western Sandpipers show behavioral plasticity, which allows them to respond to daily changes in the optimal balance between minimizing predation danger and minimizing starvation risk. Choice of foraging site and antipredator behavior are all adjusted according to this shifting balance.

### **034 Rathburn & Montgomerie**

\* Tail coloration indicates male quality in White-winged Fairy-Wrens. MELANIE K. RATHBURN and ROBERT MONTGOMERIE, *Dept Biol., Queen's Univ., Kingston, ON.*

Male White-winged Fairy-Wrens (*Malurus leucopterus*) have delayed plumage maturation and do not obtain colourful nuptial plumage until their fourth year. Prior to this, sexually mature males maintain brown-plumage similar to females but with a bright blue tail. It is possible, therefore, that when males are in brown plumage, females use tail coloration as a quality indicator to discriminate among males. We tested this hypothesis by correlating tail color with body size and indicators of breeding success. We used a spectrometer to assess tail reflectance (brightness, intensity, chroma and hue) of 77 brown-plumaged males. We monitored each individual and recorded the onset of egg-laying, duration of incubation, and number of offspring fledged. Using Principal Component Analysis, we found that brighter tail coloration was significantly positively related to body size. Males with less UV-violet chroma and more brown hue to their tails also tended to have longer tails. In White-winged Fairy-Wrens, males with short tails are older and dominant to long tailed males, further supporting the idea that tail color indicates male quality. There was a positive trend for males with more colorful tails to associate with females that bred earlier and where females incubated significantly longer, implying a tradeoff with male investment. Our findings suggest that tail coloration indicates male quality in brown-plumaged White-winged Fairy-Wrens. We discuss the implication of these findings in relation to male and females' reproductive success.

### **035 Schuetz**

\* Consequences of single versus multiple parasitism for nestlings of the brood parasitic Pin-tailed Whydah. JUSTIN G. SCHUETZ, *Ecol. & Evol. Biol., Cornell Univ., Ithaca, NY.*

In s. Africa, Pintailed Whydahs reproduce by parasitizing the parental care of Common Waxbills. Whydah nestlings do not evict eggs or young and multiple parasitism is common. Accordingly, many whydahs are raised alongside at least 1 other parasite nestling. For 3 seasons between 1998 and 2002 I documented nest and nestling fates at Common Waxbill nests. Unlike some other brood parasite systems, nest survival was not influenced by the number of parasites in a nest. Survival of parasite young, however, did show significant patterns of variation. Parasite nestlings that hatched late compared to brood mates survived poorly. The number of parasites within a brood also influenced nestling survival, but in a non-linear fashion. Whydahs that shared nests with an intermediate number of parasites survived at a higher rate than did nestlings raised without parasites or, nestlings raised with many parasites. These results have surprising implications for the evolution of both female egg-laying strategies and nestling behavior. In contrast to other brood parasite systems, loading nests with eggs may be an adaptive strategy for female Pintailed Whydahs. In addition, selection may favor parasite nestlings that exhibit cooperative strategies or reduced competition with parasite brood mates. Further studies are required to determine the precise nature of within-brood interactions and the extent to which host parent decision-making versus nestling competition determine the observed patterns of nestling survival.

### **036 Balakrishnan, Sefc & Sorenson**

\* Are sympatric, conspecific indigobirds reproductively isolated by host association: a test using multiple marker paternity analysis. CHRISTOPHER N. BALAKRISHNAN, KRISTINA M. SEFC and MICHAEL D. SORENSON, *Dept. Biol., Boston Univ., Boston, MA.*

Recent molecular analyses suggest that the brood parasitic indigobirds evolved in a recent and rapid radiation precipitated by the colonization of new hosts. Male indigobirds mimic songs of their host

species, while female indigobirds also learn host song and use it to choose both their mates and the nests they parasitize. Song learning and mimicry therefore result in the cohesion of indigobird species utilizing a particular host species. These same behavioral mechanisms, however, may lead to hybridization among established species and it is not clear to what extent the general lack of genetic differentiation among indigobirds is due to retained ancestral polymorphism versus ongoing hybridization. We are conducting an intensive behavioral field study to directly evaluate the incidence of hybridization among indigobirds using different hosts. If indigobirds reared by different hosts never mate with each other and females always parasitize a single host species, then individuals that are close relatives should always be associated with the same host, and therefore sing the same mimicry song. We are testing this prediction using genetic parentage analyses and data on song mimicry. The parentage analysis is being conducted using both microsatellite and single nucleotide polymorphism (SNP) loci. The addition of SNP loci increases the power of the parentage analysis and will allow us to assess the utility of different types of genetic markers.

### **037 Levitis**

Response of Western Scrub-Jay populations to increasing human density. DANIEL A. LEVITIS, *Mus. Vert. Zool., Univ. California, Berkeley, CA.*

Western Scrub-Jays are common urban birds along much of the west coast of the U.S. and are classified as insensitive to urbanization of their habitat. Increasing human development is considered to be the most likely cause of recent increases in scrub-jay abundance and range expansions in California, Oregon and Washington. This assessment is based primarily on 1 subspecies of Western Scrub-Jay, the coastal *californica* group. I tested the hypothesis that populations of subspecies *woodhousii* from the Rocky Mountains and Great Basin have a similarly positive response to urbanization. Using data from the U.S. Census Bureau, Breeding Bird Survey and Christmas Bird Count, I estimated the effect of human population density on scrub-jay density in each of these groups. While human density and Western Scrub-Jay density were positively correlated in *californica*, this relationship was absent or negative in *woodhousii* populations. This disparity suggests that these 2 groups should be considered separately for management purposes. How and why these subspecies respond differently to increasing human density requires further investigation.

### **038 Bowman**

Dispersal patterns among and within perceptual neighborhoods of Florida Scrub-Jays in a fragmented landscape. REED BOWMAN, *Archbold Biol. Sta., Lake Placid, FL.*

Dispersal decisions in cooperative breeding birds are influenced by the intrinsic benefits of delaying dispersal and the extrinsic constraints on finding high-quality breeding opportunities. Intrinsic benefits may vary little among populations but variation in extrinsic constraints, such as demography, population density and spatial patterns, and landscape patterns that influence movements, may vary greatly. Habitat fragmentation is likely to influence many of these extrinsic constraints because patches are likely to vary in quality; thus the relative costs and benefits of different dispersal strategies may vary among patches. I used an information-theoretic modeling approach to examine influences on the probability of dispersing within and among perceptual neighborhoods in both male and female Florida Scrub-Jays. Males were less likely to disperse beyond their perceptual neighborhood than females. Among males, those dispersing outside of their perceptual neighborhood were less successful at obtaining breeding space and had reduced fitness than males dispersing within their neighborhood. These parameters did not differ among females. The best fit models suggested younger males tend to leave high-quality, relatively large neighborhoods with many potential competitors for breeding vacancies; females tend to leave poor-quality, relatively small neighborhoods where potential mate choices may be limited. Landscape variables such as the relative isolation of neighborhoods or the permeability of the surrounding landscape appeared not to influence dispersal decisions of either sex.

### **039 Valligny, Curry & Woolfenden**

\* Effects of an intense winter fire on Florida Scrub-Jay habitat use. CHRISTOPHER D. VALLIGNY, ROBERT L. CURRY, *Dept. Biol., Villanova Univ., Villanova, PA*, and GLEN E. WOOLFENDEN, *Archbold Biol. Sta., Lake Placid, FL*.

The Florida Scrub-Jay (FSJ) is endemic to Florida scrub, a rare fire-maintained habitat. Management for the FSJ focuses on habitat maintenance using prescribed fires; however, little is known about the short-term effects on FSJs of fires of different scales, intensities, or seasons. FSJ demographic research has continued at Archbold Biological Station (ABS) in Lake Placid, FL, since 1969. On 12 Feb 2001, an accidental fire burned 247 ha of scrub at ABS. Our goal was to determine the short-term consequences of this large, intense, winter fire on FSJs. We used 1-hr focal sampling (n = 448) to collect behavioral, spatial, and dietary data from 18 color-banded FSJs in territories ranging from 0 - 97% burned. FSJ territories shifted away from burned habitat in 2001, but shifted back in 2002. Scrub-jays in all territories disproportionately avoided burned habitat relative to availability in 2001, but by 2002 some birds used it preferentially. While percentage of territory burned (PTB) was positively correlated with the rate of arthropod consumption in 2001, we found no lingering effects on diet in 2002. Despite an effect on diet immediately post-fire, PTB was not correlated with time spent foraging in 2001. A positive correlation did exist between PTB and foraging in 2002. We observed no other effects on FSJ behavior in the first 2 yr post-fire. Despite its extent, intensity, and unusual timing, these data suggest that the short-term ecological effects of such fires on FSJs are minimal. Winter fires may be an appropriate alternative method of habitat management for the Florida Scrub-Jay.

#### **040 Scheiman & Dunning**

\* Applying metapopulation models to a migratory bird: Bobolinks are not butterflies. DANIEL M. SCHEIMAN, and JOHN B. DUNNING, Jr, *Dept. For. & Nat. Res., Purdue Univ., West Lafayette, IN*.

The Bobolink is a long-distance migrant restricted to discrete habitat patches of grassland in an agricultural matrix. The current paradigm for describing the dynamics of spatially subdivided populations is the metapopulation model. Proper application of the metapopulation model requires specific data that enable separation of this model from alternative population dynamics. Appropriate classification of Bobolink population dynamics will influence the choice of management options for conserving this species.

The classic metapopulation persists in an extinction-recolonization equilibrium maintained by asynchrony and dispersal among populations. Other models used to describe the dynamics of spatially subdivided populations are: core-satellite, source-sink, patchy population, and non-equilibrium. The importance of turnover for regional population persistence is the primary criterion for distinguishing a classic metapopulation from the alternatives. Empirically-derived estimates of the distribution of dispersal distances and local extinction probabilities can be used to assess the importance of turnover. Currently, we are using mark-resight methodology to determine the dispersal patterns of Bobolinks on spatially discrete habitat patches in Indiana. We will quantify dispersal rates to determine the degree of demographic independence among populations. To estimate local extinction probabilities, we will perform a population viability analysis. Dispersal probabilities in combination with extinction probabilities for each population will enable us to classify Bobolink population dynamics. Whether or not the classic model applies, new insights will be gained about the factors that affect grassland bird population size and persistence in a heterogeneous landscape.

#### **041 Atchison & Rodewald**

\* Local and landscape level consequences of urbanization on wintering birds. KELLY A. ATCHISON, *Environ. Sci. Grad. Prog., Ohio State Univ., Columbus, OH*, and AMANDA D. RODEWALD, *School Nat. Res., Ohio State Univ.*

Few studies explicitly examine consequences of land uses within the landscape matrix, and this is especially true for studies of wintering bird communities. The landscape matrix should be especially relevant to wintering birds because land uses can alter microclimate (e.g., heat island effect), food availability (e.g., supplemental food sources), and local habitat characteristics within habitat patches. We investigated (1) the extent to which urbanization within 1 km was associated with community structure of wintering birds in riparian forests, and (2) if local characteristics (microclimate, habitat, supplemental food resources) were possible underlying mechanisms of landscape-level associations. We selected 36 sites in mature riparian forests along an urbanization gradient in Ohio, such that forest width was not

confounded with urbanization. Birds were surveyed along a 40 x 250 m transect adjacent to the river 3x from Dec - Feb 2001 - 2002 and 2002 - 2003. Habitat characteristics, microclimate variables, and numbers of bird feeders within 300 m were recorded. In general, species richness, average abundance, and abundance of common species (e.g., American Goldfinch and Tufted Titmouse) were positively related to amount of urbanization in the surrounding landscape. However, local factors, such as temperature, bird feeders, and mast-producing trees, may contribute to these landscape associations.

#### **042 Hosner, Wrege, Winkler & Cooch**

\* A comparison of dispersal methods in birds using a local dispersal study and data from the National Bird Banding Laboratory. PETER A. HOSNER, *Dept. Nat. Res., Cornell Univ., Ithaca, NY*; PETER H. WREGE, DAVID W. WINKLER, *Dept. Ecol. & Evol., Cornell Univ.*, and EVAN G. COOCH, *Dept. Nat. Res., Cornell Univ.*

Unbiased dispersal rates and distances are difficult to calculate in birds, despite a great deal of attention given to the subject. There are 2 basic direct methods for collecting dispersal data in birds, a mark recapture study on a local population, and National Bird Banding Lab recoveries from across North America. Local studies are biased by different rates of recapture for different distance classes, and National Bird Banding Lab data is often incomplete, lacking in breeding information, and of questionable quality. The purpose of this study was to compare a local dispersal dataset for Tree Swallows with the National Bird Banding Lab recovery dataset to determine if National Bird Banding Lab data is suitable for a dispersal study, or if it is useful to supplement a local study. Results show that National Bird Banding Lab data has unknown recapture rates in the banding block, and therefore it is not suitable for a dispersal study. Data is somewhat useful in supplementing local data, and reveals that dispersal distances may be much greater than previously thought. Some results from National Bird Banding Lab data conflict with results from the local data, indicating that results may be erroneous, and conclusions on National Bird Banding Lab data for dispersal should be approached with caution.

#### **043 Koopman, Hayward & McDonald**

\* Impact of matrix composition on dispersal among subpopulations of Boreal Owls in North America. MARNI E. KOOPMAN, GREGORY D. HAYWARD and DAVID B. McDONALD, *Dept. Zool. & Phys., Univ. Wyoming, Laramie, WY.*

Boreal Owls in North America exhibit 2 contrasting geographic distributions. In the northern boreal forest, Boreal Owls are found in large tracts of highly contiguous habitat. Throughout subalpine forests of the Rocky Mountains, they are found in small isolated patches of high elevation habitat. Using microsatellite markers, we investigated how matrix composition, including both type and extent, impacts gene flow among subpopulations of Boreal Owls. We found that matrix type, including lower elevation forest, short-grass prairie, and human development, was not related to gene flow rates. Nei's standard genetic distances among subpopulations, even those separated by very long distances and by large expanses of treeless matrix, were very small. Among Rocky Mountain subpopulations, we found a small but linear increase in genetic distance with increasing geographic distance, following the isolation by distance model. Among boreal forest subpopulations, however, genetic distance was close to zero over geographic distances as great as 3500 km. Because we found a significantly higher level of sex-biased dispersal among Rocky Mountain subpopulations than among boreal forest subpopulations, we concluded that increased movement by males may be responsible for a complete lack of genetic differentiation over great distances in the boreal forest. Males are philopatric in both boreal and subalpine habitat, but in the boreal forest, where prey is cyclic, prey crashes periodically cause males to move long distances. In subalpine forests, where prey crashes are rare and localized, males have little impetus to make long-distance movements and gene flow is restricted.

#### **044 Vitz & Rodewald**

\* Habitat use of early successional forests by post-breeding mature forest birds. ANDREW VITZ and AMANDA RODEWALD, *School Nat. Res., Ohio State Univ., Columbus, OH.*

Conservation strategies solely focusing on breeding, wintering, and stop-over habitat for forest

dependent birds may be inadequate because ecological needs during the post-breeding period may differ from those necessary for breeding. In particular, recent studies suggest that birds normally associated with mature forest may move into early successional habitats following breeding. We evaluated 1) whether mature forest bird use of regenerating clearcuts in se. Ohio was most closely associated with habitat structure, arthropod resources, or fruit resources and 2) if abundance of mature forest birds was related to harvest size or distance from the mature forest edge. We used equal area constant effort mist-netting to measure avian use at 8 sites ranging in age from 4 - 6 yr post harvest and size from 4 - 18 ha. Results from 2002 revealed that a significantly greater number of post-breeding mature forest birds were captured in small when compared to large harvests although no difference was detected in relation to the distance from the edge. No relationship was detected between arthropod resources and number of birds captured. Forest-ground species showed a significant positive trend with stem density (between 1.5 - 3.0 m,  $P = 0.012$ ), and fruit abundance was positively related to captures of hatch-year mature forest birds ( $P = 0.096$ ) and Scarlet Tanagers ( $P = 0.041$ ). These preliminary results suggest mature forest birds may select early successional habitat during the post-breeding period because they offer both dense cover providing protection from predators and abundant fruit resources.

#### 045 Kriese

\* Habitat use by Orinoco Geese in the Venezuelan llanos: the paradox of a tropical grazer. KENNETH KRIESE, *Dept. Wildl., Fish & Cons. Biol., Univ. California, Davis, CA.*

Most geese (Anserini) utilize Arctic habitats with nutrient-rich vegetation (>25% protein) for breeding. In contrast, nutrient-poor soils and plants characterize tropical savannas, suggesting that waterfowl with a goose-like ecology could not inhabit the tropics (Owen 1980, **Wild geese of the world**. Batsford, London). Orinoco Geese (*Neochen jubata*), 1 of 8 sheldgeese (Tadorini), however, inhabit the neotropics. It is unclear how they have adapted as grazers in this nutrient-poor environment. This project describes habitats utilized by Orinoco Geese in s. Venezuela, assesses forage quality during breeding, and identifies resources that can be managed to conserve this near-threatened species. Orinoco Geese breed during the dry season when nutrient levels in many plants are extremely low and spend most of their time (95%) feeding in short-grass habitats within 25 m of water (rivers, lakes, flooded savannas). Protein content of the 3 grass species that dominate these habitats is higher (15.5 - 19.5%) than in dry savannas where geese are absent (8 - 10.5%.) Forage quality in the same habitats remains constant, but forage availability declines during the dry season as water evaporates and birds concentrate around remaining water sources. Grazing by geese and capybara (*Hydrochaeris hydrochaeris*) reduces plant availability but may increase protein concentrations and reduce fiber content of grazed forage. Hence, Orinoco Geese have adapted to tropical savannas by selecting habitats near water with higher-quality forage. Unfortunately, satellite imagery indicates these preferred habitats are rare in s. Venezuela. Conservation planning should protect existing suitable habitats and maintain flooded savannas and permanent water sources that promote the growth of suitable forage during the breeding season.

#### 046 Witt & Ibañez-Hernandez

Mitochondrial phylogeography of the Blue-crowned Motmot species complex. CHRISTOPHER C. WITT, *Dept. Biol. Sci. and Mus. Nat. Sci., Louisiana State Univ., Baton Rouge, LA*, and P. GABRIELA IBAÑEZ-HERNANDEZ, *Mus. Zool., Fac. Ciencias, UNAM, Mexico.*

In 1923, Frank Chapman (**Bull. Am. Mus. Nat. Hist.** 48: 27-59) formulated a detailed biogeographic scenario for the diversification of the motmots based on plumage and distribution data. Chapman inferred that the motmots originated in Central America, and that the Blue-crowned Motmot complex (genus *Momotus*) invaded South America multiple times following the formation of the Central American Landbridge. We re-evaluated Chapman's hypotheses using a molecular phylogeny based on the mitochondrial cytochrome b and ND3 genes. Our results generally agree with Chapman's scenario, but notably differ with regards to the placement of certain taxa. Our results are consistent with Chapman's idea that the Highland Motmot (*M. aequatorialis*) represents an early invasion of South America following the connection between the continents. However, we found the Highland Motmot to be basal to all other motmots in the Blue-crowned group, rather than nested within it, as implied by Chapman. In addition, the phylogeny indicates that the taxon *argenticinctus* from w. Ecuador and nw. Peru does not descend from

an Amazonian form that dispersed across a low Andean valley, as previously thought; moreover, it is sister to a Central American form, thus revealing a biogeographic pattern more typical of humid-forest, Chocó taxa.

#### **047 Tello**

Molecular phylogenetics of the flatbill and tody-tyrant assemblage of tyrant flycatchers. JOSE G. TELLO, *Dept. Biol. Sci., Univ. Illinois at Chicago and Div. Birds, Field Mus., Chicago, IL.*

The flatbill and tody-tyrant assemblage, *sensu* Lanyon (1988, **Am. Mus. Novitates** no. 2923), includes 12 genera of Tyrant Flycatchers known variously as flatbills, tody-tyrants, and pygmy-tyrants. Lanyon (1988) supported the monophyly of the group based on similar skull morphology and nest form, and built intergeneric relationships based on syringeal characters. However, these comparisons were done without a phylogenetic framework. A more recent study assessing the phylogenetic relationships of Tyrant Flycatchers using published morphological and behavioral data failed to recover the monophyly of the Flatbill and Tody-tyrant assemblage (Birdsley 2002, **Auk** 119: 715-734). In this study, I use molecular data to test for the monophyly of the flatbill--tody-tyrant assemblage *sensu* Lanyon (1988). I also included representatives of the other major flycatcher assemblages for a total of 42 individuals (representing 27 tyrantid genera and 36 species) and 2 non-tyrantid outgroups. I sequenced 3022 bps of 3 mitochondrial genes (ND2, ND3, and Cyt b) and 1 nuclear intron (intron-5 of the Beta Fibrinogen gene). Levels of phylogenetic informativeness for both mitochondrial and nuclear data are high; 54.9% and 48.7% variable sites, with 89.0% and 52.6% of those variable sites being parsimony informative. I discuss the implications of this data with the previous studies and compare and contrast phylogenetic signals from the mitochondrial and nuclear DNA character systems.

#### **048 Bowie, Fjeldså, Hackett, Bates & Crowe**

The shifting roles of dispersal and vicariance in the evolution of African birds during the Plio-Pleistocene: phylogeography of a montane forest robin (*Pogonocichla stellata*). RAURI C. K. BOWIE, *Percy FitzPatrick Inst., Univ. Cape Town, Cape Town, South Africa and Dept. Zool., Univ. Stellenbosch, Matieland*, JON FJELDSÅ, *Zool. Mus., Univ. Copenhagen, Copenhagen, Denmark*, SHANNON J. HACKETT, JOHN M. BATES, *Zool. Dept. Field Mus. Nat. Hist., Chicago, IL*, and TIMOTHY M. CROWE, *Percy FitzPatrick Inst.*

Whereas many studies have documented the effect of ice-ages on the evolutionary history of Northern Hemisphere flora and fauna, this study is the first to investigate how the indirect aridification of Africa caused by global cooling in response to Northern Hemisphere glacial cycles has influenced the evolutionary history of an African montane bird. Mitochondrial DNA sequences from the NADH Dehydrogenase subunit 3 gene were collected from 283 individual Starred Robins. To separate historical process (e.g. vicariance) from recurrent processes (e.g. gene flow), a hierarchical analytical structure was followed. First a phylogeny of the identified haplotypes was constructed. This was followed by an investigation of geographical and demographic structure using a combination of nested-clade and mismatch analyses, and finally coalescent modelling was used to refine results from the above analyses and to estimate directional gene flow among geographical regions. Genetic structure and diversity within populations of the Starred Robin distributed around the montane circle of Africa appears to have been initiated by an ancient vicariance event(s), that led to the formation of 4 major ancestral populations: (1) Kenyan Highlands, (2) Albertine Rift, (3) northern Eastern Arc and (4) south-central Eastern Arc and/or the Malawi Rift. These isolates appear to have had a protracted history, with range expansions and long distance dispersal facilitating colonization of the isolated montane mountains of arid n. Kenya, young volcanoes adjacent to northern isolates of the Eastern Arc, and a southwards expansion into the central Albertine Rift from the Ruwenzori Mountains. This fragmentation of the ancestral range of the Starred Robin appears to have occurred in response to the successive aridification of Africa following the cooling of the Northern Hemisphere from about 2.8 million yr BP. With the retraction of the ice in the northern hemisphere, Africa entered a wetter phase in response to the greater influence of low-latitude insolation forcing of the west and east African monsoons in relation to the Earth's Orbital precession. Increased precipitation may have provided the impetus for the more recently observed secondary contact between populations in the northern and south-central Eastern Arc, and between the Albertine Rift and Eastern Arc.

#### 049 Hackett, Bates, Isler & Isler

Examining the correspondence between molecules and vocalizations a comparison of data for two Thamnophilid antbirds, *Myrmotherula axillaris* and *Hypocnemis cantator*. SHANNON J. HACKETT, JOHN M. BATES, *Zool. Dept. Field Mus., Chicago, IL*, M. MORTON ISLER and PHYLLIS ISLER, *Div. Birds, Smithsonian Inst., Washington, DC*.

We examine the relationship between vocal characters and molecular characters for 2 broadly distributed Amazonian antbirds, the White-flanked Antwren (*Myrmotherula axillaris*) and the Warbling Antbird (*Hypocnemis cantator*). Both have recognized morphologic variation across their distributions and both have structure supported by the molecular and vocal data. We discuss the implications for taxonomy, evolution, and conservation that result from these data. Taken together, they help provide a more detailed picture of evolutionary patterns in the Neotropics.

#### 050 Reddy

Identifying areas of endemism for montane southern Asia. SUSHMA REDDY, *Dept. Ornith., Am. Mus. Nat. Hist., New York, NY*.

Areas of endemism, defined by congruent distributions of 2 or more taxa, are essential for biogeographic studies regarding the history and relationships of these biotas. Southern Asia is a large and highly diverse region with most of its endemic avian fauna concentrated in the montane areas. However, this region has no explicit delineation of areas of endemism that are meaningful for birds. Here, ranges of endemic avian taxa were used to analyze patterns of distributions and to delimit areas of endemism. First, point locality data, collected from museum specimens of 12 passerine genera endemic to southern Asia, were used to predict species ranges. Two different grouping methods, Parsimony Analysis of Endemicity (PAE; Morrone 1994, *Syst. Biol.* 43: 438-441; Linder 2001, *Syst. Biol.* 50: 892-912) and Optimality Criterion for Endemicity (NDM; Szumik et al. 2002, *Syst. Biol.* 51: 806-816), were used to optimize the congruence of species distributions to select areas of endemism. Both analyses resulted in similar sets of areas of endemism for this region. There are roughly 17 areas of endemism for montane southern Asia. Although some of the boundaries of these areas correspond to previously suggested biotic delineations, the extent of the areas is notably different. Preliminary area-relationships incorporating phylogenetic information of endemic genera are also discussed.

#### 051 Barker

Phylogeny of Passerida (Passeriformes: Oscines). KEITH BARKER, *Bell Mus., Univ. Minnesota, St. Paul, MN*.

<no abstract>

#### 052 Rising & Zink

Molecular systematics of Savannah Sparrows (*Passerculus sandwichensis*). JAMES D. RISING, *Dept. Zool., Univ. Toronto, Toronto, ON*, and ROBERT M. ZINK, *Bell Mus., Univ. Minnesota, St. Paul, MN*.

The Savannah Sparrow is widely distributed in North America and shows considerable morphological geographic variation. A preliminary mitochondrial DNA (mtDNA) restriction site study determined that the large-billed sparrows from saltmarshes in nw. Mexico differed considerably from 'typical' sparrows. To test this distinction, and to search for phylogeographic structure across the Mexican range, we sequenced parts of 3 mtDNA genes, ND2, ND3, and the control region, for 1450 bp of bird taken from several localities, including 5 from Baja California ('Belding's' Sparrows) and 1 from Sonora (large-billed). Sequence data resolved 48 haplotypes. The haplotype tree shows 2 broad groupings, (1) Belding's and large billed sparrows from Mexico, and (2) typical birds from other parts of the species' range. The distinction between Mexican birds and those from other populations is reflected in the  $F_{ST}$  value of 0.53 (0.47 is within populations). There is no evidence of structuring in the non-saltmarsh birds, even though samples came from Alaska, California, and Ontario. Similarly, there is no phylogeographic structure among the Mexican samples. Unexpectedly, the highest nucleotide diversity came from Ontario and Alaska, suggesting that this recently deglaciated region received immigrants from several directions, as was suggested for the Song Sparrow. Unlike results from many other species, there is not evidence from mismatch distributions for population expansion, suggesting the ice age habitats were extensive for

Savannah Sparrows.

**053 Hackett, Braun, Braun, Harshman, Kimball, Moore, Sheldon, Steadman, Bowie, Chesser, Chojnowski, Christidis, Huddleston, Krosby, Marks, Miglia, Page & Yuri**

Early Bird: a collaborative project to resolve the deep nodes of avian phylogeny. SHANNON HACKETT, *Field Mus., Chicago, IL*, EDWARD BRAUN, *Univ. Florida, Gainesville, FL*, MICHAEL BRAUN, JOHN HARSHMAN, *Natl. Mus. Nat. Hist., Washington, DC*, REBECCA KIMBALL, *Univ. Florida, Gainesville*, WILLIAM MOORE, *Wayne State Univ., Detroit, MI*, FRED SHELDON, *Louisiana State Univ., Baton Rouge, LA*, DAVID STEADMAN, *Univ. Florida, Gainesville*, RAURI BOWIE, *Field Mus.*, R. TERRY CHESSER, *Australian Natl. Wildl. Coll., CSIRO, Canberra, Australia*, JENA CHOJNOWSKI, *Univ. Florida, Gainesville*, LES CHRISTIDIS, *Mus. Victoria, Melbourne, Australia*, CHRIS HUDDLESTON, MEADE KROSBY, *Natl. Mus. Nat. Hist., Washington*, BEN MARKS, *Louisiana State Univ., Baton Rouge*, KATHLEEN MIGLIA, *Wayne State Univ., Detroit*, RODERIC PAGE, *Univ. Glasgow, Glasgow, UK*, and TAMAKI YURI, *Natl. Mus. Nat. Hist., Washington*.

Early Bird is a large-scale, cooperative effort among 5 institutions in the U.S., 1 in Scotland and 2 in Australia to determine the evolutionary relationships among all major groups of birds. The project will make these relationships known to the research community and the public, and make it possible to use these relationships as a comparative framework with which to organize and understand the vast amount of information already available on avian ecology, evolution, physiology, and behavior. The project will generate large amounts of DNA sequence data for all major avian lineages from a series of carefully selected genes. These data will be integrated with existing and new morphological and fossil data to bring all relevant evidence to bear on the problem. Extensive analysis of the evidence will be conducted with the rapidly expanding suite of computational tools available for the inference of relationships, divergence times and evolutionary patterns. In this presentation, we will introduce the Early Bird project, discuss its relationship with other Tree of Life projects, and discuss preliminary results based on a limited broad taxon sampling of birds using nuclear markers.

**054 Koederitz, Weckstein & Lane**

\* Barriers to gene flow and high divergence within the Black-spotted Barbet (*Capito niger*) species complex. JESSICA L. KOEDERITZ, *Dept. Biol., Univ. Wisconsin-Milwaukee, Milwaukee, WI*, JASON D. WECKSTEIN, *Dept. Biol. Sci. and Mus. Nat. Sci., Louisiana State Univ., Baton Rouge, LA*, and DANIEL F. LANE, *Mus. Nat. Sci., Louisiana State Univ.*

Studies of Amazonian birds indicate that patterns of biogeography and genetic variation in the Amazon are complex and diverse. However, all studies published to date have been conducted on suboscine passerines. We present one of the first assessments of genetic variation in an Amazonian non-passerine species complex, the Black-spotted Barbet. Our results are consistent with Haffer's (1997, *Ornith. Monogr.* 48: 281-305) classification of 3 valid species within this complex. Within 1 species, *Capito auratus*, we find a relatively deep mtDNA split in the phylogeny with reciprocally monophyletic groups separated geographically by the Amazon and Ucayali rivers. These rivers appear to serve as a barrier to mitochondrial gene flow between populations within these clades. Levels of genetic differentiation within *C. auratus* are relatively high, similar to suboscine passerines, but apparent barriers to gene flow differ for each taxonomic group. Several *C. auratus* subspecies are paraphyletic or polyphyletic. This paraphyly and polyphyly is probably the result of using carotenoid throat coloration as a taxonomic character, which is potentially problematic, because throat coloration does not appear to be phylogenetically constrained in *C. auratus*.

**055 Groom & Grubb**

\* Dynamics of habitat colonization by permanent-resident birds in a fragmented landscape: a manipulative study. JEREMIAH D. GROOM and THOMAS C. GRUBB, *Dept. Evol., Ecol. & Organ Biol., Ohio State Univ., Columbus, OH*.

Habitat features that influence the rates of inter-patch movements and colonization may determine

the likelihood of species to persist in fragmented landscapes. We simulated patch extinction by removing Carolina Chickadees from woodland fragments in an agricultural landscape of Ohio. We then monitored the woodlands to determine their date(s) of reoccupation, and subsequent usage by the birds. Over the course of the project, all woodlots were eventually reoccupied, regardless of their size or degree of isolation. Woodlots connected to other woodland by habitat corridors were colonized sooner than were unconnected sites. Birds reoccupied woodlots throughout the winter, but usually during periods of relatively benign wind chill. Chickadees were more likely to remain to breed in larger woodlots. Individual chickadees were more often temporarily absent from smaller woodlots, suggesting they continued to explore for better habitat. Results from this experiment indicate that habitat connectivity affects the tendency of a species to move through a fragmented landscape. Habitat corridors may be important management tools for maintaining movement between patches for threatened or endangered species.

## **056 Calvert & Gauthier**

\* Heterogeneity of Greater Snow Goose harvest and management implications. ANNA M. CALVERT and GILLES GAUTHIER, *Dept. Biol., Univ. Laval, Québec City, QC.*

Sport harvest manipulation is often used as a management tool when a population is considered threatened or overly abundant. Long-term monitoring and marking of the rapidly growing population of Greater Snow Geese (*Chen caerulescens atlantica*) offered an opportunity to examine the impact on harvest of changes in the exploitation regime for this species. Analyses were conducted using band-recovery and harvest survey data from 1970 - 2001, a period characterized by a decline in harvest rates, a redistribution of geese on their staging and wintering grounds, and the implementation of a spring conservation hunt to stop the population growth. Harvest distribution and band-recovery rates were assessed to determine (1) how spatial and temporal harvest distribution may have been affected by changes in hunting pressure, and (2) whether the expansion of staging and wintering grounds was associated with changes in harvest level. We detected a gradual shift in geographic distribution of the harvest in Québec, but an abrupt northward shift in the U.S. harvest distribution in the mid-1980s, possibly due to "short-stopping". This latter effect may be the leading cause of the sudden decline in harvest rate in the mid-1980s that fuelled the most recent population increase, and therefore we suggest that management actions should be focused on increasing harvest in northern Atlantic Flyway states to control further population growth.

## **057 Ross & Smith**

The Twenty-first Century role of zoos in avian conservation. MEGAN R. ROSS, *Lincoln Park Zoo, Chicago, IL*, and KIM SMITH, *Milwaukee Co. Zoo, Milwaukee, WI.*

A common misconception of zoos is that their roles are restricted to venues of entertainment and repositories of exotic species. Recent advances in zoo philosophy have placed greater emphasis on conservation, education and research. The American Zoo and Aquarium Association Avian Scientific Advisory Group (ASAG) was created to provide technical expertise on ornithological issues to not only zoos but related organizations as well. This talk will demonstrate some of the conservation-oriented projects that have been developed and the role that ASAG plays in conservation can be a resource to the ornithological community. Research and conservation projects that groups within ASAG have instituted are: California Condor (*Gymnogyps californianus*) restoration, Guam Rail (*Rallus owstoni*) recovery and support of the USFWS Piping Plover (*Charadrius melodus*) recovery program. All of the programs involved multiple zoos working collaboratively to further the goals of an approved recovery program. Cooperation between related organizations and zoos resulted to make these programs viable and research on small population management has developed. Through these types of collaborative projects zoological institutions are able to play a significant role in conservation of endangered and threatened species. Future cooperation between the zoo world and related groups is essential to the conservation and recovery of avian species in peril. The Avian Scientific Advisory Group can offer considerable expertise and assistance to the academic community in the pursuit of these goals.

## **058 Schlossberg**

Conservation status of the Gray Vireo on the southern Colorado Plateau. SCOTT R. SCHLOSSBERG, *Prog. Ecol. Evol. Biol, Univ. Illinois, Champaign, IL.*

The Gray Vireo is a little-studied songbird with small breeding and wintering ranges. Because of uncertainty about vireo populations, conservationists are concerned about the future of this species. The goal of this study was to provide new data on the abundance and habitat preferences of the Gray Vireo. I then used those data in a GIS model to estimate the vireo's regional population in the central part of its range in n. Arizona and s. Utah. In 2001, I chose 31 transects in pinyon-juniper woodlands in n. Arizona and s. Utah, and on each transect I collected data on vireo abundance and characteristics of the vegetation. The estimated density of vireos was 6.4 birds/km<sup>2</sup>. Vireo density increased with the proportion of trees that were junipers and with the density of shrubs. Regionally, vireos increased in density from southeast to northwest and with decreasing elevation. Based on these relationships, I estimated the Gray Vireo population in the 8.8-million ha region around my study sites to be 186,000 birds (95% confidence interval: 137,000 to 245,000). Given their large population size and low habitat specificity, vireo populations in n. Arizona and s. Utah appear to be secure, at least for the short-term. Additional data on vireo demography, however, are needed to ensure the long-term conservation of this species.

### **059 Fraser, Capuano & Stutchbury**

Forest fragmentation and avian dispersal of a gap-specialist, the red elderberry. GAIL S. FRASER, *Texas Inst. Oceanography, Texas A&M, Galveston, TX*, BIANCA CAPUANO and BRIDGET J. M. STUTCHBURY, *Dept. Biol., York Univ., Toronto ON.*

In the temperate zone, few plants produce fruit during the avian breeding season. This study examines how the movements of a frugivorous bird, the Scarlet Tanager, could impact seed dispersal of an early-fruiting plant, the red elderberry. We used radiotelemetry to determine if (1) defense of breeding territories by tanagers in early summer could limit the dispersal distance of elderberry seeds and (2) whether forest fragmentation may be detrimental to early-fruiting plants because frugivores like tanagers are restricted in their movements to a single fragment. We found that 60% of visits to fruiting elderberry were made by tanagers. During the fruiting period male tanagers shifted their home range and spent more time near elderberry bushes. Total time off-territory averaged only 5% and males moved an average of only 115 m during forays within large forests. Forest fragmentation did not restrict the movements of tanagers in small isolated fragments. 6 of 12 fragment males left their fragment during the fruiting period and spent 12.7% of their time off the fragment. Nevertheless, forest fragmentation may have a negative effect on red elderberry via a reduction in the number of frugivores that occupy the fragment. Red elderberry occurred in only 22% of small fragments, suggesting that this gap-specialist may itself be area-sensitive.

### **060 Vos, Rebic & Sample**

Distribution and productivity of grassland birds on Fort McCoy military base. SUSAN M. VOS, *Dept. Wildl. Ecol, Univ. Wisconsin, Madison, WI*; CHRISTINE A. RIBIC, *USGS Wisconsin Coop. Wildl. Res. Unit, Dept. Wildl. Ecol., Madison, WI*; and DAVID W. SAMPLE, *Wisconsin Dept. Nat. Res., Monona, WI.*

Fort McCoy in Wisconsin is one of the top ten priority landscapes for grassland bird management due to the presence of large blocks of permanent grassland habitat. We determined the distribution of the grassland bird community using fixed-radius point counts. Productivity was determined by tracking the fate of nests. We collected data May - Jul 2000 - 2002. 11 bird species documented are considered Wisconsin grassland bird species of management concern. The most abundant grassland bird species were Grasshopper Sparrow and Vesper Sparrow. Grasshopper Sparrows were consistently documented in the large sites. The major source of nest failure was predation. Abandonment, military disturbance, and weather events were minor causes of nest failure; cowbird parasitism was minimal. Using a model framework to evaluate the Fort as a potential source or sink, the Fort appears to be a potential source for Grasshopper Sparrow and Dickcissel but a potential sink for Field Sparrow and Vesper Sparrow. Reductions in nest predation of 30% would be needed to change the Fort into a potential source for Field Sparrow and Vesper Sparrow.

### **061 Stratford, Robinson & Chaney**

Avian species richness across a gradient of urbanization in the southeastern United States. JEFFREY A. STRATFORD, W. DOUGLAS ROBINSON and PHILIP CHANEY, *Center Forest Sustain., Auburn Univ., Auburn, AL and Dept. Fish. & Wildl., Oregon State Univ., Corvallis, OR.*

The spread of human cities into rural areas modifies the distribution and abundance of major vegetation groups. This shift in habitat availability modifies both the local and landscape-level characteristics of avian communities. In 2002, we investigated how Neotropical migrant and permanent resident species richness varied along a gradient from an urban center, Columbus, GA, north into rural areas. Breeding Bird Survey-style point counts ( $n = 155$ ) were used to enumerate avian species richness. We used Landsat 7 imagery (30 m resolution) and FRAGSTATS to characterize habitat composition at local, territory and landscape spatial scales (radii = 100, 200, 1000 m, respectively) and habitat configuration at landscape scales around each point and evaluated how habitat and species richness changed across the gradient. Significant effects of habitat composition on species richness emerged at all scales but the direction of the effects were often conflicting between migrants and residents. Moreover, changing the spatial scale changed the importance of variables and none of the measures of habitat composition were consistent across all scales. This occurred for both groups of birds. None of the measures of habitat configuration, including indices of fragmentation and shape, were significant in explaining additional variation in species richness for migrants or residents.

### **062 Martin, Peterjohn, Koneff & Sauer**

Increasing access to North American bird monitoring data through the NBII. ELIZABETH MARTIN, *U.S. Geological Survey, Gainesville, FL*; BRUCE G. PETERJOHN, *USGS Patuxent Wildl. Res. Center, Laurel, MD*; MARK D. KONEFF, *U.S. Fish & Wildl. Ser., Laurel, MD*; and JOHN R. SAUER, *USGS Patuxent Wildl. Res. Center, Laurel, MD.*

Bird population and habitat monitoring data across North America have been collected intensively by government and non-government organizations over the past 50 yr. Although there is a tremendous amount of data, it is often dispersed and inaccessible to most natural resource planners and decision-makers. Access to bird data and information has been identified by the bird conservation community as a cornerstone for effective bird conservation planning. To address this need, the Bird Conservation Node of the National Biological Information Infrastructure (NBII) is working with partners to promote access to bird monitoring data and development of tools and standards for data sharing. Since 2001, the NBII Bird Conservation Node has supported activities that facilitate delivery of bird monitoring data over the Internet. As a result, users can now access on-line at <http://birdcon.nbii.gov> some of the major bird monitoring datasets used in harvest management and bird population and habitat conservation in North America. The NBII Bird Conservation Node is also working with partners to support development of tools for data management, data visualization, and data analysis. These efforts, together with development of agreed upon data exchange standards, will facilitate analysis and integration of bird monitoring data, thereby providing a baseline for planning of bird conservation activities.

### **063 Dearborn, Anders, Schreiber, Adams & Mueller**

Movements and genetic differentiation between populations of a wide-ranging pelagic seabird. DONALD C. DEARBORN, *Dept. Biol. and Progr. Anim. Behav., Bucknell Univ, Lewisburg, PA*; ANGELA D. ANDERS, *Prog. Ecol., Pennsylvania State Univ., University Park, PA*; E. A. SCHREIBER, *Natl. Mus. Nat. Hist., Smithsonian Inst., Washington, DC*; RACHELLE M. M. ADAMS and ULRICH G. MUELLER, *Sec. Integr. Biol., Univ. Texas, Austin, TX.*

We used AFLP markers and mark-resight data to assess movements and gene flow between Central Pacific breeding colonies of Great Frigatebirds (*Fregata minor*). Of 715 adults marked on Tern Island and Johnston Atoll, 21.3% were resighted at other frigatebird colonies at least 582 km away. Mark-resight data indicated regular movement of males and females between Tern Island and Johnston Atoll (873 km apart), and less frequent movements to other islands; no birds marked on Tern or Johnston were seen on Christmas Island. Despite the regular occurrence of inter-island movements, Bayesian analyses of AFLP data showed significant genetic differentiation between Tern Island and Johnston Atoll, and stronger differentiation between these 2 islands and the more distant Christmas Island. The AFLP

profiles of 3 birds breeding on Tern Island fell within the cluster of Christmas Island birds, both in a non-metric multidimensional scaling analysis and in a new population assignment test for AFLP data; these results suggest dispersal events from Christmas Island to Tern Island. Genetic structure among breeding colonies apparently persists despite significant inter-island movements, suggesting limits to the effectiveness of migration as a homogenizing force in this broadly distributed and extremely mobile species.

#### **064 Tarof, Ratcliffe & Boag**

Least Flycatcher breeding biology: the big story about a little bird. SCOTT A. TAROF, *Dept. Biol. Sci., Univ. Wisconsin-Milwaukee, Milwaukee, WI*, LAURENE M. RATCLIFFE and PETER T. BOAG, *Dept. Biol., Queen's Univ., Kingston, ON*.

Least Flycatchers are among the most tightly clustered socially monogamous, all-purpose territorial birds. Clusters resemble males displaying at leks. Until recently, knowledge of their breeding biology has been limited. From 1997 to 2001, we studied Least Flycatchers breeding in e. Ontario. We report data on (1) spatio-temporal dynamics of cluster formation, (2) mating behavior, and (3) summarize findings on why individuals aggregate. Hypotheses include clustering in response to resources (clusters should occur in areas with particular habitat characteristics), nest predation risk (predation should vary with territory position or cluster size), and/or to improve mating success (central males should have the highest mating success). Most males formed clusters of 2-30 territories and obtained a mate; solitary males generally remained unpaired. Territory settlement appeared to occur in groups. Song may be important in attracting males to clusters. Within pair ( $2.0 \pm 0.5$  events/hr) and extra-pair mating effort ( $1.8 \pm 0.3$  events/hr) were similar ( $n = 51$  pairs). Both sexes solicited extra-pair copulations (EPCs); 23% of forays were by females. Microsatellite paternity profiling showed that EPCs resulted in 62% (13/21) of nests containing extra-pair young comprising 39% (30/78) of offspring. Our results for why individuals cluster were consistent with the idea that clustering improves mating success, although clustering may also reduce nest predation.

#### **065 Sandercock, Székely & Kosztolányi**

The effects of sex and age on the survival of Kentish Plovers breeding in southern Turkey. BRETT K. SANDERCOCK, *Div. Biol., Kansas State Univ., Manhattan, KS*, TAMÁS SZÉKELY, *Dept. Biol. & Biochem., Univ. Bath, Bath, UK*, and ANDRÁS KOSZTOLÁNYI, *Dept. Evol. Zool. & Human Biol., Univ. Debrecen, Hungary*.

Robust estimates of survival are essential for understanding the population dynamics of shorebirds and other long-lived vertebrates. We use resighting data and mark-recapture statistics to estimate apparent survival for a breeding population of Kentish Plovers (*Charadrius alexandrinus alexandrinus*) in s. Turkey. Survival estimates for Kentish and Snowy Plovers (*C. a. nivosus*) are of interest because both subspecies are of conservation concern, and because survival rates may determine rates of ambisexual mate desertion in this species. A total of 2077 plovers were uniquely marked over a 5-yr period. Return rates of young were low (4.4%) and most philopatric young were recaptured as yearlings (69.2%). Low return rates of young may be attributed to post-hatching mortality if annual survival is ranked: chicks < fledglings = adults. We could not separate mortality from dispersal because apparent survival rates were ranked: chicks ( $\phi = 0.084$ ) < fledglings ( $\phi = 0.145$ ) < adults after first capture ( $\phi = 0.590$ ) < returning adults ( $\phi = 0.636$ ). Apparent survival rates of adult plovers were 0.60 - 0.64, and males had higher resighting rates than females (0.84 vs. 0.74). A lack of a sex difference in survival is puzzling and difficult to reconcile with a male-biased sex ratio among adults. Survival rates are lower among Kentish Plovers in Eurasia than Snowy Plovers in North America. Our estimates are consistent with return rates reported for other small-bodied *Charadrius* plovers.

#### **066 Kesler & Haig**

Cooperative territoriality in Pohnpei Micronesian Kingfishers. DYLAN C. KESLER and SUSAN M. HAIG, *USGS Forest & Rangeland Ecosyst. Sci. Center, Corvallis, OR*; and *Dept. Fish & Wildl., Oregon State Univ, Corvallis, OR*.

Reproductive success is enhanced by the presence of non-breeding helper individuals in many cooperatively breeding species. The increased success is often attributed to direct helper assistance with the rearing of young, but the mechanisms by which helpers benefit reproduction are not altogether clear. Cooperative breeders are frequently territorial and group members commonly assist with territorial defenses, which may result in larger territories and the availability of more abundant or higher quality resources. To test whether the presence of helpers enhances territory quality, we compared the resources available to members of cooperative groups and territorial pairs of Pohnpei Micronesian Kingfishers (*Halcyon cinnamomina reichenbachii*). Radio telemetry was used to assess territoriality and movements of 56 adults and 15 fledglings during 19 months of fieldwork. Remote sensing and transect surveys were used to evaluate vegetation cover types, nesting resources, and foraging habitat within each territory. The home ranges of adults on pair-held territories were 26% smaller and contained fewer resources than those on cooperative territories. While survival of fledglings was higher on cooperative territories, no difference was detected in resources used by young birds on cooperative and non-cooperative territories. Results therefore suggest that cooperative territoriality provides enhanced resource availability in Micronesian Kingfishers.

### **067 Huyvaert, Westbrook, Anderson & Parker**

Responses to uncertain paternity by Waved Albatrosses. KATHRYN P. HUYVAERT, *Dept. Biol., Univ. Missouri St. Louis, St. Louis, MO*, MARK A. WESTBROCK, DAVID J. ANDERSON, *Dept. Biol., Wake Forest Univ., Winston-Salem, NC*, and PATRICIA G. PARKER, *Dept. Biol., Univ. Missouri St. Louis*.

The "paternity uncertainty" hypothesis predicts that males will reduce care in response to possible loss of paternity from female EPCs. DNA fingerprinting of the Waved Albatross (*Phoebastria irrorata*), a long-lived, socially monogamous seabird with extensive biparental care, shows that 18% of young studied in 2002 were sired via extra-pair fertilization (EPF) and 75% of observed copulations by breeders were EPCs. Here we examine aspects of the "paternity uncertainty" hypothesis, asking whether male albatrosses respond to their mate's EPCs by increasing within-pair copulations (WPCs) and to what extent male care is affected by female EPCs and EPFs. WPC frequency increased with female EPC frequency ( $r = 0.30$ ,  $P < 0.01$ ). We did not find a similar relationship for female EPC frequency and whether a male was cuckolded or not ( $-2LL = 49.9$ ,  $\chi^2 = 0.06$ ,  $P = 0.81$ ). Further, male feeding frequency did not decrease with increased female EPCs ( $r = 0.19$ ,  $P = 0.25$ ) nor did cuckolded males reduce feeding frequency compared to males caring for within-pair young ( $t = 0.30$ ,  $P = 0.77$ ). We also explore food delivery and chick survival for both classes of males and discuss these results in the contexts of male assessment of and responses to cuckoldry.

### **068 Anderson, Humphries, Arevalo, Fischer & Townsend**

Contributions of marginal offspring to reproductive success of obligately siblicidal Nazca Boobies: a multiple hypothesis approach. DAVID J. ANDERSON, COURTNEY A. HUMPHRIES, VICTOR D. AREVALO, KAREN FISCHER and HOWARD TOWNSEND, *Dept. Biol., Wake Forest Univ., Winston-Salem, NC*.

Obligately siblicidal birds may produce 2-egg clutches, but rarely fledge 2 offspring, due to siblicidal attacks of the first-hatched "core" offspring on the second-hatched "marginal" chick. In a minority of such species, including Nazca Boobies (*Sula granti*), the marginal egg has been shown to provide insurance value against failure of the first egg or hatchling. We extended this approach by evaluating other hypothesized benefits of marginal offspring, finding a small benefit associated with adoption into nearby nests and possibly a benefit predicted by the progeny choice model. We found no evidence of a resource tracking benefit; the absolute nature of this brood reduction makes Nazca Boobies unusual even among obligately siblicidal taxa. The insurance value of marginal offspring emerged as the principal benefit associated with the 2-egg clutch, far exceeding those of adoption and progeny choice. Under the insurance egg hypothesis (IEH), costs associated with the 2-egg clutch should not exceed benefits. We found that marginal chicks had no detectable effects on the growth, probability of fledging, and probability of surviving to adulthood of their core siblings. Finally, marginal chicks that replaced failed core chicks did not differ from surviving core chicks in growth, probability of fledging, and probability of surviving to adulthood, supporting another key assumption of the IEH.

## 069 Schubert & Ratcliffe

Implications of social rank history for lifetime reproductive success in Black-capped Chickadees. KRISTIN A. SCHUBERT and LAURENE M. RATCLIFFE, *Dept. Biol., Queen's Univ., Kingston, ON.*

Dominance-structured social systems in many animals have fitness implications for their members. In particular, high-ranked individuals have been shown to experience a reproductive advantage over their low-ranked counterparts. However, a limited number of studies have investigated the relationship between individual rank history and lifetime reproductive success (LRS). We explored the phenomenon of rank acquisition in the Black-capped chickadee using long-term data from 1994 - 2002. The best predictor of male LRS was the lifetime sum of ranks held, a measure of rank history which is influenced by survivorship. We found rank in a given year to be strongly correlated with age but no measure of body size. Between-year rank relationships were associated with social factors. Chickadees exhibit flock-fidelity between years. However, males advancing in rank did so when their superiors died, or by changing their flock membership. 86% of males mated with females from their winter flocks, but high-ranked males were significantly more likely to pair with flock-mates than were low-ranked males. Our analysis also confirmed that rank is correlated with measures of reproductive success, including fledging success and male realized reproductive success. We found no a relationship between reproductive success and the rate of acquisition of advanced rank. We demonstrate that rank history, which appears to represent a salient but complex relationship between age, rank in a given year, and survivorship, is a significant predictor of LRS.

## 070 Murphy

Functional significance of elaborate plumage characters when expressed in both sexes: a case study of the Turquoise-browed Motmot. TROY G. MURPHY, *Dept. Neurobiol. & Behav., Cornell Univ., Ithaca, NY.*

Both males and females of the Turquoise-browed Motmot (*Eumomota superciliosa*) have a number of equally exaggerated plumage characters. The most notable of these is an elongate tail that terminates in large oval-shaped rackets that extends far below the body of the bird. The functional significance of the elaborate racket-tipped tail of this species was investigated. My research addresses whether the elaborate racket-tipped tail functions in a naturally selected context, or if it functions in a sexually selected context as a signal utilized in competition for mates. Field studies and manipulative experiments were performed to test the hypotheses that the ricketed tail functions as an intersexual mating signal or intrasexual status signal. Results to address these hypotheses will be presented and discussed.

## 071 Pejchar

Convergent evolution of sap feeding behavior and tree selection in the endangered 'Akiapola'au. LIBA PEJCHAR, *Dept. Environ. Stud., Univ. California, Santa Cruz, CA.*

The 'Akiapola'au (*Hemignathus munroi*), an endangered Hawaiian honeycreeper, drills 3 - 5 mm deep holes in particular ohia trees (*Metrosideros polymorpha*) and drinks the sap that emerges, a remarkable example of convergent evolution in sap feeding behavior with mainland woodpeckers and Australian sugar-glidens. There has been no research on how this species selects sap trees ('Aki trees') and what advantages they confer. I marked the location, and collected sap samples and microhabitat data from 101 Aki trees and 73 randomly selected controls in Hakalau Forest National Wildlife Refuge, Hawaii. Aki trees are rare (2/ha), spatially clustered, and defended by 'Akiapola'au. Sap flow volume and speed were substantially greater in Aki trees than in controls. Aki trees also are larger, have thinner bark, and are more likely to be located on convex, east-facing slopes where more light is available. These results support the hypothesis that Aki trees are selected based on high sap flow and a suite of unique microhabitat and tree characteristics. Sap may be an important energy source in times of low insect availability and a potent alternative to nectar for the Akiapola'au. Aki trees are both a fascinating example of niche specialization and another factor that should be considered when conserving or restoring quality habitat for this endangered species.

**072 vacant**

**073 Peters & Omland**

\* Population genetic structure and range expansion in the widespread Gadwall. JEFFREY L. PETERS and KEVIN E. OMLAND, *Dept. Biol. Sci., Univ. Maryland Baltimore Co., Baltimore, MD.*

The Gadwall, like many species of birds, has a distribution that extends across North America, Europe, and Asia. One possible explanation for this Holarctic distribution is that Gadwall recently expanded their range to occupy both hemispheres. In this study, I address 2 primary questions: (1) is gene flow restricted between North American and Eurasian Gadwall, and (2) is there evidence that Gadwall recently colonized one hemisphere from the other? I examined 658 bp of mitochondrial DNA (mtDNA) control region to address these questions. Results indicate that North American and Eurasian Gadwall are very closely related, and that several mtDNA haplotypes are shared between hemispheres. However, significant population genetic structure does exist between these populations, indicating that gene flow is restricted. In addition, North American haplotypes seem to be nested within Eurasian haplotypes, suggesting that the North American population of Gadwall is derived from the Eurasian population. Additional evidence for this recent colonization event is that the North American population has low genetic variation in mtDNA, and the observed mismatch distribution closely matches a model of population expansion. In contrast, the Eurasian population has higher genetic variation, and a bimodal mismatch distribution that is more consistent with a long-term stable population. Preliminary data from a nuclear intron, CHD, also support a recent colonization of North America from Eurasia.

**074 Bronson, Grubb, Sattler & Braun**

Reproductive success across an avian hybrid zone: implications for characterization of hybrid zones based on genetic studies. C. L. BRONSON, T. C. GRUBB, Jr, *Dept. Evol., Ecol. & Organ. Biol., Ohio State Univ., Columbus, OH*, G. D. SATTLER, *Dept. Biol. & Chem., Liberty Univ., Lynchburg, VA*, and M. J. BRAUN, *Lab. Analyt. Biol. and Dept. Syst. Biol., Smithsonian Inst., Suitland, MD.*

Black-capped (BC) and Carolina (CA) Chickadees hybridize in an east-west band from New Jersey to Kansas. Within the past century, the Ohio portion of this hybrid zone and the CA range to the south have been moving northward while the BC range has retracted. We characterized the genetic composition of an Ohio segment of the hybrid zone using 5 enzyme-probe combinations. Based on several reproductive variables (clutch size, number of nestlings, and reproductive success), we found a decrease in reproduction in the hybrid zone, a decrease significantly related to the genetic composition of the male. While the decrease in reproduction was also significantly related to the compatibility index of the breeding pair (i. e., the probability of producing homozygous offspring) it was not significantly related to the genetic composition of the female. As the zone of reduced reproductive success was considerably narrower than the zone of introgression, our results signal caution about solely using the distributions of genetic markers to characterize the functional width of a hybrid zone.

**075 Schmaltz & Quinn**

Relatedness and dispersal patterns in the communally breeding Smooth-billed Ani. GREGORY SCHMALTZ and JAMES S. QUINN, *Biol. Dept., McMaster Univ., Hamilton, ON.*

Smooth-billed Anis are communal joint-nesters members of the Cuculidae. Anis live in groups of up to 17 adults in our 2 field sites in sw. Puerto Rico. Group females typically lay eggs in the same nest and compete for access to the incubated clutch of eggs by burying each others' eggs under leaves and nesting material. Males or females may also decide to toss eggs out of the joint nest. Nonetheless, group members co-operate after the egg tossing/burial stage and share incubation, territory defense, and care of young, though not evenly. Here, we examine relatedness and patterns of dispersal using microsatellite analyses and field observations. Adult group members exhibit low levels of relatedness. In the majority of groups under study, adults were generally not related to each other. In 2 cases however, groups were made of highly related members. Overall, only about 25% of adult dyads were composed of relatives and most of this effect can be explained by the few highly related groups. These results suggest different patterns of dispersal where most birds disperse to join unrelated individuals while in a minority of groups

bird decide to remain with their relatives. Preliminary results also suggest that females tend to disperse to territories that are close to their natal group.

### **076 McDonald**

Two riddles of the lek: one space-time solution. DAVID B. McDONALD, *Dept. Zool., Univ. Wyoming, Laramie, WY.*

I propose alternative explanations for recent molecular results from lek mating systems. Riddle 1: Studies of Buff-breasted Sandpipers and Ruffs suggested that variance in paternity may be lower than supposed for leks ("lekking without a paradox"). Riddle 2: Kin clusters on leks of Black Grouse and White-bearded Manakins led to a suggested role for kin selection in lek evolution. Riddle 1 solution: Buffs and Ruffs lie at one end of a spectrum of variance in paternity -- females in those species have little time for acute mate choice and males have large testes (like high-EPP species). Tropical manakins, in contrast, have time for acute discrimination over long seasons and many years. Female Long-tailed Manakins engage in wide and accurate spatial assessment of males ("lekking with a pair o' jocks"). Grouse and manakins have small testes (like genetically monogamous species). Riddle 2 solution: Kin clusters may be simply a byproduct of high variance in paternity -- yearling males recruit to the edges of leks containing their sires ("lekking outside the box"). In Long-tailed Manakins, pairwise relatedness among males decreases with increasing difference in age. Maps of kin clusters in White-bearded Manakin leks support the hypothesis of marginal clusters of yearling kin. A range of variance in paternity, and the phenomenon of kin clusters in leks, are best understood in a larger context of variability of resources and events in space and time.

### **077 Eimes, Parker, Brown & Brown**

Extra-pair fertilizations and genetic similarity in the Mexican Jay. JOHN A. EIMES, PATTY PARKER, *Dept. Biol. Univ. Missouri-St. Louis, St. Louis, MO*, JERRY BROWN and ESTHER BROWN, *Dept. Biol. SUNY-Albany, NY.*

Extra-pair fertilizations (EPF) have been found in the majority of passerine species examined. In the Mexican Jay the EPF rate is higher than has been reported for any other bird species except for some species of fairy wrens. One possible explanation for this high EPF rate is selection against inbreeding. Studies, including one of this species, have shown that mating between close relatives negatively affects production and survival of offspring, possibly because of the expression of recessive, deleterious alleles. Such inbreeding depression would favor kin discrimination in mate choice. Two studies of birds have shown a correlation between genetic similarity of mates and their propensity to have EPFs. Using observational and molecular data from 10 field seasons studying the same population of Mexican Jays, we report the results of a study comparing genetic similarity of social mates and rate of EPF. Preliminary results show that DNA fingerprinting band-sharing values are higher, indicating closer genetic relatedness, in pairs that produced EPF young, than those that did not (Mann-Whitney  $U_{0.05(1)8,10} = 60$ , calculated  $U = 70$ ,  $0.0025 < P < 0.005$ ). New data will also compare the genetic similarity between EPF sires and their genetic mates with that of cuckolded males and their social mates.

### **078 Tarvin & Webster**

Female Splendid Fairy-Wrens choose genetically dissimilar males as extra-pair mates. KEITH A. TARVIN, *Dept. Biol., Oberlin Coll., Oberlin, OH*, and MICHAEL S. WEBSTER, *School Biol. Sci., Washington State Univ., Pullman, WA.*

Extra-pair mating in socially monogamous birds has garnered much attention, but few studies have directly assessed the benefits of extra-pair mate choice by females. Good genes hypotheses of sexual selection predict that females mate outside the social pair bond to increase the quality of their offspring, but little support for this idea has been produced. Even fewer studies have considered alternative explanations for extra-pair mating in birds. In a long-term study of extra-pair mating in Splendid Fairy-Wrens (*Malurus splendens*), we used microsatellite markers to determine paternity and to calculate heterozygosity and relatedness among individuals. Females were more likely to produce extra-pair young when relatedness between the female and her social mate was relatively high. Extra-pair sires tended to

be more distantly related to the female than the males they cuckolded, but were neither more blue, larger, nor in better condition than the female's social mate. Extra-pair young were characterized by higher heterozygosity than their within-pair nestmates. Together, these patterns suggest female Splendid Fairy-wrens select extra-pair mates with whom they are genetically compatible (i.e., less genetically similar). The resulting increase in offspring heterozygosity may reduce the deleterious effects of inbreeding, improve offspring vigor and immunocompetence, or both.

### **079 Haig, Draheim & Collazo**

Population structure and genetic diversity in Puerto Rican Parrots. SUSAN M. HAIG, HOPE DRAHEIM, *USGS For. & Rangeland Ecosys. Sci. Center, Corvallis OR*; and JAIME A. COLLAZO, *USGS North Carolina Coop. Wildl. Res. Unit, North Carolina State Univ., Raleigh, NC*.

Puerto Rican Parrots (*Amazona vittata*) were one of the first species listed under the U.S. Endangered Species Act in the 1970's. Since then the recovery program has struggled with population management for the captive and wild-caught birds. We used 7 microsatellite loci and 35 ISSR bands to identify individuals and their relatives as well as characterize genetic diversity in wild and captive birds. Of 175 individuals screened, 34 were offspring of wild parrots and 141 were offspring of parrots originating from the aviaries. We found high statistical power in individual identification for both microsatellites and ISSR's. However, in a comparison of molecular and pedigree data, both markers showed a high number of misplaced offspring within most bi-parental family groups. In general, the microsatellite data comparison results in more mismatches than ISSR data. Population genetic analyses were performed on microsatellite data indicated 1 loci had significant departure from Hardy-Weinberg expectations due to heterozygote deficits for all birds. When parrots were divided into wild and aviary offspring, aviary birds had additional heterozygote deficits and linkage disequilibrium events. In contrast, genetic differentiation between wild and aviary parrots indicated no significant difference between the 2 groups. Results indicate the importance of molecular markers in teasing apart relatedness in small populations and in planning population management strategies.

### **080 Lanyon**

Model clades: the next frontier in evolutionary biology? SCOTT M. LANYON, *Bell Mus. Nat. Hist. and Dept. Ecol., Evol. & Behav., Univ. Minnesota, Minneapolis, MN*.

The use of a "model species" approach has played a critical role in the maturation of a variety of fields in the biological sciences (e.g., Genetics, Developmental Biology, and Physiology). However, the same cannot be said of evolutionary biology and specifically the study of macroevolutionary patterns and processes. Instead, the analytical approach that has contributed most significantly to progress in the field of macroevolutionary biology in recent years is comparative phylogenetic analysis involving many species.

In this paper I will explore the possibility of integrating these 2 research paradigms through the identification of "model clades" as a means of opening new frontiers of investigation in evolutionary biology.

### **081 Bostwick**

A new musical instrument: Club-winged Manakin (*Machaeropterus deliciosus*) males "sing" with their unique clubbed feathers. KIMBERLY S. BOSTWICK, *Mus. Vert. and Dept. Ecol. & Evol. Biol., Cornell Univ., Ithaca, NY*.

Among over 9000 extant species of birds only 1 has managed to produce a sustained harmonic tone with its secondary feathers. This species, *Machaeropterus deliciosus*, was singled out by Darwin (1871, **Descent of man**) for its clubbed feathers as an example of how sexual selection for non-vocal sounds, or sonations, has caused morphological modification in birds. However, how these modified feathers produce sound has not been known. The recent development of high-speed video cameras that can be used in the field has allowed observation of the detailed kinematics used for sound production in *M. deliciosus*. I here present the astonishing results of high-speed video recordings, as well as morphological and acoustic analyses, to test numerous hypotheses of sound production mechanisms and to show: (1) the unique rattling kinematics of sound production used by male *M. deliciosus* to produce

sound, (2) the extreme speed of muscle contraction employed for sound production, and (3) the surprising modifications of wing morphology that has evolved to execute such sound production. New hypotheses of physical mechanisms underlying sound production are proposed. These results exemplify the ability of sexual selection to generate diversity, complexity, and an integrated functional-morphological system.

## 082 Scholes

Diversification of courtship display traits in the bird of paradise genus *Parotia*; examination of a sexually selected radiation. EDWIN SCHOLES III, *Div. Ornithol., Univ. Kansas Nat. Hist. Mus. & Biodiv. Res. Center, Lawrence, KS.*

Although birds are widely used in studies aimed at understanding the functional evolution of sexually selected traits, relatively few studies have examined display trait evolution within and among lineages of a clade and even fewer have done so with the explicit purpose of unraveling the processes of diversification in a sexually selected radiation: i.e., an evolutionary radiation characterized by the explosive diversification of secondary sexual traits among recently diverged lineages within a clade. The Australo-papuan birds of paradise (Paradisaeidae) are perhaps the most spectacular example of a sexually selected radiation because of the unusually high diversity of male courtship display traits within the family and because of the great disparity in display traits among closely related lineages. This study examines the bird of paradise radiation in a phylogenetic framework by examining patterns of diversification in courtship display traits within the bird of paradise genus *Parotia*. Details of courtship displays of all species in the genus are characterized using recently acquired video of wild birds in Papua New Guinea and from data available in the literature. An analysis of display trait diversification is discussed in the context of the genus *Parotia* as a unique window into the patterns and processes of diversification within the entire bird of paradise radiation.

## 083 Cheviron, Hackett & Capparella

\* Phylogeography of the Blue-crowned Manakin [*Pipra* (= *Lepidothrix*) *coronata*]: using intraspecific phylogeography to test historical hypotheses. ZACHARY A. CHEVIRON, *Dept. Biol. Sci., Illinois State Univ, Normal IL*, SHANNON J. HACKETT, *Field Mus., Chicago, IL*, and ANGELO P. CAPPARELLA, *Dept. Biol. Sci., Illinois State Univ.*

The Neotropical rainforests harbor the highest degree of avian diversity in the world, and the processes that have shaped this diverse avifauna have intrigued evolutionary biologists for over a century.

Several vicariant events have been hypothesized as important factors in the evolutionary history of Neotropical birds, but their relative importance remains poorly understood. In this study we examined mtDNA sequence variation within the Blue-crowned Manakin [*Pipra* (= *Lepidothrix*) *coronata*] in order to examine patterns and levels of genetic distinctiveness and to infer causal mechanisms for divergence among *P. coronata* lineages. From 65 individuals, a total of 1067bp of sequence data were collected from 3 mitochondrial gene (cytochrome b, ND2, and ND3) fragments. Phylogenetic relationships among *P. coronata* haplotypes were estimated using maximum parsimony, maximum likelihood and Bayesian analyses. All phylogenetic analyses support identical relationships among 6 haplotype clades and reveal a high degree of phylogeographic structure. Phylogeographic patterns were further examined using nested cladistic analysis and mismatch distributions. The combined results of traditional phylogeography, nested cladistic analysis, and mismatch distributions support 4 separate vicariant mechanisms (Andean Uplift, marine transgressions, isolation in forest refugia and riverine barriers) as well as non-vicariant processes, such as range expansion and dispersal, as important factors in the development of phylogeographic structure within the Blue-crowned Manakin. These data suggest that the premise of a single vicariant process being solely responsible for the diversification of Neotropical avian taxa is far too simplistic and highlight the importance of considering non-vicariant processes at the intra-specific level.

## 084 McGraw, Nogare, Nolan, Dobson & Jouventin

\* New plumage pigments in parrots and penguins. KEVIN J. MCGRAW, *Dept. Neurobiol. Behav., Cornell Univ., Ithaca, NY*; MARY NOGARE, *Snoqualmie, WA*, PAUL M. NOLAN, F. STEPHEN DOBSON, *Dept. Biol. Sci., Auburn Univ., Auburn, AL*; and PIERRE JOUVENTIN, *CNRS, France.*

The brilliant colors of bird feathers are generated by 2 primary mechanisms: the presence of pigments and the arrangement of feather tissues. Carotenoid and melanin pigments serve as the main feather pigments across avian orders, but these are by no means the only chemical colorants of plumage. Here, we describe 2 new classes of pigments in bird feathers. Biochemists have known for over a century that parrots use a novel set of pigments to acquire their rainbow of plumage colors, but their biochemical identity has remained elusive. We used high-performance liquid chromatography to characterize the polyenal lipochromes in red feathers from 20 parrot species representing each of the 3 psittaciform families. Red feathers from all species contained the same suite of polyenes, suggesting that this pigmentation system is quite conserved across psittaciforms. We also investigated the biochemical basis for yellow coloration in the breeding plumage of 3 penguin species and the downy plumage of 2 galliforms. Yellow feathers from these 5 species fluoresced strongly under UV light. Feather pigments were lipid-insoluble and instead were soluble in mild acids and bases. At this early stage of investigation, these pigments appear most similar to the yellow pterin compounds that color butterfly wings and the irises of certain birds (e.g. owls, starlings).

### **085 Maderson**

Feathers contain two types of keratin. PAUL F. MADERSON, *Biol. Dept., Brooklyn Coll. CUNY, NY.*

Most contemporary text accounts of feather form and replacement are based on Lucas & Stettenheim's (1972, **Avian anatomy**, USDA Handbook 362) analysis of the classical literature in their 1972 monograph. Unfortunately, they did not consider a seminal biophysical study of vertebrate keratins by Rudall (1947, **Biochem. Biophys. Acta** 1: 549-562). By ignoring [a] the presence of 2 types of keratin,  $\beta$ - (comprising rachis, vanes, and outer calamus) and  $\alpha$ - (comprising pulp caps) and [b] inter-taxic variability in the "superior umbilicus", while over-emphasizing the morphogenetic role of the so-called "epidermal collar" defined by the Chicago school in the 1930s, accounts of feather anatomy and replacement fail to explain how "pulp regression" facilitates the transformation of a curved, multi-layered sheet of keratinocytes wrapped around a dermal pulp into the planar form of components distal to the calamus. Although many specific aspects of feather histogenesis await elucidation, evaluating classical histological and more recent SEM descriptions in light of knowledge of keratinization processes in reptilian sauropsids permits a simplification of the problems associated with the emergence of form in these unique epidermal appendages. Lack of allusion to the presence of 2 different keratins and the tissues derived therefrom in modern feathers raises serious problems with the Prum/Brush model for feather evolution.

### **086 Bush**

\* Does melanin deter feather feeding ectoparasites? SARAH E. BUSH, *Dept. Biol., Univ. Utah, Salt Lake City, UT.*

Feather color has many well known adaptive functions such as thermoregulation, camouflage and mate attraction. Melanin, the pigment that makes feathers gray and black may have another adaptive function: ectoparasite defense. Melanin makes the feathers tougher. Tough feathers may be more difficult for feather feeding ectoparasites to digest. I explored the potential of melanin to deter ectoparasites in a model system: Rock Doves and their feather feeding lice *Columbicola columbae*. The amount of melanin in the plumage varies greatly among different Rock Dove morphs. Intraspecific variation in feather melanization makes Rock Doves ideal for this study. A survey of naturally occurring populations of *C. columbae* on melanin rich and melanin poor Rock Dove morphs does not support the hypothesis. Additionally, in vitro, studies show that a melanin rich diet does not affect louse fitness or the amount of feather consumed. Melanin does not deter feather lice in this system.

Numbering sequence of general papers skips 087 - 093

### **094 Marantz**

\* Within and among population variation in songs of the Buff-throated Woodcreeper (*Xiphorhynchus guttatus*: Dendrocolaptidae). CURTIS A. MARANTZ, *Biol. Dept., Univ. Massachusetts, Amherst, MA.*

Past work with tyrannid flycatchers has demonstrated that their songs are highly stereotyped, vary little geographically, and are not learned. Extrapolating these findings to roughly 1000 species in 9 families of suboscines, some authors have proposed elevating taxa to species primarily on the basis of discrete vocal differences. To better assess the viability of defining species-limits in suboscines based on vocal characters, I examined song variation in *Xiphorhynchus guttatus*, a widespread Neotropical woodcreeper. Analysis of songs recorded at sites in the Amazon Basin and the Brazilian Atlantic forest revealed that songs from the same individual may differ significantly in number of notes, but the structure of these notes does not vary within individuals. Among-population comparisons further revealed that note structure and song pattern remain remarkably consistent over vast regions of South America, but may differ strikingly on opposite sides of a geographic barrier. Overall, there are 3 discrete song-types within those taxa now recognized as *Xiphorhynchus guttatus*. Comparing the geographic distribution of song-types with a published phylogeny demonstrates that vocal differences do not correspond closely to genetic differences. If the published phylogeny is accurate, then even groups with markedly different songs may be genetically similar and thus may not be reproductively isolated. In such cases, species limits can be assessed only by direct study of those mechanisms that reduce interbreeding.

### 095 Chilton

Geographic variation in the songs of Black-throated Gray Warblers. GLEN CHILTON, *Dept. Biol., St. Mary's College, Calgary, AB.*

To date, the songs of Black-throated Gray Warblers have received very little attention. Even so, geographic variation in song has been used to justify division of the Black-throated Gray Warbler into 2 subspecies (Morrison 1990, **Northwest. Nat.** 71:53-58). I recorded 1700 songs of 115 males at 25 localities in British Columbia, Washington, Oregon, California, and Idaho. Like other wood warblers, each male produces songs in 2 categories, which vary in use seasonally and contextually. A few songs could not be attributed to one category or another on the basis of their construction. Within a category, songs varied least among localities on Vancouver Island, which has been occupied by established populations of Black-throated Gray Warblers for only 30 yr. The Strait of Georgia divides 2 song traditions in sw. British Columbia. Variation among more southerly localities was more substantial. In some cases, variation among localities was almost as great as variation among different species of wood warbler. This likely limits the value of geographic variation in song as a taxonomic tool in Black-throated Gray Warblers.

### 096 Nelson

The evolution of Puget Sound White-crowned Sparrow song dialects. DOUGLAS A. NELSON, *Dept. Evol., Ecol. & Organ Biol., Ohio State Univ., Columbus, OH.*

The songs of male Puget Sound White-crowned Sparrows form about 10 dialects along the Pacific Northwest coast. In his study in 1970, Baptista (1977, **Condor** 79: 356-370) defined 6 dialects based on the song's terminal trill because most males at each locality shared the trill. The complex syllables in the song's introduction varied among males at a locality, and were often shared among localities. From 1998 - 2001, I revisited 7 of the sites Baptista studied to determine whether the trills and complex syllables had changed over the 30-yr interval. Using Baptista's catalogs of trill and syllable types as bases for comparison, I found that the trills had remained stable at 5 of 7 sites, while the complex syllables had changed at all 7. No new trill types were found, while several new complex syllables appeared and others had gone extinct. These results suggest that trills and complex syllables evolve independently. Several observations were made on the proximate mechanisms that either produce diversity or maintain uniformity in song. In a survey of the songs of 651 males, unique improvisations were significantly more likely to occur in complex syllables than in trills. In a laboratory experiment using hand-reared males, trills and complex syllables were learned at the same age, but males were significantly more accurate in imitating trills than complex syllables. Trills and complex syllables may serve different functions.

### 097 Nicholls

\* Does habitat influence call variation in the Satin Bowerbird? JAMES A. NICHOLLS, *Dept. Zool. & Entomol., Univ. Queensland, Brisbane, Queensland, Australia.*

One explanation for intra-specific variation in avian vocalisations is that it is a response to variation in the acoustic properties of different habitat types. Vocalisations from denser habitats are predicted to utilise lower frequencies and shorter trills. This study tests whether habitat type and structure influence variation in the advertisement call of the satin bowerbird in the predicted manner. Advertisement calls were recorded from males from 16 populations occurring in a variety of habitat types. Discriminant function analyses were used to examine whether frequency and temporal characteristics of calls differed among sites and habitat types. Relationships between call measures and vegetation characteristics were also examined. The first discriminant analysis distinguished among nearly all populations, with little or no overlap between the calls from each population. When calls were grouped by habitat there was no overlap in discriminant function scores between calls from different habitats except in 2 structurally similar habitats. As predicted, trill length, peak and minimum frequencies were inversely correlated with the density of trees around bowers. This study suggests that the structure of satin bowerbird advertisement calls is influenced by the habitat in which the caller lives. Although each population has a distinct call, birds in structurally similar habitats have converged on similar call properties. Future work will involve investigating transmission properties of different habitats and testing how the various calls attenuate as they pass through different habitat types.

## 098 Berg

\* Sequential signaling in a tropical dawn chorus. KARL S. BERG, *Dept. Biol. Sci., Florida Internatl. Univ., Miami, FL.*

A temporal sequence to the dawn chorus in birds has been known to exist in temperate communities for nearly a century. Despite the wealth of information, most studies are restricted to the Oscine Passerines and no studies have addressed whether a stereotypic temporal sequence is also characteristic of richer tropical communities. I studied patterns of the dawn chorus in lowland Ecuador, recording from different forest localities to determine whether birds in this community sing in a predictable sequence. My preliminary results indicate that at least 132 species from 12 orders participated in the dawn chorus and that start times varied considerably across species. At 1 site a subset of the community gave their first vocalizations in a relatively predictable sequence on 4 mornings: tinamous, tyrant flycatchers, forest-falcons, motmots, foliage-gleaners, antvireos, antshrikes, and doves typically were the earliest to vocalize, while woodcreepers, antbirds, trogons, wrens, and grosbeaks often entered the chorus later. Woodquail, antthrushes, pigeons, parrots and toucans had predictable outbursts of vocal activity, although these usually occurred after the sun had risen. Possible causes of stereotypy and variation in the dawn sequence and a comparison to temperate studies will form the basis of discussion.

## 099 Mack & Jones

Low frequency vocalizations by cassowaries in Papua New Guinea. ANDREW L. MACK, *Wildl. Conserv. Soc., NY;* and JOSH JONES, *Scripps Inst. Oceanography, CA.*

Although some birds can detect wavelengths in the infrasound range, there has been little evidence that birds produce very low frequencies. We analyze recordings of a captive Dwarf Cassowary, *Casuarius bennetti*, and 1 recording of a wild Southern Cassowary, *C. casuarius*, near Crater Mountain, Papua New Guinea. Both species produced sounds near the floor of the human hearing range in their pulsed booming notes: down to 32 Hz for *C. casuarius* and 23 Hz in *C. bennetti*. The recordings of *C. bennetti* indicate 4 levels of harmonics with a fundamental frequency at 23 Hz. Such low frequencies are probably ideal for communication among widely-dispersed, solitary cassowaries in dense and wet rainforest. Both sexes apparently produce low vocalizations. It appears that cervical airsacs are inflated to assist in sound production and we discuss the possibility of the anomalous casque playing a role in sound reception or production. The discovery of very low frequency communication by cassowaries creates new possibilities for studying these extremely secretive birds and for learning more about the evolution of avian vocalizations.

## 100 Lovell

\* Individual recognition of neighbors by song in a suboscine, the Alder Flycatcher. SCOTT F. LOVELL, *Dept. Biol. Sci., Univ. Calgary, Calgary, AB.*

The ability of territorial male songbirds to discriminate between songs of their neighbors and songs of strangers has been documented in over 25 species. Such experiments test only a subject's ability to discriminate between 2 classes of stimuli: familiar (neighbors) and unfamiliar (strangers) songs. Individual recognition (IR) of neighbors is a finer, more complex type of discrimination. The ability of territorial oscine males to recognize individual neighbors by song has been documented in a handful of species, but is virtually unstudied in suboscines. I investigated IR of neighbors in a suboscine, the Alder Flycatcher in Alberta during the breeding season of 2002. I performed a series of song playback experiments and recorded the responses of territorial males to the songs of their neighbors broadcast from 2 locations, the regular boundary with the neighbor and an opposite boundary. Principal components analysis of the 4 response variables from 20 trials generated 2 principal components (PC) with eigenvalues >1.0. PC1 was interpreted as an approach variable and PC2 was interpreted as a vocal response. Both principal components showed that the responses differed significantly between speaker locations. Subjects responded more aggressively to songs of neighbors when broadcast from the opposite boundary than when played from the regular boundary. My study of IR of neighbors in the Alder Flycatcher is one of the first comprehensive tests of whether suboscines can recognize individual neighbors by song.

## 101 Taft

Adult Tree Swallows can change their song repertoires. BENJAMIN N TAFT, *Dept. Biol., Univ. Massachusetts, Amherst, MA.*

Male Tree Swallows may change their dawn songs annually to match the songs of their neighbors. The song type repertoires of males occupying 2 transects of nest boxes were examined to test this hypothesis. The average repertoire size among the 12 males was 2.83 song types. Song sharing averaged 41% within a row of nest boxes, with a variance of 2%. Pairwise song sharing was highly correlated with the distance (slope = -0.728,  $R^2 = 0.530$ ,  $P = 0.0002$ ) between the nest boxes of the compared males. There was no effect of male age or geographic origin on repertoire size or average sharing level. Males recorded the previous year showed change in their repertoires. All of these results indicate that Tree Swallows are open-ended song learners who are able to match their song type repertoires to those of their neighbors. The implications of this unexpected conclusion on our understanding of how song learning has evolved are discussed.

## 102 Farnsworth & Lovette

Flight call frequency variation in wood-warblers is not driven by body mass or bill length. ANDREW FARNSWORTH and IRBY J. LOVETTE, *Dept. Ecol. Evol. Bio., Cornell Univ., Ithaca, NY.*

Many birds produce flight calls, vocalizations given during sustained flight (e.g., migration) that vary in duration, frequency, modulation, and pattern among species. Little is known about the function of flight calls, although they apparently serve to maintain flocks and to communicate information among members of a flock. Although numerous workers have identified correlations between body mass or bill length and song frequencies, no studies have examined these associations in the context of flight calls. We used 19 species of wood-warblers as a model system to explore relationships between body mass and flight call frequencies and bill length and flight call frequencies. In both phylogenetically controlled and uncontrolled analyses we found no relationship between body mass or bill length and flight call frequency. Our findings suggest that factors other than body size and bill length are responsible for the observed variation in flight call frequencies in wood-warblers, and we suspect that different ecological and atmospheric properties among species might play important roles in determining flight call frequencies.

## 103 van Riper, McGrath, O'Brien & Ecton

Habitat partitioning by neotropical migrant warblers along the lower Colorado River corridor. CHARLES VAN RIPER III, LAURA McGRATH, CHRISTOPHER O'BRIEN and KRISTINA ECTON, *USGS/SBSC*

*Colorado Plateau Field Sta., N. Arizona Univ., Flagstaff, AZ.*

We examined foraging ecology of spring and fall migrant warblers in native and introduced vegetation habitat patches along the Lower Colorado River corridor. Study areas were located on the Rio Hardy and Rio Colorado rivers in Sonora, Mexico, Cibola and Bill Williams National Wildlife Refuges in Arizona. From our census and mist-net capture data, we found that warbler species' arrival and departure dates were more predictable during the spring migration period. Plant species abundance and phenology patterns dramatically influenced location of warbler foraging. Preliminary analysis of foliage invertebrate samples revealed significant differences, among tree species and particularly between native and introduced plant species. Hence, access to different tree species in a vegetation patch (e.g. mesquite, which had the highest invertebrate numbers in our fall samples) may be important to foraging migrants. We found that warbler species partitioned foraging habitat in similar manners during both migration periods, preferring native over introduced vegetation. Lucy's Warblers preferred the highest vegetation strata, while Yellow Warblers occurred primarily in the middle foliage regions. Orange-crowned Warblers were observed most often in the lower third of the vertical vegetation strata, while Black-throated Grey, Wilson's, Nashville and MacGillivray's Warblers all preferred the lowest vegetation strata. We found a threshold of native plant species composition that appears to influence migrating warbler abundance within differing vegetation patches. It thus appears that vegetation species, structure, phenology, abundance, and insect prey base all appear to play a role in structuring migrating warbler foraging patterns along the lower Colorado River corridor.

#### **104 Michi & Gauthreaux**

A radar study of the dawn ascent behavior of nocturnally migrating birds. JENNY E. MICHIE and SIDNEY A. GAUTHREAUX, Jr., *Dept. Biol. Sci., Clemson Univ., Clemson, SC.*

Myers (1964, *Ibis*. 1067-1051) was first to describe a flight behavior that birds migrating over water show when continuing to migrate during the transition of night to day. He termed this behavior "dawn ascent". We used Doppler weather surveillance radar (WSR-88D) to study this behavior off the coasts of se. U.S. during the fall migrations of 1999 - 2002. We developed criteria for identifying dawn ascent events and characterized the temporal (seasonal and daily) and spatial aspects (altitudinal distribution, occurrence over land vs. over water) of the behavior. We relate dawn ascent events to (a) migration events that take migrants over water and into areas of radar surveillance, (b) atmospheric structure, and (c) reorientation. We review existing hypotheses regarding the functional significance of dawn ascent and examine them in relation to our findings.

#### **105 Farnsworth & Gauthreaux**

Of mares' tails, mackerel skies, and calling birds: clouds and variation in flight call counts of nocturnally migrating birds. ANDREW FARNSWORTH, *Dept. Ecol. Evol. Bio., Cornell Univ., Ithaca, NY*, and SIDNEY A. GAUTHREAUX, Jr., *Dept. Biol. Sci., Clemson Univ., Clemson, SC.*

Calling by nocturnally migrating birds does not appear to be density-dependent, and factors other than bird density probably drive variation in nocturnal call counts. Atmospheric conditions influence the amount of migration aloft, and there is evidence that some atmospheric conditions (e.g., cloud cover) and artificial night lighting influence calling rates of migrating birds. We examined relationships between weather conditions and call counts of nocturnally migrating birds. We sampled nocturnal flight calls and gathered local climatic data on 13 weather variables during spring and fall 2000 in w. South Carolina and se. New York. We analyzed hour-to-hour patterns of calling relative to weather variables for 556 hr on 58 nights and night-to-night patterns of peak call counts on 32 nights relative to weather variables. We found that weather variables are responsible for a great deal of variation in nocturnal call counts, especially cloud cover and cloud ceiling which explain nearly half of the variation in call counts. Our results suggest that the spatial and altitudinal distribution of clouds play an important role in nocturnal communication in migrating birds.

#### **106 Francis**

Estimating the rate of bird migration from banding data. CHARLES M. FRANCIS, *Natl. Wildl. Res. Centre,*

*Canadian Wildl. Ser., Ottawa, ON.*

Rates of migration can be estimated for individual birds based on recaptures or recoveries of banded birds within a single migration period, as well as by following radio-marked birds. However, for most song birds in North America, data from these approaches are very sparse, limiting the ability to test hypotheses about sources of variation in migration rates. An alternative approach is to examine differences in average passage dates along the migration route of a species. Because relatively few banding stations have consistent long-term coverage, I used data from the North American bird-banding scheme, combined across many banding stations, to estimate median capture dates by degree block along the migration routes of each species. These data can then be used to estimate average rates of migration, and to test hypotheses about patterns of variation in migration rates. Preliminary analyses for 1 species (Rose-breasted Grosbeak) indicate an average passage rate of 80 km/d in spring, and 38 km/d in autumn, generally consistent with limited band recovery data, and consistent with the observation that the migration period at individual sites is much more protracted in autumn than spring. I shall present data for additional species comparing autumn with spring, and also use data from individual years to test whether the average rate of migration in spring increases with warmer spring temperatures.

### **107 Mollenhauer, Moore & Sandberg**

The effect of arrival fat on the song and song-flight performance of male Bluethroats. JEFF MOLLENHAUER, FRANK R. MOORE, *Dept. Biol. Sci., Univ. S. Mississippi, Hattiesburg, MS*, and ROLAND SANDBERG, *Dept. Animal Ecol., Lund Univ., Sweden*.

Long-distance migratory songbirds use fat as their primary source of energy during migratory flights. Many of these migrants are known to arrive on their breeding grounds with surplus fat stores. Several hypotheses have been developed to explain the possible advantages of having surplus fat stores upon arrival at the breeding grounds. We tested the time constraint hypothesis, which states that birds breeding at high latitudes (short breeding season) are able to use fat stores to offset time constraints. For example, a fat male may be able to spend more time singing because he does not need to spend as much time foraging. We measured the song and song-flight rates of male Bluethroats (*Luscinia svecica*) as they arrived on their breeding grounds in Swedish Lappland during May 2001 (n = 14) and 2002 (n = 25). Using a linear regression to control for temperature, cloud cover, date, and year we found that fat was a significant source of variance in song rates. Our results support the time constraint hypothesis. Determining how a bird's migratory phase influences its reproductive phase is crucial to understanding the annual cycle of migratory birds and the importance of stopover sites in relation to reproductive success.

### **108 Faustino & Cooch**

Mycoplasmal conjunctivitis in wild House Finches: population structure, movement, and seasonal disease dynamics. CRISTINA R. FAUSTINO and EVAN G. COOCH, *Dept. Nat. Res., Cornell Univ., Ithaca, NY*.

We are studying an emerging pathogen in a novel host as a model system for exploring disease dynamics in wild populations. In 1994, a bacterium identified as *Mycoplasma gallisepticum* (MG) was isolated from wild House Finches with severe conjunctivitis. Since the initial observation of MG, the disease has spread rapidly throughout the e. U.S. We conducted an intensive mark-recapture study in Ithaca, NY, from 2000 - 2003 to assess the dynamics of MG in the wild. Using a multi-strata analysis, we tested for differences in survival among birds with and without MG, and estimated the probability of movement between disease states as a function of sex, age, and temperature. We examined the effect of transients (birds that have been observed in the study area, and then have subsequently left the area permanently) on survival estimates. Since transients have a zero probability of apparent (local) survival after their first capture, estimates of apparent survival have the potential to be biased low. We investigated a method for evaluating the presence of transients with the added complication of pooled samples, multi-state models, and non-random sampling effort. There is strong evidence to suggest the presence of transients in our sample population. We will discuss whether this may be true transience or 'apparent transience', and how this may influence our understanding of MG dynamics in this system.

## 109 Rhymer, Ziel & McAuley

Comparison of phylogeographic patterns of American Woodcock and European Woodcock. JUDITH M. RHYMER, *Dept. Wildl. Ecol., Univ. Maine, Orono, ME*, HEATHER L. ZIEL, *Dept. Biol. Sci., Univ. Maine*, and DANIEL G. McAULEY, *USGS, Orono, ME*.

American Woodcock exhibit high levels of philopatry, suggesting the potential for high levels of geographic structuring among populations throughout their breeding range. In addition, banding returns have shown that Woodcock follow traditional migration flyways in the eastern and central regions of the U.S.. However, phylogeographic analyses based on control region and ND6 mitochondrial DNA sequences revealed no population structure. There is a high level of variability among individuals within and among populations, but it is not structured geographically. Hierarchical analysis of molecular variance indicated that essentially none of the variation was due to differences between migration flyways or among populations within flyways, with the majority (99%) due to variation among individuals. In contrast, there are 2 distinct lineages among populations of European Woodcock, that have diverged as much as some species. In addition, the high level of divergence between American and European Woodcock suggests that they are likely not congeneric.

## 110 Sinclair

Inter- and intra-specific sharing of incubation mounds by megapodes (Megapodiidae): brood parasitism or communal nesting? J. ROSS SINCLAIR. *Wildl. Cons. Soc., Papua New Guinea*.

Use of mounds by >1 species of megapode has been assumed to be brood parasitism. In a study of 3 sympatric megapodes in Papua New Guinea (Wattled Brush-Turkey *Aepyodius arfakianus*, Brown-collared Talegalla *Talegalla jobiensis* and New Guinea Megapode *Megapodius decollatus*), I observed behaviors that have been hypothesized to increase susceptibility to parasitism and be precursors to birds becoming brood parasites. Talegallas renovate abandoned mounds of the other 2 species and use mounds concurrently with New Guinea Megapodes, while contributing to maintenance of the mound. New Guinea Megapodes do not defend their mounds and > 1 pair share some mounds, with all pairs contributing to maintenance. There was no inter-specific use of brush-turkey mounds, where the male alone builds, maintains, and defends the mound. In describing megapodes as brood parasites, little attention has been given to similarities these observations have with communal and colonial nesting. None of the hypothesized costs to hosts from parasitism appear to apply to New Guinea Megapodes and Talegallas. Unlike typical brood parasitism, sharing of mounds may benefit 'host' megapodes through more efficient incubation and shared parental care (mound maintenance), and lower predation risk due to the dilution effect of extra eggs in shared mounds. Inter- and intra-specific sharing of mounds by megapodes appears to more closely resemble a special case of communal nesting than it does brood parasitism.

## 111

Breeding biology of introduced birds in Hawaii: exotic birds in exotic forests? JEFFREY T. FOSTER, *Prog. Ecol & Evol. Biol., Univ. Illinois, Champaign-Urbana, IL*.

Exotic birds are abundant in lowland nonnative habitats of the Hawaiian Islands but surprisingly few species have become residents of native forests at higher elevations. Nonetheless, exotic birds are a dominant element of all terrestrial communities in Hawaii. Despite this abundance, the factors determining their breeding biology and distributions are poorly known. Breeding success of 5 exotic species was compared among native and nonnative forests. Over 500 nests were monitored in 2 yr. In the first season, Mayfield nesting success was >43% at all sites for all species and predation was relatively low. However, predation sharply increased in the second season. For the Red-billed Leiothrix, nest success (62%) and the number of fledglings per nest (2.31) was highest in nonnative forest. Nest success was also high at the 2 native forest sites; mid-elevation (43%), high elevation (48%). Nesting densities were extremely high in nonnative forest, with 2.5 nests/ha for the leiothrix. Results for the Japanese White-eye were similar. Hwamei and Northern Cardinal nests were found only in nonnative forest, although Japanese Bush-Warbler nests were present in both forest-types. These results suggest that nonnative forests may be serving as source populations for some species of exotic birds, allowing for continued invasion of native forests. The Japanese Bush-Warbler, however, appears to prefer native forests and

may eventually invade all native forests in Hawaii.

### **112 Byers**

Male reproductive success in a socially monogamous songbird is correlated with consistent song performance, not with song repertoire size. BRUCE BYERS, *Dept. Biol., Univ. Massachusetts, Amherst, MA.*

Although conventional wisdom supposes that female songbirds prefer mates with larger, more diverse song repertoires, there is little reason to expect this supposition to be broadly valid. Instead, female mate choice is more likely to be influenced by aspects of song performance, which can allow females to directly assess the relative vigor of competing males. To begin testing this prediction, we examined the connection between singing and male reproductive success in a population of Chestnut-sided Warblers, a species in which males use repertoires of 4 - 12 different song types. We found that male reproductive success was correlated with precise, rhythmic repetition of songs, but not with song repertoire size or syllable repertoire size. Much of the increased success of males with unvarying song performance was due to their greater success in achieving extra-pair fertilizations.

### **113 Bowlin & Winkler**

Natural variation in flight performance is related to timing of breeding in the Tree Swallow. MELISSA S. BOWLIN, *Dept. Ecol. & Evol. Biol., Princeton Univ., Princeton, NJ*, and DAVID W. WINKLER, *Dept. Ecol. & Evol. Biol., Cornell Univ., Ithaca, NY.*

In many avian species, including Tree Swallows, females that lay eggs earlier in the season have higher fitness. It has been hypothesized that non-heritable variation in individual quality could explain how variation in laying date persists in the face of this apparently directional selection. Previous experimental work on Tree Swallows has suggested that natural variation in flight ability permits early-laying females to attain feeding rates high enough to support egg production on earlier, sparser food than can later-laying females. We tested this hypothesis with standardized flights through a 9.75 m flight performance test tunnel. One group of female swallows was tested at the height of the breeding season on 28 May regardless of their nesting phenology; another was tested on the 11th day of incubation. Average acceleration in the tunnel was negatively correlated with clutch initiation date for the females tested on 28 May. Daily variation in ambient environmental conditions had strong effects on swallow flight performance in the tunnel, so no relationship was observed in the Day-11 birds. Since natural variation in foraging performance is correlated with variation in female Tree Swallows' clutch initiation dates, flight ability appears to be a key element of individual quality in this species.

### **114 Ward**

Dispersal and habitat selection in Yellow-headed Blackbirds. MICHAEL P. WARD, *Dept. Animal Biol., Univ. Illinois, Urbana - Champaign, IL.*

Between-year dispersal and habitat selection was investigated in 2 Yellow-headed Blackbird populations with different densities in n. Illinois. Individuals in the low-density population exhibited low site fidelity, but high population fidelity (return rate to Illinois; site fidelity: males 19% [n = 146], females 10% [n = 181] population fidelity: males 52% [n = 146], females 40% [n = 181]) whereas in the high-density population, individuals exhibited both high site and population fidelity (site fidelity: males 71% [n = 14], females 48% [n = 25], population fidelity: males 86% [n = 14], females 64% [n = 25]). The differences in dispersal maybe due to reduced competition for territories in the low-density population. I also investigated what cues and experiences individuals used when determining whether to disperse and where to settle. These included habitat features, nestling food availability, and individual reproductive success. In addition the Public Information Hypothesis (individuals use the reproductive success of conspecifics when assessing habitats) was evaluated as a potential factor in dispersal and settlement. Both males and females did not use habitat features to determine whether to disperse or where to settle, and even though nestling food availability was correlated with the number of young fledged, they did not or were unable to use cues predictive of nestling food availability. Individuals that were reproductively successful tended to be more likely to return to their previous site. Although, the strongest predictor of

dispersal and settlement was public information. Individuals at sites where the average number of young per nest was greater than the average for the entire population were more likely to stay, whereas individuals at sites where the average number of young per nest was lower were more likely to disperse to sites with a greater average number of young per nest the previous year.

### **115 Henningsen & Best**

Effects of multiple edges on grassland passerines breeding in riparian corridors. JOHN C. HENNINGSEN and LOUIS B. BEST, *Dept. Nat. Resour. Ecol. & Manage., Iowa State Univ., Ames, IA.*

We examined patterns in bird abundance, nest placement, predation, and incidence of brood parasitism relative to edge type and distance to edge in riparian grassland strip-cover habitats (Conservation Reserve Program filter strips). Filter strips varied in width from 14 to 36 m, and were bounded by 2 edges that differed in structure (high-contrast, wooded riparian strips vs. low-contrast, rowcrop). In such a setting, birds could be influenced by, and respond to, 2 edges simultaneously. Red-winged Blackbird nest placement patterns indicated primarily wooded-edge avoidance, and to a lesser extent, rowcrop-edge avoidance. Dickcissels did not nest in filter strips adjacent to wooded edges, and nested more often in wider than narrow strips, suggesting avoidance of both edge types. We did not detect a preference for or avoidance of any edge type in Common Yellowthroat or Song Sparrow nest placement. There were no edge-distance patterns in predation or the incidence of Brown-headed Cowbird nest parasitism for either edge type. However, nest predation rates were inversely related to strip width, suggesting that predators are better at finding nests in narrower strip cover. Multiple edges can have a confounding effect on edge sensitivity of birds and predation rates near edges, especially in highly fragmented landscapes where the available habitat contains little or no core area and is influenced by > 1 edge.

### **116 Igl & Johnson**

Changes in breeding bird populations in the Platte River Valley of central Nebraska: 1979 - 1980 to 2001. LAWRENCE D. IGL and DOUGLAS H. JOHNSON, *N. Prairie Wildl. Res. Center, U.S. Geol. Surv., Jamestown, ND.*

The Platte River Valley of central Nebraska provides important breeding habitat for a variety of bird species. Habitats of the Platte River Valley have been greatly modified during the last century, including deliberate riparian deforestation beginning in the early 1980's to increase the area of roosting habitat for migrating aquatic birds. In 1979 - 1980, Craig A. Faanes and Gary R. Lingle conducted an extensive survey of breeding bird populations within 13 counties bordering the Platte, North Platte, and South Platte rivers in Nebraska. Their study provided the first quantitative estimate of breeding bird populations within the Platte River Valley. In 2001, over 2 decades after the original survey, we repeated their survey using the same sample units and methods. The objectives of this recent survey were to evaluate changes in breeding bird populations in the Platte River Valley in Nebraska between 1979 - 1980 and 2001. Data were obtained on 125 breeding bird species. Overall, breeding bird populations declined by 18.9% between the 2 periods, with greatest declines occurring in populations of species associated with grasslands, open habitats with scattered trees, open woodlands and edges, and woodlands. Breeding bird populations associated with wetlands, shrublands, and residential areas and human-made structures increased. We will assess the patterns of population changes in light of recent habitat changes, including deforestation of riparian woodlands.

### **117 Bollinger & Gavin**

Responses of Bobolinks to habitat edges. ERIC K. BOLLINGER, *Dept. Biol. Sci., E. Illinois Univ., Charleston, IL,* and THOMAS A. GAVIN, *Cornell Univ., Ithaca, NY.*

Avoidance of habitat edges may be contributing to the reduced densities of certain grassland birds in small habitat patches. Nest densities for grassland-nesting Bobolinks were much lower than expected within 25 m of forest edges at 4 sites in New York and Illinois, and this pattern ("edge avoidance") extended to 100 m at 1 site. Those nests that were located within 50 m of forest or wooded hedgerow edges experienced lower daily survival rates compared to nests over 100 m from any habitat edge.

Bobolinks tended to move away from forest edges when re-nesting following nest failure; this pattern was especially evident for females that placed their first nest within 50 m of a forest or wooded hedgerow edge. Second nests for all 7 of these females were farther from this edge type than their first nests. However, nest placement in relation to wooded edges did not vary significantly between years for those philopatric females nesting at our sites for >1 yr. Bobolinks also avoided nesting near road edges even though nest survival rates were not lower near this edge type. However, Bobolinks did not appear to avoid nesting near edges with old fields, pastures, rowcrop agricultural fields, or other grasslands. Nest survival near these edge types was higher than near wooded edges and similar to, or higher than, survival of nests over 100 m from any edge. Thus, responses of Bobolinks to habitat edges were inconsistent and nest success was also dependent on the type of edge.

### **118 Linn & Bollinger**

Impacts of rowcrop agriculture on foraging patterns and nest success of the Eastern Meadowlark. SUSAN A. LINN and ERIC K. BOLLINGER, *Dept. Biol., E. Illinois Univ., Charleston, IL.*

Midwestern populations of grassland birds have declined dramatically. Although these declines have been attributed to agricultural expansion and habitat loss, few studies have considered the potentially beneficial interactions between grassland birds and rowcrop agriculture. Over 250 Eastern Meadowlark nests were located from 1997 - 2002 and monitored at 9 separate sites in central Illinois. Periodic observations of foraging patterns were conducted in 2002 at all nests that had progressed to the nestling phase. In addition, esophageal ligature samples were collected on all nestlings in order to assess what foods were being fed to nestlings. As adjacent agricultural fields matured throughout the breeding season, Eastern Meadowlarks appeared to select these fields for foraging rather than habitat closer to individual nest sites. Arachnids were the most common taxa fed to meadowlark nestlings, although pest insects (e.g. Japanese beetles) were also included.

### **119 James**

The biogeography of the Hawaiian finch radiation (Drepanidini), including extinct species. HELEN F. JAMES, *Natl. Mus. Nat. Hist., Smithsonian Inst., Washington, DC.*

The Hawaiian Archipelago is home to many adaptive radiations in plants and animals, the best known of which is the radiation of Hawaiian finches (Drepanidini; honeycreepers, *auct.*) The drepanidines have an excellent Holocene fossil record, showing that many species suffered extinction or range contraction during the prehistoric human era in the islands. Previous biogeographic studies of the radiation were unable to effectively incorporate information from fossils because the available phylogenetic hypotheses for the radiation excluded the fossil taxa, however, a recent study of comparative osteology has supplied a taxonomically-inclusive hypothesis. I combine this phylogenetic hypothesis with distributional data for fossil and recent taxa, to reassess patterns of dispersal, differentiation, and extinction in the Drepanidini. Comparison of area cladograms suggests that the drepanidines face fewer geographic isolating barriers within the islands compared with most other radiating clades in Hawaii. I suggest that sweepstakes dispersal to newly emergent islands may be an important factor contributing to the dramatic morphological divergence of drepanidine species. Finally, I evaluate the power of the taxon cycle to explain the pattern of Holocene extinctions of drepanidines.

### **120 Omland & Funk**

Species-level paraphyly in birds: frequency, causes and consequences from a survey of animal mtDNA. KEVIN E. OMLAND, *Dept. Biol. Sci., Univ. Maryland, Baltimore County, MD,* and DANIEL J. FUNK, *Vanderbilt Univ., Nashville, TN.*

A broad survey of published mtDNA phylogenies revealed that 17% of bird species showed mitochondrial paraphyly. Across all Animalia, species-level mtDNA paraphyly was detected in 23% of over 2200 species surveyed in 14 journals from the last 13 yr (Funk & Omland 2003, **Ann. Rev. Ecol. Evol. Syst.** in press). Many uses of gene trees implicitly assume that individual species are monophyletic at the study locus. However, gene trees with thorough intra- and interspecific sampling often exhibit species-level paraphyly. The causes of paraphyly can range from misleading amplification of nuclear

copies, to informative patterns of nesting caused by recent peripheral isolates speciation. Bad taxonomy, hybridization and incomplete lineage sorting were the 3 causes most frequently invoked by study authors.

Unrecognized mitochondrial paraphyly can lead to incorrect inference of species trees and divergence times, whereas recognized paraphyly can improve inferences including more accurate ancestral state reconstructions. Our survey reveals paraphyly to be a statistically supported, taxonomically widespread, and far more common phenomenon than generally acknowledged. These findings suggest that caution is warranted in using mtDNA monophyly as the main criterion by which species boundaries are defined. We call for increased attention to sampling and careful interpretation of paraphyly in studies of closely related taxa by systematists and population geneticists alike, marking a new tradition of "congeneric phylogeography".

## 121 Chesser & ten Have

Systematics of the Australian parrot genus *Platycercus* (the rosellas). R. TERRY CHESSER and JOSE TEN HAVE, *Australian Natl. Wildl. Collection, Canberra, Australia*.

The rosellas (*Platycercus* spp.) are a taxonomically perplexing group of endemic Australian parrots, characterised by highly variable plumage and complex patterns of hybridisation. Two plumage and behavior-based species groups have conventionally been recognised: the "white-cheeked" *P. adscitus* complex (formerly known as the *P. eximius* group) and the "blue-cheeked" *P. elegans* complex. To describe evolutionary relationships among the rosellas, we sequenced portions of 3 mitochondrial genes from 2 phenotypically pure individuals of 16 of the 17 currently recognised forms. The primary division within the genus corresponded to the plumage-based *adscitus* and *elegans* species groups, a finding that contrasts with previous molecular work, in which the "white-cheeked" Western Rosella (*P. icterotis*) was found to be sister to the rest of the genus. Our results indicated that *icterotis*, although the most genetically divergent form of *Platycercus*, was instead sister to the rest of the *adscitus* group. Although genetic differentiation within the genus was rather low, 2 forms not typically recognised as species (the blue-cheeked form *nigrescens* and the white-cheeked form *diemenensis*) were found to represent reciprocally monophyletic groups. A similar degree of genetic differentiation between the Tasmanian forms (*caledonicus* and *diemenensis*) and their respective mainland sisters suggests that the same vicariant event may have separated these taxa.

## 122 Benu

Molecular phylogeny of the lorries (Psittacidae: Loriinae): unraveling an old puzzle. DEVORAH A. N. BENNU, *Dept. Ornithol., Am. Mus. Nat. Hist., New York, NY*.

The lorries and lorikeets (Loriinae) are brush-tongued nectarivorous parrots that are native to islands and archipelagos throughout the s. Pacific Ocean. They are the only large assemblage of parrots found almost exclusively on islands and as such, lorries represent a unique system to test evolutionary and speciation hypotheses that have been identified in other avian groups. Historically, evolutionary relationships between the lorries have been poorly known, probably due to their morphological similarities. Throughout the years, different morphological characters have been used to assign genera, causing taxonomic confusion that continues to this day. To reconstruct a phylogeny of the Loriinae, I sequenced the mitochondrial cytochrome b gene from 30 of 56 lorry species representing all genera and from 9 other closely related psittacine taxa to date. Preliminary results from these data suggest that the Loriinae are monophyletic. When completed, this phylogeny will provide insight into the rates of divergence among lorries and the role that genetic drift has played in their speciation. Additionally, this phylogeny will be used to describe the biogeographic history of lorries as they expanded their range outward from their putative evolutionary origin on New Guinea.

## 123 Driskell & Pruett-Jones

Evolutionary relationships among blue- and black-plumaged populations of the White-winged Fairy-Wren. AMY C. DRISKELL, *Sect. Evol. & Ecol., Univ. California, Davis, CA*; and STEPHEN PRUETT-JONES, *Dept. Ecol. & Evol., Univ. Chicago, Chicago, IL*.

The White-winged Fairy-Wren (*Malurus leucopterus*) exhibits striking plumage colour variation

between the Australian mainland and 2 islands (Dirk Hartog Island and Barrow Island) off the coast of Western Australia. Adult males on the mainland are bright blue with white wings and adult males on the 2 islands are black with white wings. To examine evolutionary relationships within this species, we sequenced 980 base pairs of 2 mitochondrial genes from 34 individuals from both islands and 5 mainland sites. Birds on Barrow Island were the most genetically distinct. Specimens from Dirk Hartog shared a unique character with, and were most similar to, birds from the Western Australian mainland. The black-and-white-plumaged subspecies from the 2 islands were not each other's closest relatives. Mapping of plumage evolution produced 2 equally parsimonious hypotheses: (1) black plumage arose from blue plumage convergently on the 2 islands, or (2) black plumage arose from blue plumage once and was followed by a re-evolution of blue plumage in mainland Western Australia birds. Levels of genetic differentiation in this species were low but genetic differentiation was discovered between morphologically identical eastern and western populations of the mainland subspecies, which is evidence for a current barrier to gene flow on mainland Australia.

## 124 Lovette

A robust species-level phylogeny for the wood-warblers (Parulidae). IRBY J. LOVETTE, *Cornell Lab. Ornithol., Cornell Univ., Ithaca, NY.*

The more than 100 species of wood-warblers have been important systems in behavioral ecology since Robert MacArthur's (1958, **Ecology** 39: 599-619) pioneering work on the spruce-woods warbler community a half century ago. Despite strong interest in the remarkable behavioral and morphological diversity within this group, we lack a comprehensive phylogenetic hypothesis with which to explore the evolution of these traits. Here I present a well-resolved phylogeny for almost all Parulidae species based primarily on long mitochondrial DNA sequences. Among a number of novel placements of particular taxa or lineages, these reconstructions suggest that the present taxonomy of the family is a poor reflection of evolutionary relationships among the major warbler lineages, as almost all polytypic genera fail to form monophyletic groups.

## 125 Rasmussen

Biogeographic and conservation implications of revised species limits and distributions of south Asian birds. PAMELA C. RASMUSSEN, *Michigan State Univ. Mus., East Lansing, MI.*

A large-scale revision of biological species limits of Indian subcontinent birds, mainly based on morphology and vocalizations, resulted in recognition of between 118 and 193 differences in species-level taxonomy as compared to previous treatments of the region's avifauna. 75 of these changes add to the region's total number of species, and these include 2 species new to science and 7 overlooked species. The revision resulted in a high relative increase in endemism in the Andaman Islands, now with 16 endemics (as much as a 200% increase from earlier treatments) forming 20% of the breeding avifauna of 80 species. In the Nicobar Islands, the 8 endemics now recognized (up 167%) constitute 15% of the 53 breeding species. Smaller increases in endemism occurred in Sri Lanka (32 endemics, up 52% to 14% of 232 breeding species) and the Western Ghats (27 endemics, up 69% to 9% of 298 breeding species). Endemism of the extremely rich Himalayan avifauna is relatively low because of contiguity with other regions, while it is very high in depauperate lowland India, a large region entirely bounded by mountains, desert, and sea. In general, species-level differences arising from the revision tend to decrease the avifaunal similarities between Africa and South Asia, between the Western and Eastern Palearctic, and between North and South Asia. Indices of species richness, breeding species density, similarity of bird species diversity, and species turnover rates are also provided. Most of the additional species recognized based on this revision are not of special conservation concern, and the number of threatened South Asian species will probably only increase from 6% to about 7%.

## 126 Jones, Kennedy & Zink

Evolutionary history of Philippine populations in two widespread passerines. ANDREW W. JONES, *Bell Mus. Nat. Hist., Univ. Minnesota, MN*; ROBERT S. KENNEDY, *Maria Mitchell Assoc., Nantucket, MA*; and ROBERT M. ZINK, *Bell Mus. Nat. Hist.*

The Philippine avifauna is one of the most diverse and endangered in the world, yet little is known regarding its evolutionary history. To investigate colonization and diversification patterns in the Philippines, we are documenting phylogeographic themes in multiple co-distributed species. We sequenced 2 regions of the mitochondrial genome (ND2, Control region) from multiple individuals of 2 species. Both species (*Brachypteryx montana* and *Phylloscopus trivirgatus*) are widespread southeast Asian species which are found throughout the Philippines, and demonstrate little morphological diversity. Phylogenetic trees based on DNA datasets show that both species are composed of multiple phylogroups. The groups reflect geologic history, with one clade in the central Visayas (Panay and Negros) and another in Mindanao. *B. montana* also has a third clade restricted to Luzon. The relationship of these distributions to Pleistocene sea level changes will be discussed, with supporting evidence from coalescence analyses.

## 127 Moyle

A re-examination of trogon relationships using nuclear and mitochondrial DNA sequence data. ROBERT G. MOYLE, *Am. Mus. Nat. Hist., New York, NY*.

Basal relationships of trogons are of great biogeographic interest because of the family's disjunct tropical distribution. The only modern molecular study of trogon systematics (Espinosa de los Monteiros 1998, *Auk* 115: 937-954) clarified relationships within genera but failed to provide deep resolution in the phylogeny. To re-examine basal relationships of the trogons, I produced an independent data set consisting of nuclear (RAG1) and mitochondrial (ND2) DNA sequences totaling over 3,800 base pairs. Most significantly, these data do not support monophyly of New World trogons. Quetzals (*Pharomachrus*) are not closely related to the genus *Trogon*. However, even the inclusion of slowly evolving nuclear DNA sequence data did not fully resolve trogon phylogeny. For example, affinities of the Cuban Trogon (*Priotelus temnurus*) remain ambiguous. Confounding factors included short internodes and lack of a close outgroup for rooting the tree. Biogeographic interpretations, especially pantropical inferences, must be re-visited in light of this new data.

## 128 Proudfoot, Honeycutt & Slack

Sex ratios and sexual dimorphism in nestling Ferruginous Pygmy-Owls. GLENN A. PROUDFOOT, RODNEY L. HONEYCUTT and R. DOUGLAS SLACK, *Dept. Wildl. & Fish. Sci., Texas A&M Univ., College Station, TX*.

From 1999 to 2002, we used molecular markers developed for the CHD-W and CHD-Z genes in birds to determine nestling sex ratios in Ferruginous Pygmy-Owls. We examined 218 chicks from 81 nests in Arizona (n = 22), Texas (n = 44), and Sonora, Mexico (n = 15). Sex ratio did not deviate from 50 : 50. However, nestling mass showed strong sexual dimorphism, females were significantly larger than males. When nestlings were sexed using variation in feather color, there was a 93% agreement between DNA analysis and feather color techniques. Although strong sexual dimorphism occurs in both adult and nestling Ferruginous Pygmy-Owls, our results do not support modification of offspring sex ratios as suggested by Trivers & Willard (1973, *Science* 179: 90-92), however, do support the hypothesis proposed by Fisher (1930, **Genetical theory of natural selection**), 50 : 50 sex ratio at the population level. In addition to answering a basic biological question regarding Ferruginous Pygmy-Owl sex ratios, our study may provide researchers and management agencies a new tool for sexing nestling Ferruginous Pygmy-Owls.

## 129 Rompre & Robinson

Parental behavior at nests of two tropical forest suboscines, Chestnut-backed (*Myrmeciza exsul*) and Spotted (*Hylophylax naevioides*) antbirds. GHISLAIN ROMPRE, *Dept. Biol. Sci., Auburn Univ., Auburn, AL*; and W. DOUGLAS ROBINSON, *Dept. Fish. & Wildl., Oregon State Univ., Corvallis, OR*.

Antbirds are known to have biparental care, but few efforts have been made to quantify the roles that males and females play in incubation and offspring care. Several hypotheses suggest that high nest predation risk should influence the behavior of birds near nests. In particular, adults are predicted by Skutch's hypothesis to reduce activity around nests so that visual predators are less likely to locate a nest.

We used continuous video monitoring to measure nest attendance and parental behavior of 2 species of antbird on Barro Colorado Island (BCI), Panama. Nests of both species were attended up to 95% of the time during incubation. Both sexes incubated during the day, but females incubated at night. Duration of incubation increased with age of the eggs, beginning as low as 25% of the day in the first few days after clutch completion and plateauing at 95% of the day in the last few days before hatching. We hypothesize that in high predation environments, risk of egg loss may be highest in the first days after laying and birds may reduce investment into incubation until eggs survive for 5 d and presumably then have a higher chance of escaping predation. The higher early risk of predation may be due to frequent trips to the nest site during nest-building.

### **130 vacant**

### **131 Marzluff, Leu & Raphael**

Modeling the risk of nest predation: accounting for little variation can produce reliable results. JOHN M. MARZLUFF, *Coll. For. Res., Univ. Washington, Seattle, WA*, MATTHIAS LEU, *USGS, Boise, ID*, and MARTIN G. RAPHAEL, *USDA For. Ser., Olympia, WA*.

Nest predation is an important limiting factor for many birds that is influenced by local and landscape attributes (e.g., vegetation structure, presence of humans). To understand how such factors affected nest predation on the canopy-nesting, threatened Marbled Murrelet, we placed over 1000 simulated nests in 45 forested plots during a 5-yr research project on Washington's Olympic Peninsula. We accounted for 27% of the variation in rate of predation with 3 landscape-level variables (patch density within 5 km of the study stand, contrast-weighted edge density within 2 km of the stand, and Shannon-Weaver evenness of patch types within 2 km of the stand). Despite accounting for a minority of the variation in predation, this model was extremely reliable at predicting the risk of predation to canopy and shrub nesting birds over a large area. In a subsequent 3-yr-long experiment, we projected the risk of predation across the w. Olympic Peninsula and successfully predicted variation in avian and mammalian nest predators, fate of simulated nests, and fate of real songbird nests. Our model's reliability likely increased because we included annual, landscape-specific, and content-specific sources of variation in our measurement of predation. Models of complex phenomena like nest predation rarely account for substantial variation in the response variable, but if substantial natural variation is included during the study, the results may be reliable.

### **132 Stake, Thompson & Faaborg**

Golden-cheeked Warbler nest predators and factors affecting nest predation. MIKE M. STAKE, *Dept. Fish. & Wildl. Sci., Univ. Missouri, Columbia, MO*, FRANK R. THOMPSON, III, *USDA For. Ser., North Central Res. Sta., Columbia, MO*, and JOHN FAABORG, *Div. Biol. Sci., Univ. Missouri, Columbia, MO*.

We monitored 67 Golden-cheeked Warbler nests with infrared video cameras and time-lapse recorders to identify predators and evaluate potential factors associated with predation. Video proved to be an effective method of monitoring because all but 1 of 25 predators were identified and only 2 nests (3%) were abandoned. Rat snakes (*Elaphe* spp.) were the most frequent predators, depredating 12 nests and capturing 3 adult females. A variety of avian predators depredated 7 nests, including American Crows, Brown-headed Cowbirds, a Western Scrub-Jay, and a Cooper's Hawk. Fox squirrels (*Sciurus niger*), the only mammalian predators we recorded, depredated 4 nests, and fire ants (*Solenopsis invicta*) depredated one. Post-outcome recordings (i.e., after young fledged or after predators caused failure) identified Western coachwhips (*Masticophis flagellum testaceus*), mice (*Peromyscus* sp.), and a Greater Roadrunner as potential predators. We measured the effects of nest-site, territory, and temporal variables on predation by ranking a set of a priori models according to AIC values. None of our models adequately explained overall levels of nest predation, but there was some evidence that snake predation increased with date and bird predation increased on mesas versus slopes.

### **133 Robinson, Rompre & Robinson**

Predators at tropical bird nests: testing assumptions of the mesopredator release hypothesis on Barro Colorado Island, Panama. W. DOUGLAS ROBINSON, *Dept. Fish. & Wildl., Oregon State Univ., Corvallis, OR*; GHISLAIN ROMPRE, *Dept. Biol. Sci., Auburn Univ., Auburn, AL*, and TARA R. ROBINSON, *Dept. Fish. & Wildl., Oregon State Univ.*

One third of the breeding bird species present on Barro Colorado Island (BCI), Panama, 85 yr ago have disappeared from the island. Most of the missing species foraged and nested near the ground. A longstanding explanation for the extinctions is that the island is too small to support normal populations of top predators, thus releasing from predation pressure populations of middle-sized mammals (mesopredators) that consume eggs and nestlings of songbirds, especially those songbirds nesting near the ground. The mesopredator release hypothesis has become a textbook explanation for the local extinction of birds in tropical forest remnants like BCI. Several assumptions of the hypothesis remain untested. First, are medium-sized mammals the primary predators of songbird nests? Second, are real nests depredated more often on BCI than in nearby mainland forest with a complete predator community? We monitored antbird nests on BCI and the mainland to compare predation rates and to identify predators. Nest predation was greater on BCI for only 1 of 4 antbird species. In 80% of cases, nest predators were snakes rather than mammals. Our results weaken mesopredator release, at least in its classical sense, as a valid explanation for bird extinctions on BCI.

### 134 Townsend & Anderson

A long-term assessment of the costs of reproduction using multi-state mark-recapture models. HOWARD TOWNSEND and DAVID J. ANDERSON, *Dept. Biol. Wake Forest Univ., Winston-Salem, NC.*

We used a long-term population band-resight survey database, a reproduction-monitoring database, and multi-state mark-recapture analysis to assess the costs of reproduction in Nazca Boobies (*Sula granti*) from Punta Cevallos, Isla Española, Galápagos, Ecuador. We merged reproductive state for banded adult Nazca Boobies from 1992 - 2000 with band-resight survey data for the same period to generate histories of the reproductive state reached by each bird during each breeding season in the monitoring period. Survival probabilities and state transition probabilities were modeled from the histories using multi-state mark recapture models; we compared models that included state-specific differences in survival and transition probabilities as well as models with a sex and state-specific effects. Models that included only state-specific effects were used to ascertain costs of reproduction. Those that included state- and sex-specific effects tested the hypothesis by Trivers (pp 136-179 in Campbell, **Sexual selection and the descent of man**. Aldine Press, Chicago), i.e., a male-biased sex ratio is expected for populations of monogamous birds that exhibit biparental care, because of the higher levels of parental investment by females. The optimal-fit model indicates that survival and transition probabilities are attributable to reproductive state. Differences in survival and transition probabilities associated with reproductive state provide evidence for survival and fecundity costs of reproduction; however, these differences are observed in some breeding seasons but not in others. These results indicate that temporal variability in the environment may confound efforts to measure costs of reproduction. Although a male biased sex ratio is observed in this population of Nazca Boobies, models of state and sex-specific survival and transition probabilities are not supported.

### 135 Rivers

An investigation of the proximate factors that influence begging behavior in nestling Brown-headed Cowbirds. JAMES W. RIVERS, *Dept. Ecol., Evol. & Marine Biol., Univ. California, Santa Barbara, CA.*

Begging by nestling songbirds is constrained by direct and indirect costs. Brood parasites are exceptional because their begging is constrained only by direct costs as they are provisioned by and compete against unrelated individuals. In generalist brood parasites, it is unclear if individuals adjust their begging rate to minimize direct costs or if they adopt a single begging strategy across all hosts. I investigated how hunger level and host nestling size influence the begging behavior of Brown-headed Cowbird nestlings when age differences between nestmates are controlled. Single cowbird nestlings were paired with a smaller, similar-sized, or larger host nestling, and both nestlings were subjected to 3 feeding regimes (control, food deprived for 90 min, fed to satiation). Cowbird nestlings begged longer and more intensely than host nestmates, regardless of their hunger level or the size of their nestmate. In response to adults arriving with food, cowbird nestlings typically begged before host nestlings, and they were more

likely to be the last individual begging for a given nest visit. These results suggest that cowbird begging behavior varies in response to hunger level and that a single strategy is not employed across hosts of different sizes.

### **136 Cruz, Prather, Wiley & Weaver**

Changes in rejection behavior in Hispaniolan weavers. ALEXANDER CRUZ, JOHN W. PRATHER, JOHN W. WILEY and PABLO WEAVER, *Biol. Dept., Univ. Colorado, Boulder, CO.*

In Africa, Village Weaver (*Ploceus cucullatus*) egg rejection is thought to have evolved as a response to cuckoo (*Chrysococcyx caprius*) parasitism. Senegal weavers laying immaculate eggs have a 73% rejection of spotted weaver eggs. Weavers were introduced into Hispaniola in the 18th century, where prior to cowbird (*Molothrus bonariensis*) arrival in the 1980s there were no parasites. In 1982, we found that weavers accepted cowbird (83%) and dissimilar weaver (87.5%) eggs. These circumstances provided a "natural experiment." Has rejection increased in the presence of the pressure of parasitism by cowbirds? In 1999 - 2002, we studied rejection of dissimilar weaver and weaver eggs painted to mimic cowbird eggs. Eggs were ejected with increasing frequency as they became less similar to host eggs, suggesting that color differences and spotting allow weavers to discriminate between their own and foreign eggs. Spotting (62.5% rejection) is more important, as weaver eggs that differed in color but not spotting were not rejected more often than were mimetic eggs. However, the off-white "cowbird" eggs were sufficiently different to allow discrimination, as ejection of cowbird eggs (82.7%) was independent of the spotting pattern of host eggs. Changes in rejection behavior are compatible with an evolutionary shift in response to parasitism.

### **137 Mermoz, Fernandez & Reboreda**

Antiparasitic defenses in Brown-and-yellow Marshbirds: when coevolution between host and parasite is not enough. MYRIAM E. MERMOZ, GUSTAVO J. FERNANDEZ and JUAN C. REBOREDA, *Departamento de Ecología, Genética y Evolución, Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina.*

It is accepted that provided enough evolutionary time, hosts develop defenses against brood parasitism. We studied antiparasitic defenses of Brown-and-yellow Marshbirds, *Pseudoleistes virescens*, in an area of old sympatry with Shiny Cowbirds, *Molothrus bonariensis*. In this host, the frequency of parasitism is 70% (with half of these nests multiple parasitized) and parasitism decreases host reproductive success at a rate of 0.5 fledglings per parasitic egg. We evaluated host defenses by measuring: agonistic responses to models of a cowbird or control species, and rejection of parasitic eggs added during laying. We also evaluated host nest attention and frequency of cowbird visits during host laying. Marshbirds attacked cowbird models more frequently and intensively than control models. They rejected cowbird eggs of the white-morph (which differ from their own eggs) but accepted cowbird spotted eggs (similar to their own eggs). Besides, marshbirds did not discriminate during feeding against cowbird chicks of any age. The rate of cowbird nest inspections during host laying was 0.5 visits/hr. Although marshbirds behaved aggressively against cowbirds, during early laying they only attended the nest 30% of the time, providing cowbirds with a wide time window for parasitism. We suggest that nest attention by the pair is constrained by male mate guarding and female energetic demands.

### **138 Strausberger**

Adaptive host-specific sex ratio skews in an avian brood parasite. BILL M. STRAUSBERGER, *Field Mus., Chicago, IL.*

Theory predicts that parents manipulate offspring sex when fitness returns of sons and daughters differ. Charnov et al.'s (1981; *Nature* 289: 27-33) 'host-quality' model predicts, and data supports, that parasitoid mothers oviposit proportionally more offspring of the sex that receives the larger relative fitness for a given host. Like parasitoids, birds sometimes adaptively skew their offspring's sex ratio in response to environmental conditions. When mothers are in superior condition, or food is abundant, the more expensive sex is sometimes over-produced. Also like parasitoids, both *Molothrus* and *Cuculus* species of avian brood parasites utilize a range of host sizes resulting in a positive correlation between host and

parasitic offspring's size. Because host quality for parasitic offspring is analogous to maternal condition in typical nesting birds, and sex specific costs may vary, the possibility exists that parasitic birds skew offspring's sex in response to host type. Here I show that host species affects male and female parasitic cowbird (*M. ater*) offspring differently and that cowbird mothers facultatively adjust offspring sex. I also provide the strongest evidence to date that birds assess zygote sex and invest differently in them.

### **139 Farmer & Uyehara**

The association of cowbirds with urban land-use in a southern California forest. CHRIS FARMER, *Southern Sierra Res. Sta., Weldon, CA*, and J. C. UYEHARA, *Los Padres Natl. For., Goleta, CA*.

Brown-headed Cowbirds are a management concern in s. California due to the threat of brood parasitism. Cowbirds frequently commute between breeding and feeding areas. Cowbirds typically feed in short-grass habitat, e.g., livestock areas, agricultural fields, urban landscapes, and ungrazed grasslands. We investigated the association between cowbird occurrence and these habitat types in the Los Padres National Forest, CA. We conducted 139 morning and 101 afternoon 5-min point counts in 2002, each followed by 1-min playback of cowbird 'chatter' then a 5-min observation period. We analyzed the relationship between the distribution of cowbirds and the availability of potential feeding habitat within 1000 m and 4828 m, along with distance to livestock, using multiple logistic regression. Cowbirds occurred at few morning sites (26.6%), and at low abundance (0.388 males and 0.086 females per count) in our study area. There was no temporal difference in feeding site usage, suggesting that cowbirds were not commuting. Cowbirds were significantly more likely to occur during morning surveys at sites with a greater amount of urban habitat within 1000 m ( $P = 0.032$ ). Cowbirds were not significantly associated with any other short-grassland habitat, or the distance to livestock ( $P > 0.2$ ). Management efforts should focus on local urban land-usage, rather than on reduction of livestock grazing in this region. We are repeating this study in 2003, and will also present these results.

### **140 vacant**

### **141 Walk, Kershner & Warner**

Predation and brood parasitism of grassland bird nests near agricultural and wooded edges. JEFFERY W. WALK, ERIC L. KERSHNER and RICHARD E. WARNER, *Dept. Nat. Res. & Environ. Sci., Univ. Illinois at Urbana-Champaign, Urbana, IL*.

Nests of grassland birds near wooded edges are at greater risk of brood parasitism and nest predation than nests farther from edges. The effects of agricultural edges on grassland bird nest fate, however, are poorly understood. We monitored 1,157 nests of 4 grassland-nesting species (Dickcissel, Field Sparrow, Eastern Meadowlark, and Red-winged Blackbird) from 1996 - 2000 in a network of grasslands (3 - 148 ha) surrounded by cropland and small patches (<1 ha) of woody vegetation in se. Illinois. Field Sparrow nests <50 m from wooded edges were frequently parasitized (36%) by Brown-headed Cowbirds compared to nests farther away (0%). Few nests of other species were parasitized (<1%). Bird species and grassland age (seeded <5 yr or >15 yr) influenced nest predation; nests of Dickcissels and Red-winged Blackbirds were the most likely to be depredated, as were nests within younger grasslands. Year of study, whether nests were initiated early or late in breeding seasons, grassland area, distance to wooded edge and distance to agricultural edge did not clearly influence nest predation. In this grassland-agriculture matrix, small patch size and proximity to agricultural edges did not negatively affect nesting success of grassland birds. Our results suggest agriculture is a more appropriate landscape context for grassland bird conservation than wooded habitats.

### **142 Taft & Haig**

Influence of wetland distribution on wintering shorebirds in an agricultural landscape. ORIANE W. TAFT and SUSAN M. HAIG, *USGS For. & Range. Ecosyst. Sci. Center, and Dept. Fish & Wildl., Oregon State Univ., Corvallis, OR*.

Spatial configuration of wetlands may influence how highly mobile species such as shorebirds

interact with the heterogeneous landscapes in which they winter. Although choice of foraging sites may be affected by local characteristics, location of sites relative to other available habitat in the landscape may be of key importance in determining use. In Oregon's Willamette Valley, a ~4500 km<sup>2</sup> landscape of dispersed agricultural and impounded wetlands, we hypothesized that disproportionate attraction to regions with high density of wetlands would be manifested in how shorebirds used individual sites. Thus, we addressed how use of sites by wintering Dunlin and Killdeer was related to local (percent substrate exposed; area of wet habitat) as well as surrounding landscape features (area of available wetland habitat in a species-defined radius around site; distance to nearest roost) over 2 winters of differing rainfall (Nov - Mar, 1999 - 2000, 2000 - 2001). We conducted weekly surveys for shorebird presence and abundance, site conditions, and collected spatial data from remotely-sensed imagery and ground mapping efforts. To find the best predictors of site use, we took an information-theoretic approach (AICc), validating competing models by running analyses on multiple data subsets. Results suggest that landscape features are most influential in dry years when habitat is scarce across the landscape. Implications for restoration and management within wetland landscapes are also discussed.

### **143 Dykstra, Hays, Simon & Daniel**

Behavior and prey of suburban-nesting Red-shouldered Hawks in southwestern Ohio. CHERYL R. DYKSTRA, *USEPA, Cincinnati, OH*, JEFFREY L. HAYS, *RAPTOR Inc., Cincinnati, OH*, MELINDA M. SIMON, *Cincinnati, OH*, and F. BERNARD DANIEL, *USEPA, Cincinnati, OH*.

We used direct observations to quantify prey types, prey delivery rate, and adult and nestling behavior at nests of Red-shouldered Hawks. We observed 21 nests for a total of 256 hr in 1997 - 2001. Small mammals made up the largest percentage of the identified prey (31.5%), followed by reptiles (22.7%), invertebrates (18.8%), amphibians (17.7%), birds (6.9%) and fish (2.5%). Hawks at nests in upland areas delivered significantly more invertebrates, primarily earthworms, than those at riparian nests ( $P = 0.001$ ). Prey delivery rate averaged  $3.4 \pm 0.6$  prey items per 4-hr observation period, or  $116 \pm 19$  g biomass per 4-hr observation period. Prey delivery rate was not correlated with the age of the nestlings ( $P > 0.05$ ). Adult attendance at the nest and time adults spent brooding nestlings decreased significantly as nestlings aged ( $P < 0.05$ ). Time adults spent feeding nestlings was negatively correlated with nestling age ( $r^2 = 0.92$ ,  $P = 0.002$ ), while time nestlings spent feeding themselves was positively correlated with nestling age ( $r^2 = 0.92$ ,  $P = 0.003$ ). These data may serve as a baseline for assessing prey delivery rates and behavior of populations of Red-shouldered Hawks throughout the lower Midwest.

### **144 Bridge**

How does intense wing molt affect diving ability in alcids? ELI S. BRIDGE, *Dept. Ecol., Evol. & Behav., Univ. Minnesota, St. Paul, MN*.

Large and medium-sized alcids have a very intense wing molt wherein many flight feathers are lost almost simultaneously and wing surface area is reduced by as much as 40%. These birds are rendered flightless during wing molt, but they still use their wings to propel themselves underwater while diving. This study asks whether reduced wing area inhibits diving ability or, as in penguins, enhances it. I addressed this question by filming captive alcids using an array of security cameras and plotting their movements in 3 dimensions. From these data I calculated swimming velocities, angles of descent, and absolute depths, which allowed me to estimate the resistance due to drag and buoyancy that must be counteracted by flapping. By incorporating the times when each wing flap was initiated and completed, I was able to estimate the amount of work expended during each flap. Initial within-bird comparisons of diving performance during and after wing molt suggested that molt leads to less powerful and more frequent flapping, implying that wing molt is a vulnerable period for many alcids wherein mobility (i.e. flight ability) and foraging ability are substantially reduced by loss of wing area.

### **145 Mills & Rising**

Autumn protogyny: do male birds play chicken? ALEX MILLS and JAMES D. RISING, *Dept. Zool., Univ. Toronto, Toronto, ON*.

Protandry, the earlier arrival of males to breeding areas, occurs in many taxa including many

migratory birds. Numerous hypotheses have been generated to explain protandry. Using autumn bird banding records, I show that protogyny, the earlier arrival of females, frequently occurs in the autumn. Autumn-protogyny is less universal and less dramatic than spring-protandry, and it appears to occur more consistently in short-distance than in long-distance migrants. In 1 species, Ruby-crowned Kinglet, it occurs in both hatch-year and adult birds. Looking at such differential migration in both spring and autumn assists in evaluating hypotheses generated only to explain protandry, a process that eliminates 5 of 7 hypotheses. The data suggest that males arrive earlier in the spring and depart later in the autumn as an indirect effect of selection operating on intrasexual male competition (rank advantage hypothesis) or as a direct effect of selection operating on a requirement for males to be present on breeding territories when females are present (mate opportunity hypothesis). In the autumn, males may "play chicken" with each other, balancing the need to protect interests for subsequent years against the costs of remaining in the north under deteriorating conditions.

#### **146 Smith, Marra & Reitsma**

Roosting behavior of the Northern Waterthrush during the non-breeding season. JOSEPH SMITH, *Dept. Biol., George Mason Univ., Fairfax, VA*; PETER P. MARRA, *Smithsonian Environ. Res. Center, Edgewater, MD*; and LEONARD R. REITSMA, *Dept. Nat. Sci., Plymouth State Coll., Plymouth, NH*.

Roosting behavior has been described for only a few species of migratory songbirds and has yet to be studied in detail. We placed radio transmitters on 100 individuals in 4 habitats during the non-breeding seasons at Roosevelt Roads Naval Station, Puerto Rico, and tracked their diurnal and nocturnal movements and patterns of habitat use. Regardless of the diurnal habitat occupied, 90% of waterthrushes moved to dense, coastal red mangrove for nocturnal roosting. The remaining 10% were more sedentary and remained within diurnal foraging habitats. Distances traveled to roost sites from diurnal foraging areas ranged from <15 m to 1.5 km. Roost site fidelity was strong, with 100% of individuals using the same roost site 1 - 2 wk later. No characteristic of roosting behavior varied by age or sex. Roosting behavior appears to be an important component of the non-breeding biology of the Northern Waterthrush and should be better understood for effective decisions regarding the conservation and management of this and similar migratory songbird species.

#### **147 Kahl & Maurer**

Effects of landscape change on Golden-winged and Blue-winged Warblers in Michigan. KATHERINE J. KAHL and BRIAN A. MAURER, *Dept. Fish. & Wildl., Michigan State Univ., East Lansing, MI*.

The objective of this research was to compare changes in landscapes over time where Golden-winged and Blue-winged Warblers were present and absent in the lower peninsula of Michigan. To do this, the landscape composition (land cover types) and landscape structure (degree of fragmentation) along Breeding Bird Survey (BBS) routes where both species were present were examined and compared to routes where they were absent in 1978, 1993, and 2000. Differences in landscape composition and structure around 46 BBS routes were compared using classified land cover data from 1978, 1993, and 2000. A GIS was used to create a 400-m buffer around BBS routes. Total area and area-perimeter ratios for 12 landscape composition and 12 landscape structure variables were calculated within each buffered area. Principal components analysis explained covariation patterns across multiple landscape composition and structure variables. Analysis of variance was used to test the significance of each principal component. Results show that both Golden-winged and Blue-winged Warblers are moving northward. Potential causes of range shift for these species may be due to increased human influence and increased fragmentation on landscapes they find favorable creating an overall more homogeneous landscape.

#### **148 Bonter & Hochachka**

The influence of landscape context on the composition of winter bird communities in New York. DAVID N. BONTER and WESLEY M. HOCHACHKA, *Lab. Ornithol., Cornell Univ., Ithaca, NY*.

While associations between landscape structure and breeding bird communities are widely studied, little attention has been paid to the response of wintering birds to landscape structure. We

investigated the distribution of 16 feeder bird species inhabiting New York State during the winter of 2002. Presence / absence data were recorded by participants in Project FeederWatch, a continent-wide survey of the abundance and distribution of birds that visit feeders. Landscape structure within 2 km of 169 FeederWatch locations was quantified in a geographical information system using 30 m resolution land cover data derived from Landsat Thematic Mapper satellite imagery. Logistic regression indicated that the presence of many species was related to land cover type, configuration and diversity. The proportion of forest in the landscape significantly impacted the presence of 10 species. Agricultural land use was positively associated with the presence of 4 species. Further, latitude impacted the presence of 10 species, with the likelihood of detection decreasing further north for 8 of these species.

### **149 Vetter & Lima**

Marsh bird occurrence in midwestern reclaimed coal mines. WILLIAM E. VETTER and STEVEN L. LIMA, *Dept. Life Sci., Indiana State Univ., Terre Haute, IN.*

The reclaimed coal mines of sw. Indiana harbor many birds whose global populations have declined in recent decades. This includes many marsh birds whose decline primarily reflects the loss of wetland habitat. Reclaimed mines are of particular importance since they contain proportionally more wetland habitat than the surrounding agricultural landscape. Survey data from the 2002 and 2003 breeding season demonstrates that many marsh bird species utilize the wetlands present in the mines. Using broadcast vocalizations of 12 marsh bird species and passive point counts, we surveyed over 90 points in the Universal Mine (Vermillion Co.) and Chinook Mine (Clay and Vigo Co.) and recorded 10 different species. Temporal variation of some species indicated use of these sites as migratory stopovers, especially for Marsh Wrens, American Coots, and Common Moorhens. Several other species used these sites for breeding habitat. We detailed evidence of probable breeding for King Rails, Virginia Rails, and American Bitterns and confirmed breeding in Soras, Pied-billed Grebes, Green Herons and Least Bitterns. Landscape-level analyses of these occurrences indicated higher species abundance in reclaimed mine wetlands than in wetlands in the surrounding landscape and suggested (within mines) a higher diversity in wetland complexes rather than isolated wetlands.

### **150 Roth, Lima & Vetter**

Predictability of daily movements and the use of space by wintering *Accipiter* hawks. TIMOTHY C. ROTH II, STEVEN L. LIMA and WILLIAM E. VETTER, *Dept. Life Sci., Indiana State Univ., Terre Haute, IN.*

The predatory behavior of wintering *Accipiter* hawks is largely unknown. Even basic information such as home range size is not known. Hence, we examined the movement patterns of wintering Cooper's Hawks and Sharp-shinned Hawks to understand better their role in avian predator/prey systems. 10 Cooper's Hawks and 20 Sharp-shinned hawks were intensively radio tracked during the winters of 1999 - 2001 and 2001 - 2003, respectively, in and around Terre Haute, IN. Cooper's Hawks dominated the urban/suburban environs and ranged on average over 7.6 km<sup>2</sup> (95% kernel). Sharp-shinned Hawks were chiefly restricted to rural areas and ranged on average over 29.0 km<sup>2</sup>. Cooper's Hawk home ranges were relatively stable throughout the season, while Sharp-shinned Hawks shifted their core areas multiple times. Both species focused their hunting on areas with abundant, predictable prey. Sharp-shinned Hawks focused predominantly on feeders, while urban Cooper's Hawks largely avoided them. Daily use of space by both species was not significantly different from random based on a variety of spatial analyses. However, the movement of Sharp-shinned Hawks tended to be more predictable due to the constraints of utilizing feeders and travel corridors. These observations indicate that *Accipiter* hunting strategies may be based largely on unpredictability.

### **151 Lima, Roth & Vetter**

Daily activity patterns in accipters and their prey: intraguild predation and low-risk feeding times for small birds. STEVEN L. LIMA, TIMOTHY C. ROTH II, and WILLIAM E. VETTER, *Dept. Life Sci., Indiana State Univ., Terre Haute, IN.*

Many small wintering birds exhibit bursts of feeding during the early and late portions of the day. The activity patterns of their main *Accipiter* predators probably influence this prey feeding pattern, but the

behavior of these hawks is virtually unknown. We thus examined the activity patterns of radio-tagged Cooper's (COHA) and Sharp-shinned hawks (SSHA) to better understand the daily feeding patterns of small wintering birds. COHA left roost before sunrise and usually terminated daily activity just after sunset. Hunting activity (attacks/hr) for these hawks was most intense during the early and late portions of the day. SSHA almost always left roost well after sunrise (often 30 min or more) and were usually back at roost 1 - 3 hr before sunset. This difference in feeding pattern may reflect the risk of intra-guild predation experienced by the smaller SSHA, which frequently fall prey to COHA: SSHA appear to avoid hunting during the times when COHAs are hunting most intensely. This, in turn, makes early and late bursts of feeding relatively risk-free for the smaller prey targeted by SSHA and largely ignored by COHA. The existence of these low-risk periods helps explain the bimodal feeding patterns in small wintering birds and thus provides an alternative to present thinking about their cause.

## 152 Kratter & Filardi

Vanuatu's endemic *Neolalage banksiana* (Buff-bellied Monarch): foraging behavior and relationships of a distinct and unique monarch. ANDREW W. KRATTER, *Florida Mus. Nat. Hist., Univ. Florida, Gainesville, FL*, and CHRISTOPHER E. FILARDI, *Burke Mus., Univ. Washington, Seattle, WA*.

*Neolalage banksiana*, a monarch endemic to Vanuatu (New Hebrides) in the south Pacific, is the only member of its genus. Morphologically, *Neolalage* differs from other monarch genera by the combination of distinct plumage (black, buff, and white), a long narrow bill, and a non-spotted juvenal plumage. Fieldwork in Vanuatu in 2002 - 2003 revealed that it has distinctive foraging behavior as well. Although previously characterized as a gleaner and occasional sallier, this insectivorous species employs an exceptionally wide variety of specialized foraging techniques, including searching dead leaves (like several Neotropical passerine genera), clambering up and hanging-sideways on trunks and large branches (like *Sitta* nuthatches), flashing its white wing and tail patches and then flutter-pursuing flushed insects (like *Myioborus* redstarts), and sally strikes to air and vegetation (like most of its monarchid brethren). To elucidate the relationships of this enigmatic genus, we compared mtDNA sequences to a sample of other monarchid taxa in Melanesia (i.e., several *Monarcha* species from different clades, *Clytorhynchus*, *Myiagra*).

## 153 Jedlicka

Foraging behavior seasonal niche shift of the Rufous-capped Warbler in a Chiapas, Mexico, coffee farm. JULIE A. JEDLICKA, *Ecol. & Evol. Biol., Univ. Michigan, Ann Arbor, MI*.

Coffee farms in Mexico, especially less intensive, high-shade farms, are important wintering locations for many migrant bird species. The annual influx of migrant species creates a potential for resource limitation and competition with local resident birds. The Rufous-capped Warbler (RCWA) is an insectivorous, common resident of coffee farms in Chiapas. I tested the hypothesis that the RCWA forages more in the coffee layer during the winter season and more in the overstory during the summer, and that they utilize different foraging techniques in coffee plants versus overstory trees. Using independent observations of RCWA foraging techniques in both summer and winter seasons, I found a significant difference in plant species utilization between seasons, such that the RCWA forages more in the coffee during the winter when migrant bird species are present. Furthermore foraging maneuvers in coffee were significantly different than those in overstory species, suggesting behavioral as well as resource niche shifts in the presence of migrant bird species.

## 154 Bruce

The diet and ecology of Laughing Falcons in Belize. TABATHA A. BRUCE, *Dept. Ecol. & Evol. Biol., Cornell Univ., Ithaca, NY*.

This research represents only the second careful study of the Laughing Falcon, a neotropical snake specialist. In 2002 and 2003, nest sites were located and observed in the Rio Bravo Conservation and Management Area, Belize. Extensive diet data were gathered using digiscoping. Efforts were made to understand the Laughing Falcon's foraging abilities and habitat use by identification of prey species. Additional findings of interest include novel nest-site selections and behavior not previously recorded for

Laughing Falcons.

### **155 Koenig & Liebhold**

Bird populations and the periodical cicada problem. WALT KOENIG, *Hastings Res., Univ. California Berkeley, Carmel Valley, CA*, and SANDY LIEBHOLD, *USDA For. Ser., Northeastern Res. Sta., Morgantown, WV*.

The extraordinarily long life cycle, synchronous emergences, and complex geographical distribution of periodical cicadas (*Magicicada* spp.) in e. North America represent one of the most enduring problems in ecology and evolutionary biology. Predator satiation is universally assumed to have been a critical selective factor in these phenomena, but no prior study has examined this hypothesis by investigating the dynamics of actual predator populations over the length of periodical cicada cycles. Using 37 yr of North American Breeding Bird Surveys, we show that cicada emergences have significant effects on the dynamics of the overall densities of 15 species of insectivorous birds known to depredate *Magicicada*. Avian populations within the range of 13-yr broods exhibit a significant numerical response to cicada emergences after which they suffer a steep decline, reaching a nadir 4 yr post-emergence. They then undergo a slow recovery to above-average densities 11- and 12-yr post-emergence followed by a secondary crash, resulting in low densities of predators during the emergence year itself. This indicates that periodical cicada emergences have long-term effects on populations of avian predators. It also suggests an ecological pattern favoring both 13-yr over shorter life-cycles and the subsequent evolution of a single developmental jump to a 17-yr life-cycle.

### **156 Schmidt**

Linking frequencies of acorn masting in temperate forests to long-term growth rates in the Veery. KENNETH A SCHMIDT, *Dept. Biol. Sci., Texas Tech Univ., Lubbock, TX*.

Many terrestrial ecosystems are characterized by intermittent production of abundant resources for consumers, termed pulsed resources. The impact of resource pulses on populations downwind of the initial pulse are only beginning to be characterized, while the relationship between the frequencies of pulses and the long-term growth rate of affected species is unknown. I monitored the reproductive success of Veeries breeding in oak-dominated forest in se. New York State from 1998 to 2002. During this time Veeries experienced high interannual variability in growth rates as a consequence of trophic cascades stemming from pulsed production of acorns. Rodent populations that benefitted from acorns also depredated Veery nests, while raptors that increased in response to rodent outbreaks are major predators on adult and juvenile birds. Veeries may recoup losses following low to moderate acorn crops that lead to rodent population declines. Thus, Veeries fluctuated between years of positive and negative growth rate; however, long-term population trends cannot be made until the frequency of various year types is characterized. I simulated long-term growth rates using reproductive parameters estimated from field studies and survivorship data from the literature. Simulations suggest that variability in the frequency of masting events in oaks can lead to ~10% fluctuation in long-term growth rates in Veeries. These studies suggest that temporal variability in masting dynamics has the potential to substantially influence songbird population trends.

### **157 Benson**

Does arthropod abundance explain variation in habitat use by breeding riparian songbirds? THOMAS J. BENSON, *Dept. Nat. Resour. Ecol. & Manage., Iowa State Univ., Ames, IA*.

Studies of songbird-habitat relationships seldom account for the potential influences of food resource abundance. Yet, as the primary food source for songbirds during the breeding season, arthropods represent a potentially important habitat feature. In the breeding seasons of 2001 and 2002, I collected data on bird abundance, vegetation structure and composition, and the abundance of different orders and size classes of arthropods in restored grasslands and seasonal wetlands along the Iowa River in east-central Iowa. I predicted that songbird abundance and species richness would be positively associated with arthropod abundance. Arthropod abundance data significantly improved habitat models for bird species richness, total bird abundance, and abundances of Dickcissels, Common Yellowthroats,

Sedge Wrens, and Red-winged Blackbirds. Models incorporating arthropod size classes or the abundance of individual orders generally received more support than those including only total arthropod abundance. I conclude that models incorporating both vegetation and arthropod data can be used to better understand songbird habitat use.

## POSTERS

### 201 Martin & Wikelski

Trade-offs between molt and immune activity in north-temperate and neotropical House Sparrows. LYNN B. MARTIN II and MARTIN WIKELSKI, *Dept. Ecol. & Evol. Biol., Princeton Univ., Princeton, NJ.*

Molt and immune defense are costly activities in which all birds must invest. Investment strategies between immune defense and molt may change with latitude however, as optimal allocations will vary depending on local ecological conditions. I found evidence for trade-offs between molt and cell-mediated immune activity (using phytohemagglutinin (PHA-P)) in House Sparrows from both neotropical (Panama) and north-temperate (New Jersey) populations maintained in benign, common garden conditions for 16 mon. Immune responses during molt were significantly lower than responses during the non-breeding season. Furthermore, the more wing and tail feathers a bird was molting, the weaker cell-mediated immune response it had. Induced immune activity also affected molt rate: PHA-injected birds had significantly fewer growing feathers 2 wk after challenge compared to saline-injected control birds. Latitude of residence had no effect on molt rate or immune responses during molt. However, House Sparrows from New Jersey showed a much greater increase in immune activity from the molting season to the non-breeding season than did sparrows from Panama, implying that the demands of molt for north-temperate birds are greater than for Neotropical birds. In sum, these results suggest that birds face trade-offs between feather regeneration and self-defense and that latitude of residence may influence the degree of these trade-offs.

### 202 Pless, Martin & Wikelski

Parasite load in House Sparrows. MONICA I PLESS, LYNN B MARTIN II, and MARTIN WIKELSKI, *Ecol. & Evol. Bio. Dept., Princeton Univ., Princeton, NJ.*

Life history strategies differ strongly between neotropical and north-temperate birds ; possibly reflecting resource allocation shifts between reproduction and survival. Differences in parasite pressure may be responsible for these allocation decisions. Here, I report that wild, north-temperate house sparrows had significantly higher seasonal variation in ectoparasites than neotropical house sparrows. North-temperate house sparrows also had significantly higher ectoparasite loads in the early breeding season than neotropical House Sparrows. Although birds from the 2 latitudes had similar intracellular blood parasite loads during the breeding season, north-temperate birds were clear of infection over the winter. In an 18-mon common garden experiment, I found that both north-temperate and neotropical house sparrows could reduce their blood parasite loads to undetectable levels, suggesting that all sparrows can clear parasites under benign conditions when re-infection is unlikely. All sparrows cleared infections under captive conditions, but only north-temperate sparrows showed this clearance in the wild. Our results thus show that parasite threat varies between latitudes, but in a different pattern throughout the year. Furthermore, our results imply that neotropical birds may maintain low level infections year-round to avoid the high costs of parasite defense and benefit from cross-immunity to other parasites. In sum, our data suggest that parasites could play a role in shaping passerine life histories, especially because of seasonal variation in climate across latitudes.

### 203 Walk, Kershner & Warner

Habitat use by Eastern Meadowlarks and Dickcissels in a grassland-agriculture landscape. JEFFERY W.

WALK, ERIC L. KERSHNER and RICHARD E. WARNER, *Dept. Nat. Res. & Environ. Sci., Univ. Illinois at Urbana-Champaign, Urbana, IL.*

We used radio-telemetry to determine habitat use by breeding female Dickcissels and Eastern Meadowlarks and by fledgling Eastern Meadowlarks at Prairie Ridge State Natural Area, Jasper Co., Illinois, in 1999 and 2000. Habitat use by females of both species varied with the nest cycle. All nests were placed within grassland, and during incubation, females were located primarily in grassland habitat. While females were provisioning nestlings or recently-fledged young, most (71% to 88%) utilized cropland and were observed carrying invertebrate prey from cropland to young birds within grasslands. Adult birds preferred soybeans over corn (the 2 predominant agricultural land uses in the region). Juvenile Eastern Meadowlarks were found in grassland habitat almost exclusively for the first 2 wk after fledging, likely due to their limited mobility, but moved into agricultural fields as they dispersed from nest sites. After becoming independent of adults, juvenile meadowlarks exhibited preference for soybeans, grassland and hay, and avoidance of corn. Synergistic interactions between grassland wildlife and agriculture present opportunity for conservation action. Nesting birds may be significant predators of economically important crop pests, and agricultural practices can greatly affect the quality, quantity and accessibility of resources in cropland adjacent to grassland nesting areas.

#### **204 Morris, Covino, Mattern, Mustillo, Larracuenta, Liebner & Sheets**

They're staying how long? Uncertainties about stopover duration of migrant songbirds. SARA R. MORRIS, KRISTEN M. COVINO, KATHRYN E. MATTERN, MELISSA S. MUSTILLO, AMANDA M. LARRACUENTE, DAVID A. LIEBNER, *Biol. Dept., Canisius Coll., Buffalo, NY*, and H. DAVID SHEETS, *Physics Dept., Canisius Coll.*

The length of time that migrants stay at stopover sites will affect the total length of migration and may affect the ability of birds to obtain quality territories. However, estimating stopover has proven difficult. Minimum stopover, the time between first and last capture, is a conservative statistical estimate of the length of time birds spend at a stopover site, but this estimate only includes recaptured individuals, rather than the entire population sampled. Open population models incorporate all individuals, but require the numerical fitting of complex models to the observed capture histories to produce estimates of the stopover duration. Furthermore, the utility of these models is influenced by the number of individuals captured, the recapture rate, and the length of the trapping period. We examine factors that might contribute to the variation in stopover estimates, including the effects of sample size, the capture history (e.g., the number of days in the capture history, the number of recaptures, and the recapture rate), and the number of parameters estimated in an open population model. We also compare the variation in stopover estimates obtained using these 2 approaches.

#### **205 Kostecke, Ellison & Summers**

Continued expansion of Bronzed Cowbird breeding range. RICHARD M. KOSTECKE, *The Nature Conservancy of Texas, Fort Hood, TX*; KEVIN ELLISON, *Dept. Zool., Univ. Manitoba, Winnipeg, MB*; and SCOTT G. SUMMERS, *The Nature Conservancy of Texas*.

Bronzed Cowbirds continue to expand their U.S. range. In Texas, breeding has been documented as far north as Lubbock and the northern edge of the Edwards Plateau. In general, an exponential increase in area occupied over time has occurred. Rate of spread has been constant in New Mexico, averaging 12.72 km/yr. In Texas, spread was more rapid post-1956, occurring at a mean rate of 13.75 km/yr. Pre-1956, spread occurred at a rate of 6.22 km/yr. More rapid spread post-1956 is likely attributable to favorable, human-induced habitat changes. Potential for further northward spread exists. Observational and trapping data indicate increasing populations at the northern limits of their range in Texas. Fat indices of birds trapped during spring at the northern limits of their range in Texas were relatively high ( $3.11 \pm 1.13$ ), suggesting the potential for further northward migration. Assuming continuous flight, we estimate that these birds could have migrated 406 km further north. Continued range expansion should be carefully monitored as the Bronzed Cowbird, a generalist brood parasite, may elevate risk of songbird nest failure, particularly in areas where they are sympatric with other cowbird species.

## 206 Funk

Similarities in play behaviors in some mammals and birds. MILDRED FUNK, *Biol. Dept., Roosevelt Univ., Chicago, IL.*

Play has been described in many mammals and birds and, as is true with humans, it is the young that spend the most time playing. The young have the most to learn, about themselves, about others and about their environment. Although the 2 taxonomic classes are separated by a long evolutionary history and have contrasting modes of birth, locomotion and morphology, their development has many parallels. I noted the play behaviors of 2 broods of young Yellow-crowned Parakeets (who were also successfully performing on many developmental tasks designed for human infants (Funk 1996a, **Anim. Learn. & Behav.** 24: 375-383; 1996b, **Bird Behav.** 11: 91-104; 2002, **Anim. Cognit.** 5: 167-176). In this poster, I give examples of the parakeets' spontaneous play behaviors (e.g., doing somersaults, using swings, tug-of-war, repetitive dropping and monitoring objects) that were also similar to those described in human infants and nonhuman primates. The parallels in play and on the tasks are probably due to ecological pressures on the maturation of birds and mammals. In many species of both taxonomic groups, the young build strength through exercise and diet, note how parents react to novel objects and various environmental stimuli, meet conspecifics and interact with them, and avoid danger through escape or flight. Play offers opportunities to learn and practice these skills even though play is not done for learning; it is done for pleasure. However, many species in both classes show differences in play because of species differences in competencies and flexibility and "style".

## 207 Dolby, Temple, Williams, Dilger, Stechler & Davis

Nocturnal thermoregulation in the White-throated Sparrow. ANDREW S. DOLBY, JOHN G. TEMPLE, LAURA E. WILLIAMS, EMILY A DILGER, KATRINA M. STECHLER and VANESSA S. DAVIS, *Dept. Biol. Sci., Mary Washington Coll., Fredericksburg, VA.*

Shallow nocturnal hypothermia has been observed in a number of passerine families. Use of this energy saving strategy by members of family Emberizidae, however, has been little investigated under field conditions. We used temperature-sensitive radio-transmitters to determine whether White-throated Sparrows employ nocturnal hypothermia during winter. We obtained skin temperature measurements on 24 free-ranging sparrows between 13:00 and 14:00 hr and between 02:00 and 03:00 hr for 3 d and nights per subject. The average nightly skin temperature reduction per individual was 3.44° C (SD = 0.96). Thirteen sparrows reduced their skin temperatures by an average of > 3° C. The maximum single temperature reduction observed was 7.0° C. White-throated Sparrows, therefore, exhibit variation in use of nocturnal hypothermia, an observation that deserves further exploration. We found a significant negative correlation between magnitude of skin temperature reduction and nighttime ambient temperature. Additionally, we found a marginally significant negative correlation (P = 0.06) between depth of hypothermia and a physical condition index calculated by dividing each subject's body mass by the cube of its wing chord length. We did not find a statistical interaction between the effects of ambient temperature and physical condition.

## 208 Brown, Urban, Russell & Russell

Why do birds breed as early as they can? JERRAM L. BROWN, JULIE URBAN, STEPHEN M. RUSSELL and RUTH O. RUSSELL, *Dept. Biol. Sci., University at Albany, Albany, NY.*

Interest in breeding seasons has been reawakened by the potential influence of global warming on spring phenology. Breeding seasons are believed to have evolved by selection to maximize the fitness of the mother by timing the brood for the period when food for nestlings is most abundant (Lack, Perrins), thus favoring the season that maximizes production of fledglings. Parental fitness also depends, however, on survival of those young to maturity, which is rarely estimated. We test the hypotheses that annual survival of early broods is better than that of late broods and that this advantage depends on higher overwinter survival of young in the Mexican Jay. We observed survival of individually color-banded nestlings from fledging to the next 1 May in the Chiricahua Mts of Arizona, 1969 - 2002 and to 1 Oct in 1983 - 1990. Analysis was based on logistic regression. Fledglings from early first broods survived to next May in significantly higher proportions than those from later first broods or from second broods. The

advantage of early broods was present from fledging to spring and from fall to spring but not from fledging to fall. The effect of breeding date on survival thus depended mainly on events during winter. Our results suggest that post-fledging survival is critical for the advantage of early broods and that winter may be the period of greatest importance with regard to the advantage of early breeding.

## 209 Mack & Wright

Have avian frugivores evolutionarily affected the size of fleshy fruits? A study from Papua New Guinea. ANDREW L. MACK and DEBRA D. WRIGHT, *Wildlife Conservation Society, NY*.

The shapes of fleshy fruits have presumably evolved in response to selection exerted by frugivores that disperse seeds and thereby increase plant fitness. It has been hypothesized that gape limitation among birds that swallow whole fruits will evolutionarily affect fruit shape. We examined this adaptive allometry hypothesis (Mazer & Wheelwright 1993, **Evol. Ecol.** 7: 556-575) with morphology data from 400 fruit species from Crater Mountain, Papua New Guinea. Using reduced major axis regression and testing by family, fruit type or all species pooled, we found no evidence for the first prediction of negative allometry (fruits should tend to become more oblong with increasing size). All slopes were close to 1.0 and the 95% confidence intervals broadly overlapped 1.0. The second prediction, that variance in diameter would diminish as fruits become larger, was also not supported. Additionally, the coefficient of variation was not smaller in more oblong fruits. There is little evidence in this flora to support the adaptive allometry hypothesis. Possibly the presence of effective dispersers that are not gape limited because of their large size, like cassowaries and hornbills, and the presence of flying foxes which are not gape-limited override any subtle evolutionary effect exerted by smaller frugivorous birds.

## 210 Bowie, Fjeldså, Hackett & Crowe

Phylogeography of the Olive Sunbird throughout Africa. RAURI C. K. BOWIE, *Percy FitzPatrick Inst., Univ. Cape Town, Cape Town, South Africa and Dept. Zool., Univ. Stellenbosch, Matieland*, JON FJELDSÅ, *Zool. Mus., Univ. Copenhagen, Copenhagen, Denmark*, SHANNON J. HACKETT, *Zool. Dept. Field Mus. Nat. Hist., Chicago, IL*, and TIMOTHY M. CROWE, *Percy FitzPatrick Inst.*

The present study constitutes the first investigation of the phylogeographic structure of a forest bird distributed throughout the montane and lowland forest biomes of Africa. Its key objective is to investigate the importance of Pleistocene climatic cycles on avian diversification across Africa. The Olive Sunbird is a relatively large polytypic sunbird widely distributed throughout evergreen, montane and coastal forests in Africa. Recently, it was split into 2 species, the Eastern Olive Sunbird *N. olivacea* and the Western Olive Sunbird *N. obscura*. The basis for this split is derived from the presence or absence of large yellow pectoral tufts in females. A 395 bp fragment of the mtDNA NADH subunit 3 gene with flanking tRNA sequences was obtained from 282 individuals, 196 from *N. olivacea* and 86 from *N. obscura*, respectively. A relatively high frequency of haplotypes (19.5%) was identified. However, genetic divergence levels were low. Across some 9000 km, from Ghana in the northwest of Africa to KwaZulu-Natal in e. South Africa, genetic divergence levels were of the order of 1.0 to 2.4%. Neither currently recognized Olive Sunbird species, Eastern Olive Sunbird *Nectarinia olivacea* and Western Olive Sunbird *N. obscura*, was monophyletic using any of 3 tree-building methods. Instead, genetic diversity within the *N. olivacea/obscura* complex was dominated by 3 star-like phylogenies linked to each other by a single mutational step and 2 subnetworks (IV and V) separated from the core star-like phylogenies (subnetworks I, II and III) by 5 to 6 mutational steps. The dominant evolutionary mechanism shaping genetic variation within the *N. olivacea/obscura* complex as identified by nested-clade analyses appears to be one of range expansion, associated with a period of rapid-forest during the mid-Pleistocene, some 15 - 1.2 million yr ago. Mismatch profiles suggested that secondary contact has occurred between eastern and western lineages within the Ufipa Escarpment and possibly Zimbabwe, as well as between eastern lineages in the Kenyan Highlands and northern Eastern Arc.

## 211 Gjerdrum, Elphick & Rubega

Molt in *Ammodramus* sparrows: differences among species, sexes and sites. CARINA GJERDRUM, CHRIS ELPHICK and MARGARET RUBEGA, *Ecol., Evol. Biol., Univ. Connecticut, Storrs CT*.

We examined the timing of prebasic molt in relation to migration timing for 3 species of saltmarsh-breeding *Ammodramus* sparrows. Saltmarsh Sharp-tailed Sparrows (*A. cauducutus*) bred at all 3 study sites in Connecticut and most birds apparently underwent complete molt before fall migration. On average, flight feather molt was initiated on 14 Aug and lasted 52 d, ending on 5 Oct. Body molt followed approximately the same schedule. Males initiated flight feather molt significantly earlier than females, but there was no difference in their rate of molt. Birds initiated molt significantly later at our smallest marsh, and the rate of molt at this site was increased. Seaside Sparrows (*A. maritimus*) bred at 2 of our 3 study sites and in general, left the breeding grounds before the onset of molt. Nelson's Sharp-tailed Sparrows (*A. nelsoni*) do not breed in Connecticut and were only caught during fall migration, and arrived with new flight and body feathers. We discuss the scheduling of molt and how it fits in to the annual cycle of these 3 closely related species.

## **212 Elphick, Gjerdrum, Rubega & Comins**

Point counts accurately reflect sparrow abundance, but not breeding success. CHRIS ELPHICK, CARINA GJERDRUM, MARGARET RUBEGA, *Ecol., Evol. Biol., Univ. Connecticut, Storrs CT*, and PATRICK COMINS, *Audubon Connecticut, Southbury, CT*.

Point counts are commonly used to index bird population sizes, document trends, and describe habitat use. Point counts, however, are not ideal for all species and may be unsuitable for those with certain traits. For example, since point counts rely largely on the detection of singing birds they may be inappropriate for Saltmarsh Sharp-tailed Sparrows, in which males are polygynous and non-territorial. On the other hand, point counts might be expected to provide good information about seaside sparrows, which are monogamous and territorial. To test these ideas we studied these sparrows at 3 coastal Connecticut marshes where we conducted intensive mark-recapture banding, regular nest searches, and repeated double-observer point counts in 19 1-ha plots. In total, we banded 449 Saltmarsh Sharp-tailed Sparrows and 59 Seaside Sparrows. Point counts provided a good index of the total number of sparrows caught within each plot, explaining over half the variance for Saltmarsh Sharp-tailed Sparrows and about one-fifth of the variance for seaside sparrow. Neither average point count numbers nor the number of birds banded on a plot, however, were significantly related to either the number of nests or the number of nestlings banded in a plot for either species. Based on these data, point counts appear to provide a useful index of population size, but do not identify the best breeding sites.

## **213 Rubega & Boster**

What do students learn about birds when they study ornithology? MARGARET A. RUBEGA, *Dept. Ecol. & Evol. Biol., Univ. Connecticut, Storrs, CT*, and JAMES S. BOSTER, *Dept. Anth., Univ. Connecticut*.

Undergraduate ornithology classes generally aim to provide students with a broad background in avian biology and systematics. We were interested in understanding how the content and organization of students' knowledge of birds changes as a result of taking a first course in ornithology. To assess changes in undergraduates' perception, recognition, and recall of birds, we asked students to judge the similarity among pictures of birds, to identify the birds in the pictures, and to list all the bird names they could recall in 5 min at the beginning and end of a semester-long course. We found no consistent differences in skill, and no greater agreement in judging similarity between the beginning and end of the course. In contrast, we found both consistent improvements in skill, and greater agreement (which we interpret as learning) among students in their ability to identify birds. Similarly, there were consistent differences among students in their ability to recall birds, and greater number of birds recalled at the end of the course. We also found that the order of students' recall of bird names was in greater concordance with the scientific taxonomy at the end of the semester than at the beginning.

## **214 Ray & Rubega**

Surface tension transport in Red Phalaropes. MOIRA K. RAY and MARGARET A. RUBEGA, *Dept. Ecol. & Evol. Biol., Univ. Connecticut, Storrs, CT*.

Surface tension transport (STT) is an avian feeding mechanism using the surface tension of water to transport tiny aquatic prey from bill tip to mouth. It was first documented in Red-necked Phalaropes

(Rubega & Obst 1993, **Auk** 110: 169-178), and subsequently has been shown to occur in Wilson's Phalaropes and a number of other scolopacid shorebirds (Rubega 1997, **Ibis** 139: 488-493; unpubl.). The genus *Phalaropus* consists of 3 unusually aquatic species of shorebird, and to date there have been no detailed analyses of feeding mechanics in Red Phalaropes. Using a high speed video system capturing images at 250 - 500 frames/s, we documented the use of STT in Red Phalaropes feeding on dipteran larvae. We conducted a frame by frame analysis in order to compare Red Phalarope STT performance to that of other phalaropes and scolopacid shorebirds. Red Phalaropes spread their jaws more widely during a cycle of STT, resulting in the prey-bearing drop moving farther, but without a significant increase in drop speed compared to other scolopacids eating insect larvae. Wilson's and Red Phalaropes exhibited similar drop speeds despite a 6-fold difference in the mass of prey being transported.

## 215 Anciães

Female preferences and the effect of ambient light on the display behavior of male Ilicurini Manakins (Pipridae). MARINA ANCIÃES, *Nat. Hist. Mus., Univ. Kansas, Lawrence, KS.*

The importance of ambient light (i.e., available light in the environment as a result of weather and forest geometry) in producing conspicuous visual signals used as cue for mate choice has been emphasized as a mechanism underlying the evolution of female preferences among manakins. The sensory drive hypothesis of female choice predicts that male courtship behavior should evolve to optimally stimulate the female sensory system in certain ambient light condition or backgrounds in order to facilitate mate search. I conducted continuous focal observations to assess whether male display activity and female attendance are affected by ambient light in 4 species of manakins from the tribe Ilicurini (*Corapipo altera*, *C. heteroleuca*, *C. gutturalis* and *Ilicura militaris*) with distinct geographic distributions. Males from 3 of the 4 focal species displayed with equal frequency across all observed ambient light conditions, and female attendance was equally frequent in all 4 species. These results suggest that male phenotypic plasticity has evolved to match ambient light or background pattern in only 1 species in the Ilicurini clade, and that the role of sensory drive mechanisms of sexual selection by female choice in the evolution of male plumage and display behavior across manakins can be rejected. Further comparative analyses of closely related taxa should reveal the importance of specific mechanisms in the evolution of female preferences for particular male phenotypes.

## 216 Carey

Lack of response to Brown-headed Cowbirds at the nest by female Field Sparrows in an unparasitized northeast Pennsylvania population. MICHAEL CAREY, *Dept. Biol., Univ. Scranton, Scranton, PA.*

Since 1987, I have followed the history of 809 Field Sparrow nests in a ne. Pennsylvania population; only 2 have had Brown-headed Cowbird eggs laid in them. Burhans et al (2001, **Auk** 118: 776-780) showed that, while female Field Sparrows in parasitized populations reacted aggressively to the placement of female cowbird models near the nest in the early incubation period, females in my population did not react so aggressively. Strausberger & Burhans (2001, **Auk** 118: 770-776) also reported that female Field Sparrows in their parasitized populations regularly deserted nests when cowbird were presented during nest building and egg laying. In this paper I present the responses of female Field Sparrows in my population to cowbird models placed at the nest during nest building and egg laying. In 2002, I placed cowbird models at 15 nests (1 during nest building, 7 early laying (eggs 1 - 2), 6 late laying, and 1 in incubation). Additional placements will be made in the 2003 breeding season. Thus far, the cowbird models have caused no desertions by any of the females attending these nests. In fact, in over half of the presentations, the model failed to elicit any response at all from the attending female.

## 217 Horn

Bird abundance at feeders increases with decreasing distance to cover and increasing distance from housing. DAVID JOSEPH HORN, *Dept. Biol., Aurora Univ., Aurora, IL.*

When given a choice, birds should choose to visit food sources with the lowest probability of predation. I examined the effects of distance to nearest vegetative cover and distance to nearest housing on bird abundance at feeders. The study was conducted at 4 residences in and around Aurora, IL, during

the winters of 2002 and 2003. In 2002, at each residence, 4 birdfeeders were placed 0.0, 2.5, 5.0, and 7.5 m, respectively from the nearest tree. In 2003, at each residence, 4 birdfeeders were placed 2, 4, 6, and 8 m, respectively from the nearest house. 8 species were more abundant at feeders closest to cover: Mourning Dove, Black-capped Chickadee, Northern Cardinal, White-throated Sparrow, Dark-eyed Junco, Red-winged Blackbird, House Finch, and House Sparrow. Distance to cover had no effect on abundance of American Crow and European Starling. 5 of 7 species analyzed were more abundant at the feeder 8 m away from a house compared to 2 m away: Mourning Dove, European Starling, Northern Cardinal, House Finch, and House Sparrow. Distance to house had no effect on Black-capped Chickadee and Dark-eyed Junco. Birdfeeders placed closer to cover or farther from a house will have more birds than feeders farther away when birds are given a choice.

## 218 Berg

\* A test of sex ratio biasing in the White-throated Magpie-Jay, a cooperative breeder with female helpers. ELENA C. BERG, *Center Animal Behav., Univ. California, Davis, CA.*

Recent studies suggest that many bird species are able to vary the sex ratio of their young. Among cooperative breeders, in which adult "helpers" aid the genetic parents in the rearing of young, 2 models have been invoked to explain this variation. According to the local resource competition (LRC) hypothesis, parents should bias offspring sex ratios towards the dispersing sex in order to minimize competition for local resources. In contrast, the local resource enhancement (LRE, or "production of helpers") hypothesis states that parents should overproduce the non-dispersing sex if the presence of relatives enhances reproductive success. I examined these models in a Costa Rican population of White-throated Magpie-Jays (*Calocitta formosa*), a cooperatively breeding corvid with female helpers. Using DNA microsatellite analysis, I sexed 135 offspring from 38 broods and 14 groups over a 3 yr period. I used generalized linear models to look for variation in offspring sex ratio and the effect of population, social group, helper number, breeding female, or season. Unlike the Seychelles Warbler (*Acrocephalus sechellensis*), one of the only other avian species with primarily female helpers, I found no evidence for systematic sex ratio bias supporting either LRC or LRE hypotheses in the magpie-jay. This suggests that female-biased helping is not a sufficient condition for the evolution of offspring sex ratio biasing.

## 219 Roth & Islam

Cerulean Warbler breeding biology. KIRK ROTH and KAMAL ISLAM, *Dept. Biol., Ball State Univ., Muncie, IN.*

The Cerulean Warbler is a neotropical migrant which breeds in North America and winters on the slopes of the Andes in n. South America. This species has experienced severe population declines, with an annual decline of at least 3.4% during the last 4 decades. Few intensive studies of the nesting biology of Cerulean Warblers have been undertaken. This ongoing project is the first research project in Indiana that addresses aspects of the Cerulean Warbler's breeding biology, information critical to the recovery of this species, particularly as Indiana represents the center of this bird's breeding range. During 2002, Cerulean Warbler territories were located and mapped. These territories were observed for breeding behavior and nests. After the breeding season, vegetation parameters associated with each territory and nest, as well as random sites were collected to determine habitat needs for this species. In 2002, 14 nests were located and monitored. Also, 40 territories were located and 30 of those were mapped.

## 220 Beheler & Rhodes

Within-season prevalence of extra-pair young in broods of double-brooded and mate-faithful Eastern Phoebe. AMANDA S. BEHELER and OLIN E. RHODES, Jr., *Dept. For. & Nat. Res., Purdue Univ., West Lafayette, IN.*

We examined the prevalence of extra-pair young (EPY) between broods of Eastern Phoebe pairs where (1) the male and female maintained their pair bond for all broods within the breeding season and (2) adults successfully fledged their first brood and subsequently attempted a second brood within the same breeding season. We utilized Eastern Phoebe microsatellite loci to document the presence and frequency of EPY in first and second brood offspring from 87 social family units where all individuals had been

sampled (n = 174 broods, n = 81 social males, n = 82 social females, n = 769 offspring). Although the majority of pairs were both socially and genetically monogamous within a breeding season, 17.2% (15/87 families) of all families had EPY in at least 1 brood and we found 2 cases of intraspecific brood parasitism. Overall, 9.2% of all broods (16/174 broods) contained EPY and 5.1% of all nestlings that hatched were EPY (39/769 nestlings). Second broods were significantly more likely to contain EPY than first broods [4.6% first broods with EPY (4/87), 13.8% second broods with EPY (12/87)]. The total number of EPY was greater in second broods than in first broods [1.0% EPY (4/411 nestlings) in first broods, 9.8% EPY (35/358 nestlings) in second broods].

## **221 vacant**

## **222 Langen & Luttbeg**

Cognitive models of Western Scrub-Jay foraging behavior. TOM A. LANGEN, *Clarkson Univ., Potsdam, NY*, and BARNEY LUTTBEG, *Univ. California - Davis, Davis, CA*.

Birds often must select one item from a set of candidates, as when picking a foraging site or choosing a mate, and they are expected to possess accurate and efficient rules for acquiring information and making these decisions. Very little is known, however, about the decision rules birds or other animals actually do use. We compare patterns of information sampling by Western Scrub-Jays when choosing a nut to store, with 3 decision rules: Best-of-n, Flexible Threshold, and Comparative Bayes, using data originally analyzed in (Langen 1999, **Animal Cognition** 2: 223-233). We apply an innovative model selection approach based upon information theory that quantifies how well each decision rule produces the empirically observed patterns of nut sampling behavior, and conclude that the Comparative Bayes decision rule, in which individuals use past experiences to make non-random assessment and choice decisions, produces patterns of behavior that more closely correspond to the patterns of behavior observed in Scrub-Jays than the other 2 rules.

## **223 Ferretti, Wrege & Winkler**

The cost of polygyny in the Tree Swallow. VALENTINA FERRETTI, PETER H. WREGE and DAVID W. WINKLER, *Dept. Ecol. & Evol. Biol., Cornell Univ., Ithaca, NY*.

One hypothesis that has been proposed to explain high rates of extra-pair paternity in birds states that females can risk engaging in extra-pair copulations only when male parental care is not essential. Here, we assess the costs incurred by female Tree Swallows mated to polygynous males, a species with one of the highest levels of extra-pair paternity. Over the past 14 yr, we detected 52 nests that were attended by polygynous males (n = 1262). After controlling for age, females of polygynous males (FP) and non-polygynous males (FNP) did not differ in clutch size. However, FP females paid reproductive costs at both early and late stages of the nesting cycle. Initial brood sizes were lower because a higher proportion of eggs failed to hatch. The FP females had very similar lay dates, and it is possible that lower hatchability in clutches of FPs is due to sperm depletion caused by increased copulations of their mates. After controlling for female age and initial brood size, fledging success was also lower in FP females, perhaps reflecting reduced paternal feeding rates of nestlings. Our results thus show that there is a cost in breeding success associated with polygyny. We believe that the high rates of extra-pair paternity observed in this species cannot be explained by a total emancipation from the need for male parental care.

## **224 Llambías, Wrege & Winkler**

Causes and consequences of divorce in the Tree Swallow. PAULO E. LLAMBÍAS, PETER H. WREGE and DAVID W. WINKLER, *Dept. Ecol. & Evol. Biol., Cornell Univ., Ithaca, NY*.

If a pair of monogamous birds survives the non-breeding season they can breed again together (remate) or they can breed with a different partner (divorce). Here we describe the causes and consequences of divorce in an aerial insectivore, the Tree Swallow based on a 14-yr study of a nest-box

population in Ithaca, New York. We limited our study to pairs where both sexes were banded and survived to the following breeding season (n = 214). A total of 163 pairs divorced between breeding seasons, resulting in an overall divorce rate of 76%. Pairs that subsequently divorce produce fewer fledglings than pairs that re-mate, and they were more likely to include younger females than pairs that remained together the following season. On the other hand, clutch size did not differ between divorcing and remating pairs. After divorce or remating neither females nor males increased their breeding success, suggesting that divorce and mate-retention are not strategies to increase breeding performance. 81% of the pairs that re-mated and 76% of the males that divorced bred in the same or adjacent boxes, while 74% of the females that divorced moved > 50 m. We suggest that divorce in our population is a consequence of female breeding dispersal caused by low breeding success.

## **225 Rakotoarisoa**

\* Breeding, foraging behavior and habitat characteristics of the Scaly Ground-Roller of Madagascar. JEAN E. RAKOTOARISOA, *Dept. Biol. Sci., Illinois State Univ., Normal, IL and The Peregrine Fund, Antananarivo, Madagascar.*

The Scaly Ground-Roller (*Brachypteracias squamiger*) of Madagascar is classified as a vulnerable species by the IUCN. Despite its status, little information is available on the behavioral ecology and breeding biology of this endemic species. The Scaly Ground-Roller was studied during 2 breeding seasons from Oct 1997 to Jan 1999 in Masoala National Park. Of the 269 prey items observed, earthworms (55%) and centipedes (21%) were the most numerous prey-types taken (n = 4 individuals). Nests were placed in ground burrows with tunnels that measured < 10 cm in diameter and < 1 m in depth.

A single egg clutch was laid in each nest (n = 3 nests), and incubation and the nestling periods lasted 18 d and 24 d, respectively. Trees were only used for resting, perching when defending territories and roosting. A few times, individuals were seen foraging in clearcuts, which suggests it might tolerate a certain degree of deforestation as long as the forest nest site is intact. The low reproductive rate (1 young/nest) suggests the species has a low ability to rebound from population decline and therefore is more vulnerable to demographic and environmental stochasticity.

## **226 Perkins, Roth, Bowman & Green**

Do flushing, capture, and blood-sampling affect return rate of nesting female Wood Thrushes? KELLY A. PERKINS, ROLAND ROTH, JACOB L. BOWMAN and JORDAN GREEN, *Dept. Entomol. & Wildl. Ecol., Univ. Delaware, Newark, DE.*

Studies of songbird nesting ecology often use techniques (flushing, capture, and blood sampling) that have the potential to affect reproduction, survival, and site fidelity negatively. Although studies have examined the effects of these techniques on avian reproduction and survival, their effect on return rate of breeding songbirds has not. We used data from a 28-yr demographic study to investigate the possible effect of these 3 practices on the return rate of female Wood Thrushes. We also tested reproductive success and age as predictors of return because they have been shown to influence site fidelity. Number of successful nests in a breeding season was the variable that best predicted return the following year. None of the research practices negatively affected return rate. That pattern held even among yearlings with zero production, a group that should be the most easily disturbed. We also show that using all years of return for site faithful birds as observations (i.e., repeated sampling) inflates the estimated return rate.

## **227 Judy, Roth & Bowman**

An evaluation of the Mayfield technique for estimating production of a Wood Thrush population. JARED I. JUDY, ROLAND R. ROTH and JACOB L. BOWMAN, *Dept. Ento. & Wildl. Ecol., Univ. Delaware, Newark, DE.*

Nest success determined by the Mayfield method has become the standard measure of avian reproductive success in recent years. The widespread use of this estimator, frequent comparison of results from different workers, and several potential biases warrant its further evaluation. We used a 15-yr data set to examine the effect of different nest check intervals on estimates of success and to determine how well the Mayfield estimate of nest success can track and estimate total fledgling production of a local

population. The data are from Roth's intensive study of Wood Thrush nesting biology (Brown & Roth 2002, **Ecology** 83: 958-969). Mayfield estimates based on several nest-check intervals used by researchers varied negligibly from estimates based on checks made at 1-d intervals. Nest success was significantly related to total annual fledgling production ( $r^2 = 0.48$ ,  $P = 0.005$ ), but the 95% confidence intervals were unacceptably wide. Between-year changes in nest success and in total production were not related ( $r^2 = 0.11$ ,  $P = 0.24$ ) indicating the inability of nest success to track actual production. At least within the range of values in our data, Mayfield-derived nest success is at best a weak estimator of production and not useful for tracking changes in productivity. We recommend caution in going beyond its use as an estimate of nest survival.

## **228 Strode & Warner**

The uncoupling of wood warblers (Parulidae) from their food resources in spring. PAUL K. STRODE and RICHARD E. WARNER, *Dept. Nat. Res. & Env't. Sci., Univ. Illinois, Urbana-Champaign, IL.*

Since 1912, Neotropical-Nearctic migrant birds may now have up to 20 fewer days to travel between S. Illinois, where spring is arriving later, and N. Minnesota, where spring is arriving earlier, to exploit optimal habitat conditions (expanding leaves and caterpillar activity) for refueling and breeding. As case studies of the affect of climate change on bird migration, I analyzed 2 long-term data sets of arrival times for 8 species of northern breeding migratory wood warblers (Parulidae) gathered over a 100 yr period in e.-central Illinois (IL) and a 40 yr period in w. Minnesota (MN). Six (IL) and 7 (MN) of the wood warbler species showed no significant tendency to migrate earlier in response to earlier springs in their breeding range. These results suggest that climate change may force many species of long-distance migratory songbirds to become uncoupled in the spring from their food resources that are driven by temperature.

## **229 Sauter & Bowman**

\* Is human-provided food in suburbs an evolutionary trap for Florida Scrub-Jays? ANNETTE SAUTER, *Zoologisches Institut, Univ. Zurich, Zurich, Switzerland*, and REED BOWMAN, *Archbold Biol. Sta., Lake Placid, FL.*

The effects of human-provided foods available to birds in suburban habitats are mostly unknown. Florida Scrub-Jays in suburban habitat feed their nestlings the same amount of food as wildland birds, but include some human-provided foods. Suburban nestlings have reduced growth and survival compared to wildland birds. We tested whether the availability of human-provided foods causes Florida Scrub-Jays to make a maladaptive food choice. We tested 1) if scrub-jays prefer natural to human-provided foods when food availability is equal and whether this preference depends on breeding stage, 2) how differences in food availability influence food preferences and 3) whether supplementation with natural foods increases nestling growth and survival. Preference for natural foods increased with breeding stage from pre-breeding to nestling phase. However, this preference did not exist when the handling time for natural food was experimentally increased. Supplementation increased body mass in both sites, but the effect seemed greater in the suburbs. The interaction between site and supplementation was not significant, but 2002 was an exceptional year and the first time in 9 yr that the day 11 mass of control nestlings did not differ between the 2 sites. Our results suggest that Florida Scrub-Jays make maladaptive food choices and therefore might fall into an evolutionary trap based on their behavioral response to human-provided food.

## **230 Horvath, Harper, Capparella, Frick, Gerwin & Browning**

Organochlorine pesticide contamination in Nearctic resident birds. JEFF HORVATH, R. GIVEN HARPER, *Dept. Biol., Illinois Wesleyan Univ., Bloomington, IL*; ANGELO CAPPARELLA, *Dept. Biol. Sci., Illinois State Univ., Normal, IL*; JEFF FRICK, *Dept. Chem., Illinois Wesleyan Univ.*; JOHN GERWIN and REBECCA BROWNING, *North Carolina State Mus. Nat. Sci., Raleigh, NC.*

Fourteen species of Nearctic resident passerines and woodpeckers collected in central and n. Illinois and North Carolina between 1991 - 2001 were analyzed for the presence of 17 organochlorine (OC) pesticides and metabolites. OCs were detected in all 23 individuals examined. Individual birds

contained from 1 to 10 compounds, with aldrin (mean  $\pm$  SE; 130.46  $\pm$  53.64 ng/g), beta-BHC (17.93  $\pm$  4.98 ng/g), p,p'-DDE (25.41  $\pm$  4.98 ng/g), dieldrin (24.16  $\pm$  8.08 ng/g), endosulfan I (27.26  $\pm$  8.31 ng/g), and heptachlor epoxide (17.50  $\pm$  2.87 ng/g) appearing most frequently. Levels of contamination in individuals ranged from 3.84 - 688.95 ng/g. For 17 specimens from Illinois, there were significantly higher total OC levels in birds collected in urban locations (430.53  $\pm$  135.27 ng/g) compared to birds collected in suburban locations (103.49  $\pm$  24.58 ng/g;  $t = -2.38$ ,  $df = 6.40$ ,  $P = 0.05$ ). There was no significant effect of age (HY: 357.40  $\pm$  114.58 ng/g; AHY: 81.22  $\pm$  28.72 ng/g) on total OC levels in Illinois birds ( $t = 2.145$ ,  $df = 9.00$ ,  $P = 0.06$ ). Use of the majority of the OC compounds detected has been restricted in North America for ~5 - 30 yr. The high frequency of OC contamination in Nearctic resident birds indicates the presence of OCs in the environment through extended persistence, continued usage, and/or atmospheric deposition.

### **231 García-Borboroglu & Yorío**

Habitat requirements and selection in Olrog's Gulls in Argentina. PABLO GARCÍA-BORBOROGLU; and PABLO YORIO, *Centro Nacional Patagónico (CONICET) and Wildl. Conserv. Soc., Puerto Madryn, Argentina.*

The Olrog's Gull is internationally considered as threatened and is endemic to the Argentine coast. We analyzed its breeding habitat requirements and selection along 2500 km of coastline, encompassing its entire distribution range. We studied 6 colonies and measured 13 habitat variables at 336 nests and 139 random points from 1998 to 2001. Colonies were located in proximity to intertidal mudflats with presence of crabs (367  $\pm$  407 m,  $n = 6$ ), their main prey throughout their range. All colonies were on islands. Colonies were placed near the high tide line (12.9  $\pm$  13.7, range = 0.7 - 40) m and at low altitude over the sea level (0.9  $\pm$  0.7, range = 0.1 - 1.9 m;  $n = 3$  colonies and 12 subcolonies). Colonies were located on open ground and far from the tall vegetation or partly bordered by short species (<0.2 - 0.3 m high). Gulls nested in discrete groups at high densities (internest distance 0.66  $\pm$  0.25,  $n = 231$  nests). Nests were built on gravel, sand, low vegetation or vegetation debris. Mean external diameter and height of nests were 41.7  $\pm$  7.3 and 7.1  $\pm$  3.3 cm respectively ( $n = 198$  nests). Gulls preferred to nest at sites closer to the water, further from the vegetation and in areas with lower vegetation cover. Olrog's Gull colony-site selection appears to be related mainly to the proximity to its main food sources, while nest-site selection may be associated to predation and heat-stress avoidance. The information presented will allow better implementation of conservation measures for this species.

### **232 García-Borboroglu & Yorío**

\* Effects of microhabitat preferences on Kelp Gull breeding performance. PABLO GARCÍA-BORBOROGLU and PABLO YORIO, *Centro Nacional Patagónico (CONICET) and Wildl. Conserv. Soc., Puerto Madryn, Argentina.*

We tested the hypothesis that nest microhabitat preferences are adaptive in Kelp Gulls at one of its largest colonies in Patagonia. We quantified 13 habitat variables at 104 and 92 nest-sites and at 70 and 60 random points in 1998 and 1999, respectively. We recorded egg laying dates, hatching success and breeding success at 92 of these nests in each of the study seasons. Compared to random points, nest sites presented more vegetation cover and were closer to the nearest available bush, but were located farther from the nearest clearing to take flight. Nests were built on substrates with lower slopes and higher percentages of silt-clay, but with lower percentages of rock. In both years, breeding parameters were related to vegetation cover and distance to nearest vegetation. Substrate slope and composition contributed to explain the variation in hatching and breeding success in 1998 and 1999, respectively. Our study shows that some Kelp Gull breeding parameters are affected by nest-site habitat characteristics. These associations were influenced in most cases by the timing of breeding, with earlier breeders being more successful. Vegetation effects and substrate characteristics were important variables in distinguishing random from nest sites and in explaining variation in breeding performance, showing that their preferences appeared to be adaptive and allowing us to detect both the pattern and process in Kelp Gulls habitat selection.

### **233 Dykstra, Hays, Daniel & Simon**

Home ranges and habitat use of suburban Red-shouldered Hawks. CHERYL R. DYKSTRA, *USEPA, Cincinnati, OH*, JEFFREY L. HAYS, *RAPTOR Inc., Cincinnati, OH*, F. BERNARD DANIEL, *USEPA, Cincinnati, OH*, and MELINDA M. SIMON, *Cincinnati, OH*.

We studied Red-shouldered Hawks inhabiting suburban areas of Hamilton Co. in sw. Ohio. Standard radio telemetry techniques were used to determine home range size and habitat use for 11 Red-shouldered Hawks during the breeding season and 9 hawks during the non-breeding season. Home ranges averaged  $90 \pm 11$  ha during the breeding season,  $189 \pm 33$  ha during the non-breeding season and  $165 \pm 24$  ha for the year-round home range. During the breeding season, the suburban home ranges were comprised of 45% forest, 37% residential areas, 17% fields/parks, and 0.4% water/wetland, on average. Home ranges contained an average of 169 buildings (1.8 buildings/ha). Habitat used by Red-shouldered Hawks differed from habitat available within the home ranges and within the study area for all birds ( $P < 0.05$ ). Four of the 5 hawks tested used riparian zones and pond edges more than would be expected, based on availability of such habitats within their home ranges. For all birds together, habitat used by the hawks differed from the available habitat within the mean annual home range ( $P < 0.05$ ); the hawks preferred the natural habitats of forests, fields and wet areas, and avoided suburban areas. Nonetheless, the suburban Red-shouldered Hawks demonstrated significant use of human-altered habitats, as well as tolerance of human disturbance.

### **234 Lester & Dunning**

The effect of prescribed burn size and age on bird communities. KATHRYN C. LESTER and JOHN B. DUNNING Jr., *Dept. For. & Nat. Res., Purdue Univ., West Lafayette, IN*.

In many forests in the e. U.S. prescribed burning is being implemented as a tool for habitat restoration. Only a few published studies to date have examined the impact of prescribed burning on bird populations in mature eastern deciduous forests. Most of these studies have only considered the direct effects of small-scale, short-term prescribed burning. Published studies will be summarized to illustrate what is known about fire in this ecosystem and the impacts of prescribed burning on bird populations. Negative effects, such as reduced abundance and nest success, on ground and shrub-nesting migrants are likely when a fire regime is reintroduced in eastern deciduous forests. However, understory/sub-canopy and canopy nesting species may benefit from burning. This study will examine the long-term indirect effects of prescribed burning on bird populations, particularly neotropical migrants. The study will be conducted in Mammoth Cave National Park, Kentucky, and will take into account burn size and date of last burn. Fixed-radius point counts will be conducted in burned and control sites and observations of breeding activity such as pairing, nest building, and courtship displays will be recorded.

### **235 Forney, Dick & Johnson**

Seasonal characteristics of mycoplasmal conjunctivitis among House Finch at West Point, NY. J. RUSS FORNEY, BRADLEY C. DICK, *Dept. Chem. & Life Sci., U.S. Mil. Acad., West Point, NY*, and MICHAEL J. JOHNSON, *Dept. Math. Sci., U.S. Mil. Acad.*

Mycoplasmal conjunctivitis is an infectious disease demonstrating considerable morbidity and mortality in the House Finch population, initially among birds resident to the e. U.S., but with recent reports of infection in the Rocky Mountain states. Transmission has distinct seasonal characteristics with peak prevalence typically observed in the winter months in the northern hemisphere. We monitored host activity at established feeding stations over a 12 mon period to document the prevalence of conjunctivitis in House Finches located on the West Point military installation, West Point, NY. Symptomatic prevalence peaked between late Oct and mid Nov 2002; trailing maximal host population densities by about 3 weeks. Infection demonstrated an association with the seasonality indicators of ambient temperature and photoperiod and showed proximate association with the phenology of significant host life cycle events such as the onset of prebasic molt and the aggregation of feeding flocks late summer and early fall. A decline in the monthly mean daily maximum bird count was observed in Dec and Jan, likely reflecting a lack of host recruitment in the nonbreeding period, potentially exacerbated by increased mortality in the host population secondary to mycoplasmal infection. Using this empirical data several preliminary discrete event simulations were constructed with promising results. Key parameters were identified that performed well to explain much of the seasonality of the data. A more refined model, using a more robust simulation

software packages has shown some increased flexibility and predictive potential which warrants further investigation.

### **236 Hofmann, Omland & Cronin**

\* Spectrophotometric analysis of color among New World Orioles (*Icterus*): evidence of multiple pigment types. CHRISTOPHER M. HOFMANN, KEVIN E. OMLAND and THOMAS W. CRONIN, *Dept. Biol. Sci., Univ. Maryland Baltimore Co., Baltimore, MD.*

The oriole genus is the largest and among the most colorful in the blackbird family. Differential use of dark and colored pigments gives each species a unique plumage type. Previous research (Omland & Lanyon 2002, **Evolution** 54: 2119-2133) showed considerable convergence and reversal in oriole plumage patterns. However, this study did not attempt to quantify color plumage. We used spectrophotometry to measure plumage coloration across the oriole genus. We found considerable variation in plumage coloration down to the subspecies level. Coloration appears to be caused by 2 general classes of pigments with very different spectral characteristics. One group of pigments resembles carotenoids and the others appear to be melanins. The use of these novel 'melanin like' pigments for coloration is limited to a single clade, indicating that some plumage characters do track the phylogeny.

### **237 Snell-Rood & Badyaev**

\* Ecological gradient of sexual selection: elevation and song complexity in finches. EMILIE C. SNELL-ROOD and ALEXANDER V. BADYAEV, *Dept. Ecol. & Evol. Biol., Univ. Arizona, Tucson, AZ.*

Ecological gradients provide an opportunity to examine how multiple selection pressures affect interspecific diversity in sexual displays. Elevational changes in habitat structure and climate have strong effect on life histories and mating systems of animals. Sexual selection intensity decreases with increase in elevation of breeding and this should result in pronounced elevational gradients in sexual displays. We examined variation in courtship song complexity and structure in relation to elevation in 126 extant species of cardueline finches, while controlling for the effects of phylogeny, body size and habitat structure. As predicted, species breeding at lower elevations sang louder, longer, and more complex courtship songs, and had songs with more notes, but shorter length of notes and internote intervals than related species breeding at higher elevations. These results and previous observation of strong elevational gradient in avian sexual dichromatism emphasize the importance of ecological factors in the evolution of sexual displays.

### **238 Colbeck, Webster & Marra**

Assessing population genetic structure in the American Redstart using AFLPs. GABRIEL J. COLBECK, MICHAEL S. WEBSTER, *Dept. Zool., Washington State Univ., Pullman, WA,* and PETER P. MARRA, *Smithsonian Environ. Res. Center, Edgewater, MD.*

We are assessing the utility of Amplified Fragment Length Polymorphism (AFLP) for detecting breeding range population structure in the American Redstart. Blood samples were collected at 5 sites from across the redstart breeding range: Louisiana, Maryland, New Hampshire, Michigan and Montana. Previous studies attempting to measure geographic structure in migratory birds, using mtDNA, allozymes and/or microsatellites, have discovered broad east-west patterns. The apparent lack of significant population structure could be due to high gene flow, recent range expansion from a population bottleneck, or a lack of sensitivity in the markers used. AFLPs are highly variable due to a high mutation rate, can generate 100s of polymorphic loci (including population specific loci) and thus have the potential to detect structure where other markers have failed. Detection of breeding ground population structure may allow us to measure the strength of migratory connectivity between breeding and wintering populations.

### **239 Cristol & Keiser**

Hippocampus in migrant and nonmigrant birds before migration. DANIEL A. CRISTOL and JEFF T. KEISER, *Dept. Biol., Coll. William & Mary, Williamsburg, VA.*

Some Dark-eyed Juncos migrate >1000 km each autumn from n. U.S. and Canada to Virginia,

while others are sedentary year-round in Virginia's mountains. We have shown previously that after the autumn migration season migrants have better spatial memory at a room-scale and denser hippocampal neurons, suggesting that migration has led to cognitive and neuroanatomical differences. We wanted to know whether the enhanced hippocampus of migrants arises as the result of experiencing a migratory journey, or is present even in young birds that have never migrated, as the result of natural selection for better navigational abilities. In early autumn, just prior to migration, we collected naïve and experienced migrants on the breeding grounds in Maine. We compared their hippocampuses to those of young and adult nonmigrants from Virginia collected at the same time. Migrants had bigger hippocampuses than nonmigrants, and adults had bigger hippocampuses than young in both migrants and nonmigrants. Thus, hippocampal enlargement may be related to migration over evolutionary time, but within the lifetime of an individual the hippocampus also enlarges for reasons other than migratory experience. Curiously, the differences in density between migrants and nonmigrants found earlier in post-migration birds was not seen before migration, suggesting that migratory experience and age may affect the hippocampus differently.

#### **240 Devault, Phodes & Smith**

Condition indices for wintering American Wigeon. TRAVIS L. DEVAULT, OLIN E. RHODES, Jr, *Dept. For. & Nat. Res., Purdue Univ., W. Lafayette, IN*; and LOREN M. SMITH, *Dept. Range, Wildl. & Fish. Manage., Texas Tech. Univ., Lubbock, TX*.

Condition indices that provide reliable estimates of body condition are valuable tools in waterfowl management. We evaluated the ability of condition indices to predict total body fat and protein for hunter-killed American Wigeon wintering on the s. High Plains of Texas. 642 wigeon were collected from 1 Oct 1988 to 15 Mar 1989 and processed in the laboratory to determine mean values of carcass components including lipids, ash, and ash free lean dry mass (protein). In regression equations for various sex/age groups, mass of omental fat deposits was the single best predictor of total body fat ( $R^2 = 0.82$  to  $0.90$ ), although the addition of body mass or carcass mass to the equations somewhat improved the accuracy of the models (up to  $R^2 = 0.93$ ). Protein was not as accurately predicted by the measured variables, although equations using the same variables that accurately predicted total body fat (carcass mass or body mass + omental fat mass) provided  $R^2$  values up to  $0.53$  for protein. Total body fat, and to a lesser extent, protein, can be estimated reliably for wintering American wigeon using easily obtained measurements of dead birds.

#### **241 Whittingham, Dunn & Clotfelter**

Parental allocation of food to nestling Tree Swallows: the influence of nestling behavior, sex and paternity. LINDA A. WHITTINGHAM, PETER O. DUNN, *Dept. Biol. Sci., Univ. Wisconsin-Milwaukee, Milwaukee, WI*, and ETHAN D. CLOTFELTER, *Biol. Dept., Amherst College, Amherst, MA*.

Parents are expected to invest more in young which provide the greatest fitness returns. The cues parents use to allocate resources among their offspring have received much recent attention. In birds, parents may use begging intensity, position in the nest or nestling size as cues to provision the most competitive young, or those most likely to survive. In addition, it may be beneficial for parents to invest in young differentially by sex or relatedness if the fitness returns of sons and daughters differ or broods are sired by multiple males. Although parents cannot assess parentage or sex of young directly, these attributes may vary in relation to nestling begging behavior. We examined the allocation of food to Tree Swallow nestlings in relation to their begging behavior, size, sex and paternity. Provisioning by parents was not related to nestling size, sex or paternity. The begging behavior of nestlings did not differ with respect to sex or paternity. Both parents were more likely to feed nestlings that begged first or were closer to the nest entrance, suggesting that parents allocate food resources in response to cues that nestlings control. As a consequence, brood reduction was facilitated by biased provisioning within the brood in addition to the nestling size hierarchies created by hatching asynchrony.

#### **242 Gulas-Wroblewski**

A new pelecaniform phylogeny: an argument for monophyly and the importance of fossils. BONNIE E.

GULAS-WROBLEWSKI, *Dept. Org. Biol. & Anat., Univ. Chicago, Chicago, IL.*

The order Pelecaniformes (pelicans, frigatebirds, tropicbirds, boobies, gannets, cormorants, and darters) has classically been considered a natural grouping and was designated a monophyletic assemblage on the basis of morphological and behavioral studies. However, arguments for the paraphyletic status of this clade arose concerning the placement of *Balaeniceps rex* (the shoe-bill stork) based on morphological similarities to pelecaniforms. More recent molecular and muscular analyses of this avian order have designated traditional Pelecaniformes a paraphyletic grouping as well. A cladistic analysis employing 153 morphological characters across 9 extant pelecaniform genera, 2 fossil pelecaniform genera, *Balaeniceps rex*, 2 representatives of Ciconiiformes, *Eudypetes* (Sphenisciformes), and *Oceanodroma* (Procellariiformes) resulted in 1 tree that supports the hypothesis of a monophyletic Pelecaniformes. The importance of fossil taxa in resolving phylogenetic relationships is exemplified by this study. Upon the removal of the 2 fossil genera from the analysis, 3 trees are retrieved, the consensus of which displays a paraphyletic Pelecaniformes with *Balaeniceps rex* and the 2 ciconiiform genera nested within the order.

### 243 Johnson & Dunn

Genetic signature of the extinct Heath Hen. JEFF A. JOHNSON and PETER O. DUNN, *Dept. Biol., Univ. Wisconsin-Milwaukee, Milwaukee, WI.*

The Heath Hen (*Tympanuchus cupido cupido*) once occurred on the northeastern coast of North America from Maine to perhaps as far south as North Carolina. However, by 1870, the heath hen was found only on the island of Martha's Vineyard off the coast of Massachusetts, and despite intensive management, this subspecies of prairie grouse was extinct by 1932. To assess levels of genetic variability in the Heath Hen prior to their extinction, we obtained toe-pad tissue from museum samples collected on Martha's Vineyard from 1890 to 1899. With 20 samples, we were successful in sequencing 384bp from the highly variable 5' domain of the mtDNA control region. Sixteen variable sites were observed (all transitions) forming 4 mtDNA haplotypes. Two Heath Hens possessed a haplotype that has also been observed in Greater Prairie Chicken (*T. c. pinnatus*) in high frequency (16% of n = 160 birds). However, the remaining 3 haplotypes, 1 of which was observed in 80% (16/20) of Heath Hens sampled, have not been observed in Greater Prairie Chicken samples to date. Subsequently, both haplotype (h) and nucleotide diversity (p) were low for Heath Hens, at 0.363 and 0.0087, respectively, yet Tajima's D neutrality test was not significant (-0.96676, P > 0.10). These results suggest that by the 1890's when the population numbered ~200 birds, the Heath Hen had low mtDNA control region variability, and this reduction in genetic variability may have been a contributing factor leading to their ultimate extinction.

### 244 Piaskowski, Figueroa, Martinez & Teul

Breeding season bird banding in pine savanna habitats in Belize. VICTORIA D. PIASKOWSKI, *Zool. Soc. Milwaukee, Milwaukee, WI*, OMAR A. FIGUEROA, WILBER MARTINEZ and MARIO TEUL, *Foundation for Wildlife Conservation, Inc., Belize.*

To learn more about the breeding biology of Neotropical bird species, we conducted bird banding based on the methods of Baillie (1990, *Ibis* 132: 151-156), Peach et al. (1996, *Bird Study* 43: 142-156) and Burton & DeSante (1998, **MAPS manual**. Inst. Bird Pop., Point Reyes Station., CA.) in pine savanna habitat at 2 sites in central Belize from Apr - Aug 1999 - 2002. Banding was conducted for 2 seasons at Site One and for 3 seasons at Site Two. Nets were operated for 2.5 to 4.2 hr each banding day. Numbers of birds banded and species composition varied between years at each site. At Site One, 174 birds of 46 species (18.8 birds/100-net-hr) were banded; the species banded in highest numbers were the *Myiarchus tyrannulus*, *Elaenia flavogaster* and *Sporophila torqueola*. At Site Two, 351 birds of 46 species (29.8 birds/100-net-hr) were banded; the species banded in highest numbers were the *Sporophila torqueola*, *Elaenia flavogaster* and *Volatinia jacarina*. 41 birds (24%) of 20 species banded at Site One and 49 birds (14%) of 20 species banded at Site Two were in breeding condition when banded as evidenced by the presence of a brood patch (Brewer et al. 1991, **Atlas of breeding birds of Michigan**, Michigan State Univ. Press). At both sites, hatch year birds comprised <14% of the birds banded. These findings will aid in describing the breeding biology of some of the avian species utilizing Belize's pine savanna habitats.

## 245 Kondo & Omland

Inferring the directionality of speciation in Baltimore and Black-backed Orioles. BEATRICE KONDO and KEVIN E. OMLAND, *Dept. Biol. Sci., Univ. Maryland-Baltimore Co., Baltimore, MD.*

Baltimore Orioles and Black-backed Orioles are very recently diverged, with less mtDNA separation than is found in most avian subspecies pairs. Surprisingly, males of the 2 species differ by 17 plumage characters. Baltimore Orioles are long-distance migrants, breeding in eastern to mid-western North America, and wintering in Central America to n. South America. By contrast, Black-backed Orioles breed in the northern portion of the Mexican Plateau, and winter in the southern portion. To investigate the possible causes and directionality of plumage and migratory changes between Baltimore and Black-backed Orioles, we analyzed the mtDNA distributions of cytochrome b and the hypervariable portion of control region within and between both species. We used phylogenetic and population genetic approaches to reconstruct the history of speciation in these 2 taxa. Our results indicate that these species diverged within the late Pleistocene, possibly even as recently as the last glacial maximum. Furthermore, several aspects of our results suggest that Black-backed Orioles may have descended from a Baltimore Oriole-like ancestor. Baltimore Orioles display a greater haplotype diversity and greater percent sequence divergence within species than Black-backed Orioles. If supported, these results will illuminate the study of losses in migration distance, as well as the extremely rapid change in male plumage characters that occurred in 1 or both species.

## 246 Hudson, Barton, Strong & Jaramillo

Long-term avian occurrence in an urban riparian restoration site. SHERRY HUDSON, GINA BARTON, CHERYL STRONG and ALVARO JARAMILLO, *San Francisco Bay Bird Observ., Alviso, CA.*

In the Santa Clara Valley of California, bird diversity and species richness is influenced primarily by the presence of high quality riparian woodlands. In this long-term study we evaluated the effects of an urban riparian restoration site on neotropical migrant species and on species sensitive to urbanization. The site consisted of a pre-existing riparian area, 2 areas planted with native riparian plants in 1987 and 1993, and an overflow channel. The 20 focal species included 11 species of neotropical migrants and 9 species sensitive to urbanization in the Santa Clara Watershed. We surveyed birds using a standardized mist net protocol year-round from 1987 - 1998, with vegetation measurements taken each year in Jun. In the area replanted in 1987, canopy cover, understory density and height, and litter accumulation increased significantly during the study period, approaching measurements in the area of pre-existing riparian vegetation. Regression analysis results showed significant increases in relative abundance of 6 neotropical migratory species and 4 species sensitive to urbanization. Canopy cover and habitat complexity were positively associated with avian relative abundance, although focal species occurred in a matrix of older and younger forested habitats and open areas throughout the study site. The increase in relative abundance of the focal species during maturation of revegetated areas suggests that the riparian restoration project was successful. We suggest replicating this study by conducting future bird and vegetation surveys at similar urban riparian revegetated sites to determine the effectiveness of restoration efforts.

## 247 Hudson, Barton & Strong

Avian occurrence in managed urban riparian areas of Santa Clara County. SHERRY E. HUDSON, GINA BARTON and CHERYL STRONG, *San Francisco Bay Bird Observ., Alviso, CA.*

Riparian habitat in California is one of the most degraded yet one of the most important habitat types to bird communities during all times of the year. In this study we compared avian presence and abundance in relation to vegetation and urbanization at 6 study sites in managed urban riparian areas in the Santa Clara watershed from Mar through Dec 2001. We chose 20 focal species: 11 species of neotropical migrants and 9 species sensitive to urbanization. The 6 sites consisted of riparian areas adjacent to an open field-like "overflow channel" containing no woody vegetation. We surveyed birds using a standardized mist net protocol, with vegetation measurements collected in Jun. 10 of the 20 focal species occurred at all 6 study sites and in both riparian and overflow channel vegetation, including Salt Marsh Common Yellowthroat (*Geothlypis trichas sinuosa*), a species of special concern in California. More neotropical migrant species were captured in riparian than overflow channel vegetation, while focal

breeding species were captured equally in both vegetation types. In addition, avian abundance was positively associated with height and diversity of plants in the overflow channel. The overflow channel, in conjunction with the riparian vegetation, provided useful habitat for the focal species during migration and the breeding season. Proximity to urban development negatively affected focal species occurrence in general, but was positively associated with other generalist species.

### **248 Stanback, Cowan, Gall & VanDerVolgen**

Current vs. future reproduction in a multi-brooded passerine, the Eastern Bluebird: an experiment. MARK STANBACK, BLAIR COWAN, MEGAN GALL and JESSI VANDERVOLGEN, *Biol. Dept., Davidson Coll., Davidson, NC.*

The trade-off between current and future reproduction is a critical one. For multi-brooded passerines, future reproduction within the same season is highly likely, so one might expect them to be sensitive to the costs of investing too heavily in spring nests. When faced with an enlarged brood, adults can presumably either maintain their per capita feeding rate (to the potential detriment of their own condition and summer clutch size) or they can reduce their per capita feeding rate to ensure adequate reserves for a summer breeding effort. To determine which option is utilized by Eastern Bluebirds, we manipulated brood sizes in spring nests to either 2 or 6. Using paired t-tests, we compared both chick condition and subsequent clutch size at nests of reduced and enlarged broods.

### **249 Ryder, Blake & Loiselle**

A test of the environmental hotspot hypothesis for lek placement in three species of manakins (*Aves*, Pipridae) in lowland, Ecuador. THOMAS B. RYDER, JOHN G. BLAKE and BETTE A. LOISELLE, *Dept. Biol., Univ. Missouri-St. Louis, St. Louis, MO.*

Lekking is classified as a form of male dominance polygyny in which males lack control of essential resources for the acquisition of females. Of particular interest to behavioral ecologists have been the mechanistic nature of male spatial aggregation and the maintenance of site fidelity over time. The hotspot hypothesis has been proposed as both an ultimate and proximate mechanism by which males might aggregate in locations where females are likely to be encountered. The hypothesis has been further extended to include areas of the environment which might act to concentrate female use of space. Here we have set out to explicitly test the environmental hotspot hypothesis and its potential to act as a proximate mechanism in lek placement for 3 species of manakins in the family Pipridae. Examinations of fruit biomass components, measured at lek and non-lek localities, are implicative of a correlative relationship between lek placement and overall resource base. Lek sites had an overall higher fruit biomass than did non-lek control sites. Moreover, lekking localities had a higher number of plants bearing ripe fruit, as well as a higher fruit biomass per plant. Our results provide clear support for the environmental hotspot hypothesis to proximately explain current site occupancy, as well as long term site fidelity of leks. We also present a novel direct benefit for subordinate male manakins derived from the notion of central place foraging and public information sharing.

### **250 Stapleton & Robertson**

Radio-tracking of female Tree Swallows during fertile period. MARY STAPLETON and RALEIGH ROBERTSON, *Dept. Biol., Queen's Univ., Kingston, ON.*

Tree Swallows exhibit one of the highest levels of extra-pair fertilizations of any North American passerine. Despite the high frequency of extra-pair fertilizations, extra-pair copulations are rarely seen. One explanation that has been suggested is that extra-pair copulations are occurring pre-dawn at communal roosting sites during a female's fertile period. We investigated individual movement patterns of female Tree Swallows during predawn, dawn and dusk periods using radio-telemetry in an effort to track individuals to nightly roosting sites. Bi-angulation was used to determine approximate location of individuals and plotted onto a topographic map using AutoCad. Movement patterns between different individuals will be compared. In addition, patterns of extra-pair paternity will be examined with respect to individual movement data.

## **251 Havelka, Pekarik, Weseloh & Cuthbert**

Population trends and contaminant levels in colonial waterbirds of Lake Erie and connecting channels. TANIA HAVELKA, CYNTHIA PEKARIK, D.V. CHIP WESELOH, *Canadian Wildl. Ser., Downsview, ON*, and FRANCIE CUTHBERT, *Dept. Fish & Wildl., Univ. Minnesota, St. Paul, MN*.

During 1997 to 1999, Canadian and American government agencies completed the third bi-national survey of nesting colonial waterbirds on Lake Erie and the Detroit and Niagara Rivers. Eleven species were confirmed nesting; we report on 4 in detail (Double-crested Cormorants, Herring and Ring-billed Gulls, and Common Terns). Cormorant numbers increased 3.8-fold since 1990 to 9,300 pairs. Herring Gulls declined by 20% to 9,300 nests. The most numerous species was the Ring-billed Gull with 131,000 nests, a 13% increase since 1990. Common Tern populations declined 19% since 1990 to 1,566 nests. Common Terns declined on Canadian Lake Erie but increased on American Lake Erie. Since 1974, the Canadian Wildlife Service has monitored contaminant levels in Great Lakes Herring Gull eggs. Data from 4 sites in this study area indicated that contaminant levels had decreased significantly (1974 - 2002). Using change-point regression analysis, we examined trends of: DDE, HE, HCB, mirex, dieldrin, PCBs and 2,3,7,8-TCDD. Of the 28 analyses (7 compounds X 4 sites), 17 (61%) declined at a constant rate; 5 (18%) declined faster after the change-point, 3 (11%) declined slower after the change-point, 2 (7%) increased after the change-point and 1 (4%) had no trend.

## **252 Havelka & Weseloh**

Continued growth of the Double-crested Cormorant population on Lake Ontario, 1982 - 2002. TANIA HAVELKA and D. V. CHIP WESELOH, *Canadian Wildl. Ser., Downsview ON*.

Annually from 1982 to 2002 all known breeding colonies of Double-crested Cormorants on Lake Ontario were censused. This extended the annual record of cormorant numbers on Lake Ontario from 1945 to 2002, a period of 57 yr. Cormorants increased from 770 pairs on 2 colonies in 1982 to 28,180 pairs on 20 colonies in 2002, a 36.6 fold increase or 19.7%/yr. The between-year growth rates during this time period ranged from -8.9% to +84%. In 2002, the western basin from Toronto to Hamilton contained 19.9% of the population (5,621 nests on 8 colonies). The central basin from east of Toronto to Prince Edward Point contained 46.0% of the population (12,952 nests on 4 colonies). The eastern basin from Prince Edward Point to Kingston contained 34.1% of the population (9,607 nests on 8 colonies). Since 1991, nest numbers in the eastern basin were fairly stable growing at 3.1% annually while elsewhere they displayed dramatic growth. The central and western basin populations grew at 19.7% and 24.0%, respectively, per year. Cormorant numbers declined 43.2% on Little Galloo Island from 8,410 to 4,780 nests (1996 to 2002), although an annual egg-oiling program only began in 1999. On High Bluff Island, cormorant numbers increased 4.3-fold from 2,442 to > 10,000 during that same time.

## **253 McCarty, Ortega & Wolfenbarger**

Dickcissel nest site habitat: selectivity and consequences for reproductive success. JOHN P. McCARTY, MARLON F. ORTEGA and L. LAREESA WOLFENBARGER, *Dept. Biol., Univ. Nebraska at Omaha, Omaha, NE*.

Availability of suitable habitat for nest sites is an important component of overall habitat quality for breeding birds. We studied nest placement in Dickcissels, a grassland species of high conservation concern. Nests were located at 3 study areas in the Missouri River Valley north of Omaha, Nebraska. Parasitism by Brown-headed Cowbirds, hatching success of eggs, and the number of young fledged were measured for nests. After a nesting attempt was completed, we measured the habitat at the nest site and at randomly selected points in the territory around the nest. Vegetation structure and composition at the nest site differed significantly from random points around the nest. We interpret this as indicating that Dickcissels are selective in choosing nest sites. In general, these habitat variables were not correlated with measures of reproductive success.

## **254 Wolfenbarger, Berkeley, Klug & McCarty**

A framework for studying large-scale ecological effects of herbicide tolerant crops on avian communities and reproduction. L. LAREESA WOLFENBARGER LORELLE BERKELEY, PAGE KLUG and JOHN P. McCARTY, *Dept. Biol., Univ. Nebraska at Omaha, Omaha, NE*.

In the Great Plains, grassland and riparian ecosystems have been replaced by an agriculturally dominated landscape. Remaining natural vegetation represents a small percentage of land and is disproportionately important to bird communities. Consequently, agriculturally mediated changes can have profound implications for the management and sustainability of these avian populations. Large-scale adoption of herbicide tolerant crops and their accompanying agricultural practices may produce environmental changes that alter avian communities and reproduction. In particular, avian communities and populations are affected by habitat structure, food supply and nest predators. At farm sites in e. Nebraska and w. Iowa, we are measuring the effects of transgenic glyphosate tolerant soybeans and their accompanying agricultural practices on avian communities, reproduction, their food supply, and the vegetation structure within the habitats they use and compare these to effects of nontransgenic soybeans and their agricultural practices. The data to address these effects will have considerable use to U.S. regulators and policymakers as glyphosate-tolerant crops are submitted for deregulation and will provide information to landowners and extension agents on management of CRP (Conservation Reserve Program) lands for grassland birds.

### **255 Owen**

Immunological condition of long-distance migrants improves during stopover. JENNIFER C. OWEN, *Dept. Biol. Sci., Univ. S. Mississippi, Hattiesburg, MS.*

The importance of stopover during the migratory period is tied to a migrant's need to replenish fat stores, rest, and seek refuge from inclement weather and predators. I predicted that stopover habitat may also be a location where resources are reallocated to the immune system following a period of immunosuppression. I assessed the change in immunological condition during stopover using 3 measures of immunocompetence, white blood cell (WBC) count, heterophil/lymphocyte (H/L) ratio, and cell-mediated immune (CMI) response, among 4 species of intercontinental migrants, Swainson's Thrush (SWTH), Wood Thrush (WOTH), Veery (VEER), and Ovenbird (OVEN). The study site was located on the northern coast of the Gulf of Mexico in sw. Louisiana. Data were collected from both field and aviary experiments during spring of 2000 and 2001. Using hematological data for WOTH, VEER, and OVEN, WBC count increased during stopover for all 3 species. H/L ratio significantly decreased in VEER but did not differ significantly between first and last capture for WOTH or OVEN. In addition, for WOTHs and SWTHs, there was a positive linear relationship between CMI response and stopover length. Stopover sites may provide the opportunity for an immunosuppressed bird to reallocate resources into their immune system, which may be crucial because a migrant encounters novel parasite and pathogens en route.

### **256 Cribbs & Vleck**

Corticosterone stress response in House Sparrows. AMBER M. CRIBBS and CAROL VLECK, *Dept. EEOB, Iowa State Univ., Ames, IA.*

Corticosterone is a hormone released from the adrenal gland by birds in response to stress. The release of the corticosterone elevates blood glucose, is anti-inflammatory and alters mood and behavior, improving an individual's chance of surviving a short-term stressful situation. Chronically elevated corticosterone levels compromise the resistance to disease, reduce the function of the immune system and inhibit reproductive function. We measured plasma corticosterone levels by RIA in house sparrows within 3 min of capture and after 30 min of handling at 3 times of the year: summer (breeding), fall and winter. We found that plasma corticosterone levels increased significantly in response to capture and handling. Baseline and stress-induced corticosterone levels were similar between sexes and did not vary with body mass. There were significant differences in corticosterone levels (both baseline and after 30 min of handling) between fall and summer. Levels were higher in the fall birds. We have not yet measured levels of corticosterone binding globulin, so we do not know if the estimated free corticosterone levels vary between seasons.

### **257 Kirkpatrick & Conway**

Effects of fire on montane forest birds in southeastern Arizona. CHRIS KIRKPATRICK and COURTNEY J. CONWAY, *USGS Arizona Coop. Fish & Wildl. Res. Unit, Univ. Arizona, Tucson, AZ.*

We surveyed montane forest birds in 8 "sky island" mountain ranges in se. Arizona to examine how presence of bird species correlated with evidence of recent wild and prescribed fires of varying intensities at >1,500 survey points. We detected associations between bird presence and evidence of fire damage for 19 of 35 bird species analyzed. Of these species, 11 were positively associated with fire (6 with severe fire damage, 3 with less-severe fire damage, and 2 with both) and 8 were negatively associated with fire (4 with severe fire damage and 4 with both severe and less-severe fire damage). In addition, we detected only a few individuals of several open woodland species thought to have decreased as a result of fire suppression in the region. Our results suggest that recent wild and prescribed fires have the potential to affect the distribution of many montane forest birds in the "sky islands" of se. Arizona.

## **258 Liu & Vleck**

Does oxidative damage to DNA increase with age in birds? WEI LIU and CAROL VLECK, *Dept. EEOB, Iowa State Univ., Ames, IA.*

Aerobic respiration and exposure to various exogenous agents results in the formation of reactive oxygen species (ROS) that cause oxidative damage to biological systems. Cumulative damage to cellular macromolecules, like DNA, may contribute significantly to aging. Measurement of oxidative lesions in genomic DNA provides an overall estimation of exposure to ROS. Because birds have high rates of metabolism, yet surprisingly long lifespans, they promise to have both lower rate of free radical production and increased capabilities for damage repair. 8-oxo-2-deoxyguanosine (8oxodG) is the most commonly used marker and can be measured with relative ease. Oxo8dG levels have been measured in a few avian species, but have not been correlated with ages. We used Zebra Finches (*Taeniopygia guttata*) of known age from 0.3 to 45 mon from our lab colony for this study. An FPG enzyme-gel electrophoresis method was used to determine the 8oxodG levels in DNA extracted from finch pectoral muscle and heart muscle tissues. We observed an age-related increase in 8oxodG levels in genomic DNA isolated from both muscle ( $P = 0.004$ ) and heart tissues ( $P = 0.006$ ), showing that there is a cumulative effects of oxidative damage on DNA over the lifetime of birds. We will measure the 8oxodG level in other tissues. These results may help to explain the relatively greater life span in birds than mammals.

## **259 Tello, Caballero, Bowie, Schulenberg & Bates**

Preliminary assessment of relationships in *Tolmomyias* Flycatchers. JOSE G. TELLO, *Dept. Biol. Sci., Univ. Illinois at Chicago and Div. Birds, Field Mus., Chicago, IL*; ISABEL C. CABALLERO, RAURI C. K. BOWIE, THOMAS S. SCHULENBERG and JOHN M. BATES, *Div. Birds, Field Mus., Chicago, IL.*

The Neotropical genus *Tolmomyias* comprises 34 taxa, traditionally arranged among 5 species of large-headed, broad- and flat-billed flycatchers. *Tolmomyias* is found from Argentina to Mexico and inhabits the canopies of a variety of wooded habitats including humid montane forests, humid lowlands forest (both in varzea and terra firme), semi-deciduous woodlands, and mangroves. The genus is among the more problematic to differentiate and their similar plumage coloration and patterns provide few clues on their phylogenetic relationships. To date no hypotheses of relationships have been proposed for this genus. Knowledge of the evolutionary relationships of widely distributed taxa, such as *Tolmomyias*, is necessary to understand the patterns and processes underlying the diversification of the Neotropical region. We present sequence data from 24 individuals of *Tolmomyias* (representing 4 species and a total of 8 taxa) and two outgroups. We sequenced 1392 bps of mtDNA (including the entire ND2 and ND3 genes). Levels of phylogenetic informativeness for the mitochondrial data are high: 38.3% of sites are variable sites, and 68.1% of those sites are parsimony informative. Maximum parsimony, Maximum likelihood, and Bayesian inference did recover the same general tree. The overall topology of the trees suggests a great deal of genetic structure, both among and within current recognized species. The degree of uncorrected pairwise sequence divergence within *Tolmomyias* is high, ranging up to 11.9%. Although the limitations of taxon sampling used in this study prevent

fully resolving the interspecies relationships of *Tolmomyias*, this preliminary data set showed some interesting geographic and taxonomic results, e.g. the non-monophyly of *T. sulphurescens*.

## 260 Garcia & Conway

Effects of food and ectoparasites on age of natal dispersal in Burrowing Owls. VICTORIA GARCIA and COURTNEY J. CONWAY, *School Renew. Nat. Res., Univ. Arizona, Tucson, AZ.*

Post-fledging decisions such as when to leave the natal area may influence survival probability and may impact a juvenile's ability to find a suitable breeding territory the following year. In many birds, the post-fledging period when natal dispersal is initiated is the life stage with the lowest daily survival probability. Optimal timing of natal dispersal influences fitness and may vary among individuals, across regions, and across years because early and late dispersal both have potential benefits. For example, within populations of Burrowing Owls individuals vary widely in age of natal dispersal. We examined 2 possible alternative hypotheses to explain variation in age of natal dispersal: food abundance and ectoparasite infestation. We radio tracked 1 juvenile owl from each of 67 nest burrows to determine dispersal age. We compared dispersal age among nests within 4 treatments: nests supplemented with food (laboratory mice); nests treated for ectoparasites with diatomaceous earth; nests both food-supplemented and treated for ectoparasites; and control nests that received no treatment. We compared dispersal timing among treatment groups using a 2-way ANOVA for a completely randomized design with factorial treatment. Juveniles at nests that received food supplements dispersed earlier than control juveniles, and those at nests that were treated with diatomaceous earth dispersed later than control juveniles. Other results are presented and discussed.

## 261 Wilkins

Characteristics of forage trees and energy demands of wintering Yellow-bellied Sapsuckers. H. DAWN WILKINS, *School Sci. & Tech., Quincy Univ., Quincy, IL.*

A number of organisms, including Yellow-bellied Sapsuckers, use plant sap, gum, and nectar as a source of nourishment. The factors used to choose individual plants and avoid others are relatively unknown. I compared the sugar concentration, water content, bark thickness, phloem thickness, and orientation of sap wells on forage trees to trees of the same species and diameter and found no differences in these characteristics between trees used by sapsuckers and those that were not. I manipulated the sugar concentration of experimental trees through girdling to see if selection was affected. Girdled trees had higher sugar concentrations and more sap wells excavated above the girdle than below. Sapsuckers may be choosing forage trees at random or based on other characteristics such as bark complexity and tree health. In addition, I examined the possibility of sapsuckers using the phloem tissue to fulfill their energetic demands during the winter when there is little sugar movement in the trees. Based on my calculations, it is unlikely that sapsuckers are meeting their daily energetic needs from consuming sap. My evidence suggests sapsuckers consume phloem tissue and that it is broken down as it passes through the birds' digestive system. I hypothesize that symbionts allow sapsuckers to digest the cellulose in the phloem tissue. Their total energy intake is probably a mixture of sap, phloem tissue, fruits, and insects.

## 262 Clifford & Anderson

Food availability and obligate brood reduction in the Nazca Booby LESLIE D. CLIFFORD and DAVID J. ANDERSON, *Dept. Biol., Wake Forest Univ., Winston-Salem, NC.*

Siblicide refers to aggressive behavior between siblings that results in death for at least 1 of the participants. This behavior has been classified as facultative or obligate based on the incidence of chick mortality, but there are other potential differences between the 2 types of siblicide. Evidence indicates that sibling aggression is regulated proximately in facultatively siblicidal species by the nutritional condition of the chicks, while observational evidence indicates that this may not be so for obligately siblicidal species. We experimentally tested the hypothesis that sibling aggression is independent of food availability in an obligately siblicidal seabird, the Nazca Booby (*Sula granti*). We supplemented the diets of parents with

newly hatched chicks, and compared the number of days it took for siblicide to occur in the supplemented nests and in control nests. We found that food supplements did not decrease the probability or timing of brood reduction; chicks with supplemented parents committed siblicide just as quickly as control chicks. We conclude that obligate siblicide is not regulated by food availability.

### **263 Robinson & Risch**

Sources of egg size variation in Eastern Bluebirds. THOMAS J. ROBINSON and THOMAS S. RISCH, *Dept. Biol. Sci., Arkansas State Univ., Jonesboro, AR.*

We measured the length and breadth ( $\pm 0.01$  mm,  $n = 198$  eggs) of 40 complete clutches of Eastern Bluebirds nests that were initiated between 24 Mar and 18 Apr 2003 in recently established nest boxes. We then calculated egg mass (g) using the formula:  $\text{mass} = K \times L \times B^2$  (Hoyt 1979, *Auk* 96: 73-77). Each egg was labeled on the day of laying, thus we determined laying sequences for all nests. Clutch size varied from 4 to 6 eggs, with the majority of clutches containing 5 eggs (4-eggs,  $n = 4$ ; 5-eggs,  $n = 34$ ; 6-eggs,  $n = 2$ ). Egg mass ranged from 2.28 g to 3.78 g. A large portion of the variation in egg size existed among nests ( $r^2=0.84$ ,  $P < 0.0001$ ,  $F_{38,193} = 20.72$ ). However, in addition, there was a positive association of egg size with laying order within the clutch ( $r = 0.21$ ,  $n = 198$ ,  $P < 0.003$ ). The average mass of eggs in a clutch was not significantly associated with date of laying ( $r = -0.07$ ,  $n = 40$ ,  $P > 0.647$ ). To investigate the relationship of parental size to egg size we captured and weighed adults associated with nests ( $\pm 0.1$  g, males,  $n = 21$ ; females,  $n = 16$ ) during the brood rearing period. Regression analyses revealed no significant relationship between adult female mass and egg size ( $r^2 = 0.05$ ,  $F_{1,14} = 1.76$ ,  $P < 0.20$ ), but a negative relationship existed between adult male mass and egg size ( $r^2 = 0.31$ ,  $F_{1,19} = 10.19$ ,  $P < 0.005$ ). This last result suggests that males may face a trade-off between allocation of resources between self-investment versus reproductive investment (e.g. mate attraction and territory defense). Data collection is ongoing and additional results will be presented.

### **264 Christensen & Vleck**

Lactotroph distribution and response to VIP stimulation across the breeding cycle in the Zebra Finch. DEBORA E. CHRISTENSEN and CAROL M. VLECK, *Dept. Zool. & Gen., Iowa State Univ., Ames, IA.*

In arid regions of Australia, Zebra Finches are opportunistic breeders whose breeding cycles are coupled to nonseasonal rainfall rather than photoperiod, requiring them to be reproductively competent on short notice. We measured plasma prolactin (PRL) levels by RIA in breeding and nonbreeding Zebra Finches both before and after exogenously administered vasoactive intestinal peptide (VIP), the avian prolactin-releasing hormone. In incubating birds, basal PRL levels were high and did not change after VIP injection. In nonbreeding birds, basal PRL levels were low but increased to levels comparable to those found in breeding birds following a single VIP challenge. This pattern differs from photosensitive species in which only during a breeding cycle do birds transiently, but significantly, elevate their level of PRL in response to exogenous VIP. In photosensitive birds, the seasonal increase in PRL is associated with an increased number of lactotrophs that densely populate the cranial lobe of the anterior pituitary and extend caudally during breeding. Preliminary results show Zebra Finch lactotroph clusters scattered throughout the cranioventral anterior pituitary, with colocalization of PRL-ir and GH-ir in immunoreactive cells more pronounced during breeding, but present even in adult reproductively naïve birds. This suggests that even when not actively breeding, Zebra Finches maintain competent pituitary lactotrophs that can secrete PRL at maximal rates as part of the suite of characters enabling these birds to take advantage of opportunistic breeding conditions.

### **265 Westbrook, Huyvaert, Hagen & Anderson**

Sex-specific nestling mortality, food requirements, and sex ratios in the Waved Albatross. MARK A. WESTBROCK, *Dept. Biol., Wake Forest Univ., Winston-Salem, NC*, KATHRYN P. HUYVAERT, *Dept. Biol., Univ. Missouri - St. Louis, St. Louis, MO*, MARINA HAGEN and DAVID J. ANDERSON, *Dept. Biol., Wake Forest Univ.*

Fisher's hypothesis of equal parental investment in the sexes predicts that frequency dependent selection will result in equal total expenditure incurred for each sex, resulting in sex ratios approximating

equality. Factors that may cause a sex ratio to differ from equality include sex-specific differential mortality and resource requirements to raise an offspring to independence. Testing predictions of sex allocation in regard to these factors is often confounded by intra-brood nestling competition and a period of time between fledging and offspring independence, during which it may be difficult to measure parental expenditure. Using the simple system of the sexually size dimorphic (female mass = 0.81 male mass) Waved Albatross, which has a clutch size of 1 and temporally coincident fledging and independence, we examined the sex-specific mortality and food requirements of 44 nestlings by performing constant feeding observations during daylight hours from hatching until fledging. Feed sizes were estimated by weighing chicks before and after feedings. These data on sex-specific parental expenditure allow quantitative comparison with population level secondary and tertiary sex ratios to test Fisher's predictions.

## **266 Powell & Finkbeiner**

Comparing avian species richness, density, and productivity among grazing systems in the Nebraska Sandhills. LARKIN A. POWELL and SILKA L. FINKBEINER, *School Nat. Res., Univ. Nebraska-Lincoln, Lincoln, NE.*

We monitored avian species richness, density, and productivity on upland study sites in the Nebraska Sandhills during the summers of 2002 - 2003. 12 sites from the following broadly defined grazing systems were selected: continuous grazing, medium-duration grazing (4-pasture), and short-duration grazing (management intensive). During 2002, 30 species of birds were recorded. While species richness was higher on continuously grazed pastures, Grasshopper Sparrows were more abundant on rotational systems. 58 nests were located and monitored during the 2002 field season. Of the 39 passerine nests monitored, 11 (28%) fledged at least 1 host young, 26 (68%) failed or fledged only parasite young. Daily nest success did not vary among grazing treatment groups; the pooled nest success rate was 0.941. Common Nighthawks and Lark Sparrows had highest daily nest success rates (0.985 and 0.981, respectively); Grasshopper Sparrows had the lowest (0.862, corresponding to a 24-day rate of 0.029). Only 1 of 11 Grasshopper Sparrow nests in our sample was successful, compared to 7 of 9 Lark Sparrow nests). The grazing systems in our study do not fit into discrete categories; thus, as we incorporate data from 2003, we plan to use grazing parameters as covariates in our density and nest success estimation procedures.

## **267 Porter & Anderson**

Social interest of nestlings to non-breeding adult Nazca Boobies; causes and consequences. ELAINE T. PORTER and DAVID J. ANDERSON, *Dept. Biol., Wake Forest Univ., Winston-Salem, NC.*

Non-breeding adult Nazca Boobies (*Sula granti*) show an unusual interest in conspecific nestlings. In our large, dense breeding colony in the Galapagos Islands, these Non-parental Adult Visitors (NAVs) approach unattended nestlings and exhibit mixtures of courtship, aggressive, and sexual behaviors, as well as simple attendance. Nestlings typically behave passively during these encounters, which may last minutes to hours. The aggression involves bites to the head, neck, wings, and rump, frequently causing bloody injuries that lead directly or indirectly to the nestling's death, and constituting a major source of mortality in some breeding seasons. We test a number of hypotheses for the causation of this behavior at both ultimate (nest site and mate acquisition, eliminating same-sex mating competitors) and proximate levels (inexperience leads to erroneous identification of nestlings as potential mates, organizational effects of their own nestling hormone experience).

## **268 Mong & Sandercock**

Upland Sandpipers habitat use in an experimental landscape. TONY W MONG and BRETT K. SANDERCOCK, *Div. Biol., Kansas State Univ., Manhattan, KS.*

We used data collected from Upland Sandpipers *Bartramia longicauda* during the spring/summer of 2001 and 2002 to determine habitats used during nesting and foraging at Konza Prairie Biological Station in the Flint Hills of ne. Kansas. This research site is subdivided into 60 experimental units or "watersheds" (average size = 60 ha) that are subjected to a specific combination of prescribed burning regime (burned at 1, 2, 3, 4, 10 or 20 yr intervals) and 1 of 3 grazing treatments (ungrazed, grazed by

domestic cattle *Bos taurus*, or grazed by native bison *Bison bison*). These experimental units span the full range of habitats available in a tallgrass prairie. Our objective was to determine the habitat requirements of the Upland Sandpiper by determining if individuals used one habitat more frequently than other habitats during nesting and foraging. Upland Sandpipers were captured and banded using 2 methods; spotlighting (use of a dip net while the birds were dazzled with bright lights) and horizontal mistnets at nests. Individuals were fitted with radio-transmitters glued on the back and sandpipers were tracked for the duration of the attachment of the radio. We used data collected from 52 nests to look at habitat use for nest sites and we examined radio-telemetry data from 9 individuals with a total of 152 locations. Preliminary analysis revealed that during foraging individuals used watersheds burned the same spring, whereas for nesting they used watersheds that had not been burned recently (36 of 52 nests in watersheds that had not been burned for 2 yr or more, mean =  $5.4 \pm 3.6$ , range = 2 - 11). This is the first attempt to examine habitat use by Upland Sandpipers with radio-telemetry. Our results indicate that the sandpipers require a mosaic of habitats in the tallgrass prairie ecosystem.

### **269 Powell, Kocer & van der Burg**

A landscape perspective on the effects of mesopredators on avian nest success in wetlands in Nebraska's Rainwater Basin. LARKIN A. POWELL, CHRISTINA J. KOCER, and MAX POST VAN DER BURG, *School Nat. Res., Univ. Nebraska-Lincoln, Lincoln, NE.*

We monitored mesopredator movements and avian nest success in 11 wetlands in Clay Co., Nebraska, during 2002. We captured 46 mesopredators during 1345 trap nights, and we radio-marked 6 raccoons, 5 striped skunks, and 4 opossums. Radio-marked raccoons and skunks regularly used wetlands, and were usually found within a 3 km x 3 km localized area. The more isolated wetlands had the fewest predators captured per trap night. We found 188 bird nests; 166 of those were Red-winged Blackbird nests, of which only 29 (18%) were successful and 48 (29%) were parasitized by Brown-headed Cowbirds. We found differences in nest success among individual wetlands, and our model comparisons suggest that small wetlands had the lowest nest success. In addition, wetlands surrounded by upland restorations have significantly higher nest success than wetlands without upland restorations. For small and medium-sized wetlands in our study, the wetlands with lowest numbers of predators captured had the highest avian nest success. While other nest predators, like snakes, may be quite important to avian nest mortality, our data indicates that mammalian predators have some influence on nest success rates. And, we suggest that landscapes may impact dynamics of mammalian predators and avian nest success.

### **270 Curry, Gueres, Cornell, Reudink, Rossano & Zitnay**

Moving on up: shifting contact zone between Black-capped and Carolina Chickadees in southeastern Pennsylvania. ROBERT L. CURRY, SUSAN L. GUERS, KERRI L. CORNELL, MATTHEW W. REUDINK, LINDSAY M. ROSSANO and RYAN ZITNAY, *Dept. Biol., Villanova Univ., Villanova, PA.*

Parapatrically distributed Black-capped and Carolina Chickadees come into contact and hybridize in many localities along a narrow zone from central New Jersey to w. Kansas. Genetic and morphometric data from 2 sites in se. Pennsylvania indicate rapid northward movement of the contact zone. At Nolde Forest (s. Berks Co.), mitochondrial DNA haplotypes shifted from 85% Carolina to 100% Carolina between 1998 and 2002, but microsatellite genotypes indicate that the majority of resident chickadees are hybrids. At and near Hawk Mountain Sanctuary (n. Berks/se. Schuylkill Cos.), all chickadees sampled in the 1980s had Black-capped mtDNA, but 1 female with Carolina haplotype was present as early as 1996. Out of 26 breeding residents we studied in 2002, 5 (all females) had Carolina mtDNA. Microsatellite data suggest that these individuals were hybrids rather than pure Carolina Chickadees. Patterns documented to date support a model for this shifting contact zone in which hybrid females mate with Black-capped males at the leading edge, while hybrid males mate with hybrid and pure Carolina females at the trailing edge. Transition to pure Carolina genotypes at the southern edge of this shifting contact zone is obscured by retention of Black-capped song in predominantly Carolina populations.

### **271 Rogers**

Is food limiting during the nonbreeding season of birds? A view provided by optimal body mass models. CHRISTOPHER M. ROGERS, *Dept. Biol. Sci., Wichita State Univ., Wichita, KS.*

Students of the ecology of tropical-wintering migratory birds often employ measures of body mass components as surrogate measures of habitat quality. For example, low fat or nonfat mass is considered to reflect low habitat quality, i.e. a habitat with low food supply and therefore low survival probability. The food limitation hypothesis states that food supply directly limits one or more body mass components. However, the predation-food hypothesis also explains observed trends in mass components among habitat of differing quality. This latter hypothesis, derived from models of adaptive regulation of avian body mass, suggests that food is inadequate to support high mass components in poor habitats at the existing level of predation. The 2 hypotheses make a nonoverlapping set of predictions about lapses in foraging and the extent of premigratory fat deposition in species that make initial long-distance migratory movements directly from the wintering grounds. During winter, body mass decisions influencing individual fitness are focused on the mass strategy that minimizes the combined probabilities of starvation and predation. However, in early spring, fitness is suddenly strongly related to reaching the breeding grounds, as no breeding opportunities exist for migrants wintering in tropical regions. Only the predation-food hypothesis makes the prediction that with newly changed fitness priorities in spring, fat reserves will increase suddenly as the bird prepares for a long-distance migratory flight, possibly over a large expanse of water. The food limitation hypothesis predicts that food supplies on the wintering grounds are inadequate to support any increases in either the fat or nonfat component of body mass. Distinguishing between hypotheses clarifies the role of simple food limitation versus the role of the food-predation interaction, as factors affecting body mass regulation and mass-dependent migration and subsequent reproduction schedule.

## **272 Earnhardt, Rentsch, VanderWerf, Wolf, Ross & Thompson**

The science of reintroduction: a survey of avian release programs. JOANNE M. EARNHARDT, DENNIS RENTSCH, *Dept. Conserv. & Sci., Lincoln Park Zoo, Chicago, IL*; ERIC VANDERWERF, *U.S. Fish & Wildl. Ser., Pacific Islands Fish & Wildl. Office, Honolulu, HI*; LISA FAUST, AMY WOLF, MEGAN ROSS and STEVEN D. THOMPSON, *Dept. Conserv. & Sci., Lincoln Park Zoo.*

Reintroduction is a powerful conservation tool in the restoration of endangered species. However, program design and implementation is critical to the success and value of this tool. We have developed a database on avian reintroduction programs that can help guide the design of future reintroductions, characterize past reintroduction practices, and compare/contrast procedures across programs. The database includes 80 parameters pertinent to the species, release location, individuals released (e.g., number, sex, age, origin), and release techniques (e.g., supplementation, intervention). Database information is collected from peer-reviewed journals, gray literature, websites, and personal interviews. Data collection is ongoing with 54 species and 350 releases currently incorporated. Our summary statistics for the database indicate high variability within and between reintroduction programs. The biggest impediment to locating data is that quantitative information is lacking from many publications. For example, for 30-d survivorship, we could find data for only 54% of 183 release events. For reintroduction theory and practice to progress, it is essential that the design of future reintroductions be based on rigorous review of methods, results and lessons from the past.

## **273 Nuechterlein & Buitron**

Avoiding confusion in a multiple use call: Advertising bout sequences in Western Grebes. GARY L. NUECHTERLEIN and DEBORAH BUITRON, *Dept. Biol. Sci., North Dakota State Univ., Fargo, ND.*

Courting male and female Western Grebes use 2-noted Advertising calls ("cree-creet") to attract potential mates. However, newly formed pairs continue to use these calls to individually identify one another. These 2 uses of the same call (mate attraction and mate identification) become a source of message confusion during colony formation. As 100s of pairs converge to form colonies in dense emergent beds, pair-members frequently become separated and use repeated back-and-forth Advertising to re-unite. Unpaired birds, however, are often attracted to these aggregations, and these courting birds frequently approach and answer paired birds that are calling to their mates. Both sexes of Western Grebes Advertise in bouts of 1 - 6 calls spaced about 1 s apart. Courting birds typically give bouts of 3 or more calls, while paired birds separated from their mates most commonly give 1-call bouts. Both groups, however, also give 2-call bouts, which creates a source of message confusion. Sequential Advertising

bouts given within 1 minute of each other by the same individual often vary in length. An examination of such sequences of Advertising bouts suggests that back-and-forth calling between 2 individuals may provide enough information to sort out the message confusion of the 2-noted call, and so allow unpaired individuals to avoid wasting time and energy approaching birds that have already paired.

## **274 Vukovich & Ritchison**

Nest-site selection and nesting success of Northern Harriers on reclaimed surface mines in Kentucky. MARK VUKOVICH and GARY RITCHISON, *Dept. Biol. Sci., E. Kentucky Univ., Richmond, KY.*

Populations of many grassland bird species, including raptors, have been declining, and loss of grassland habitat is a contributing factor. Reclaimed surface mines in Kentucky and elsewhere have apparently created suitable habitat for grassland birds, including Northern Harriers. The objective of our study was to examine nest site selection and nesting success of harriers breeding on reclaimed grasslands in west-central Kentucky. From Apr - Jul 2002, we attempted to locate all harrier nests on reclaimed grasslands on the 25,000-ha Peabody Wildlife Management Area in w.-central Kentucky. 27 nests were located, and 5 (18.5%) fledged at least 1 young. Of the 22 failed nests, 21 (95.5%) were lost to predators and 1 was abandoned. Harrier nests on the management area were located in dry, upland locations and previous work indicates that nesting success is typically lower in such areas than in wetter areas. A comparison of nests that failed during incubation and those that either failed during the nestling period or were successful revealed significant differences in foliage cover below 0.5 m, vertical cover between 0.5 - 1 m above ground, and distance from the nearest tree. In general, nests that failed earlier were in areas with shorter vegetation and less cover. Our results suggest that reclaimed grasslands provide suitable habitat for breeding harriers. However, given the apparent importance of nest concealment for harriers in drier, upland locations, the availability of sites with sufficiently tall, dense vegetation to minimize predation risk might be a limiting factor. If so, managing reclaimed grasslands and other upland habitats to insure the presence of such sites could potentially improve the nesting success of Northern Harriers.

## **275 Sutter & Ritchison**

Reproductive success of Grasshopper Sparrows in grazed and ungrazed habitats in central Kentucky. BENJAMIN J. SUTTER and GARY RITCHISON, *Dept. Biol. Sci., E. Kentucky Univ., Richmond, KY.*

Populations of Grasshopper Sparrows are declining, and reasons for these declines are poorly known. While habitat loss and fragmentation and agricultural practices, such as grazing by cattle are likely contributing factors, little is known about the effects of grazing on grassland birds. Grasshopper Sparrows were studied at the Blue Grass Army Depot in Madison Co., Kentucky, from 1 May - 8 Aug 2002. Nesting success of sparrows in grazed (n = 9 nests) and ungrazed (n = 21 nests) areas differed significantly, with 3 of 9 nests (33%) successful in grazed areas and 17 of 21 nests (81%) successful in ungrazed areas. Ungrazed areas were found to have more litter, taller and denser vegetation, and more vertical cover than grazed areas. Such differences likely influence predation rates. For example, predators may be more likely to locate nests in the shorter, less dense vegetation of grazed areas, while nests in ungrazed areas may be better concealed and more difficult to locate. In addition, Grasshopper Sparrow nests in grazed areas were typically located in isolated clumps of thick grasses. While potentially able to develop a search image for such clumps, which might increase predation rates and reduce nesting success, predators are likely unable to do so for nests located in the homogeneous vegetation of ungrazed areas.

## **276 Mumme**

Geographic variation in a foraging adaptation: an experimental analysis in the Slate-throated Redstart. RONALD L. MUMME, *Dept. Biol., Allegheny Coll., Meadville, PA.*

The Slate-throated Redstart (*Myioborus miniatus*) flushes insect prey by fanning its contrasting black-and-white tail during animated foraging displays. Although previous experimental work has demonstrated that white tail feathers are critical to foraging success, the amount of white in the tail varies considerably over the species' broad geographic range (n. Mexico to Bolivia). I am investigating the evolutionary significance of this geographic variation by experimentally reducing or increasing the amount

of white in the tail of Costa Rican redstarts to mimic the natural extremes of geographic variation in tail pattern. Because experimental birds with reduced-white tails show significant reductions in both prey attack rates and flush-pursuit foraging success, the null hypothesis -- that geographic variation in the extent of white in the tail is a result of genetic drift and has no adaptive significance -- can be rejected. White-addition experiments, currently in progress, will discriminate among 3 remaining hypotheses for geographic variation in tail pattern: (1) foraging performance increases with the extent of white in the tail, but geographically varying tradeoffs constrain the evolution of more extensive white, (2) foraging performance generally increases with the extent of white in the tail but is subject to geographically varying diminishing returns, and (3) plumage pattern maximizes foraging performance and reflects precise adaptation to regional prey and habitat characteristics.

### **277 Blanc, Emerson & Walters**

The role of the Red-cockaded Woodpecker in the cavity-nesting bird community: a nest web approach. LORI A. BLANC, *Dept. Biol., Virginia Tech Univ, Blacksburg, VA*; ROBERT EMERSON, *Virginia Tech RCW Res. Team, Niceville, FL*; and JEFFREY R. WALTERS, *Dept Biol., Virginia Tech Univ.*

We are studying cavity-nesting birds and their relation to the federally endangered Red-cockaded Woodpecker (RCW) in the longleaf pine forests of Eglin Air Force Base, Florida. As the only excavator of cavities in living pines, RCWs play a vital role in the cavity-nesting community of longleaf pine forests. 27 vertebrate species are known to use RCW cavities. Our objective is to examine the role of the RCW in this community using a nest web approach. A nest web is a modified interaction web with cavities as the central resource and bird species as members of the hierarchy. In this study, we relate the abundance of cavity-nesting birds to numbers of RCWs, RCW cavities and snags and incorporate the resulting correlation data into a nest-web. Species identified as having the potential to be impacted by RCW cavity management included the Northern Flicker, Red-headed Woodpecker and Southeastern American Kestrel. Of particular importance is the Southeastern American Kestrel, which is listed as threatened in the state of Florida and has a strong, positive and significant correlation to RCW cavity trees ( $r = 0.37$ ,  $P = 0.03$ ). The kestrel is a secondary cavity nester that depends on other cavity-excavating birds to provide nesting cavities. Their need for enlarged cavities creates the potential for them to be negatively impacted by restrictor plates, commonly used to protect RCW cavities. These preliminary results suggest the importance of understanding potential impacts of RCW cavity management on other cavity-nesting birds.

### **278 Leumas, Sherry & Sigel**

Decline of insectivorous rainforest understory birds from La Selva Biological Station, Costa Rica. CECILIA LEUMAS, THOMAS W. SHERRY and BRYAN SIGEL, *Dept. Ecol. & Evol. Biol., Tulane Univ., New Orleans, LA.*

The literature suggests that tropical rainforest understory insectivores are particularly sensitive to habitat fragmentation. However, historical data that assess such changes and their causes are rarely available. We report declines in insectivorous understory birds mapped at La Selva Biological Station from 1976 - 1978. We used GIS to obtain habitat distributions by species, transformed the species X habitat matrix to equalize observations by habitat, then compared the 1970s matrix to one obtained using as many as possible of the same species in 2003. The maps document that 8 widespread species of flycatchers and puffbirds in the 1970s declined to zero or a few individuals today. Our data also suggest multiple explanations for the declines. We found no support for differential susceptibility of habitat specialists. Species that follow antwren flocks largely disappeared, in parallel with the disappearance of the antwren flocks themselves. Two ground nesting puffbirds may have declined due to increases in ground predators. Estimated insectivore population sizes in the 1970s at La Selva were in the 10s to 100s at most, suggesting the possibility of genetic problems, if the populations were sufficiently isolated by surrounding habitat conversion.

### **279 St. Germain, Murray & Kirkpatrick**

Avian Atlas of Ft. Chaffee - Maneuver Training Center (MTC), Arkansas, fall 2002 - summer 2004. MICHAEL J. ST. GERMAIN, REBECCA L. MURRAY, *Conservation Mgmt. Inst., Virginia Tech Univ.,*

Blacksburg, VA, and SABRINA M KIRKPATRICK, *Environ. Branch, Ft. Chaffee-MTC, Ft. Smith, AR.*

This 2-yr atlas is designed to map the year round distribution, abundance, habitat use and breeding status of birds on Fort Chaffee-MTC. All birds are identified and recorded, resulting in a mapped distribution of bird species by habitat and season on the installation. Physiognomic habitat classes (deciduous forest, coniferous forest, deciduous woodland, coniferous woodland, grassland, shrubland, open water, developed areas) were recorded for every bird identified. Effort was recorded as the number of person-hours spent in each habitat encountered. We used birds/hr metric to describe differences in bird abundance among the habitat classes and seasons. Abundance status (rare, uncommon, fairly common, common, abundant) is based on the number of individuals detected and the total amount of survey time for each habitat encountered. During the spring and summer season we used behavior to determine the breeding status (observed, possible, probable, confirmed) of each species encountered following the definition recommendations of the North American Ornithological Atlas Committee. Preliminary data shows there is a substantial change in the avian community between seasons. High use by passerines occurs during the spring migration and there is a large diversity of sparrows in winter and grassland birds in summer.

## **280 Steinkamp, McCallum & Peterjohn**

Using signature sounds of Bonin Petrels to identify individuals for use in capture-recapture models. MELANIE STEINKAMP, *Wetlands International, Arlington, VA*; ARCH McCALLUM, *Applied Bioacoustics, Eugene, OR*; and BRUCE PETERJOHN, *USGS Patuxent Wildl. Res. Center, Laurel, MD.*

The Bonin Petrel (*Pterodroma hypoleuca*) is a small gadfly petrel with breeding populations in the remote Hawaiian Islands and the Volcano and Bonin Islands of Japan. These burrow-nesting petrels are strictly nocturnal over their breeding grounds, returning at night to exchange incubation duties. Current survey methods for petrels and shearwaters are difficult to conduct and often result in poor data. At the same time, many of these species are believed to have experienced marked population declines during recent decades, and are generally considered to be of high global conservation concern. Nocturnal, fossorial petrels are known to rely on vocalizations to locate, identify and communicate with their mates. We explored the use of signature sounds for identifying individuals repeatedly and thereby estimating numbers with mark-recapture methods. Early work by Grant et al. (1983, *Wilson Bull.* 95: 522-539) identified 3 call-types used in intra-pair relations. All 3 types are abundantly represented in our tapes from Jan 2002. "Churr" is a low-frequency broad-band sound made by males. The deep amplitude modulation of this sound occurs at irregular rates, and has high potential for encoding individuality. Males also give rather simple "Ti-ti-ti" calls, with the potential for spectral and temporal encoding of information. The female's "Kuk-u-er" call exhibits sudden transitions from periodic to aperiodic to chaotic dynamics, including period doubling and mode locking. We present the details of each of these sounds, and test for individuality with small samples from positively identified individuals.

## **281 Park**

New wintering site of the White-fronted Geese at the Nagdong River, South Korea. HEE CHEON PARK, *Dept. Biol., Kyungpook Natl. Univ., Daegu, Korea.*

In the winter of 1999, about 300 individuals of White-fronted Geese, *Anser albifrons*, wintered at the Nagdong River, South Korea. It was the first time to find the wintering group of the *Anser albifrons* since 1980 at this place. In the last winter of 2002/2003, about 6,500 individuals of this birds have wintered at this small migratory bird sanctuary. There were 2 feeding activities of the White-fronted Geese during the stay for wintering. First type to feed at the nearby rice paddy field was appeared from late-Oct to mid-Jan, and the second type to feed the food along the river traveling for about 50 km to the north and returning to roost in every evening from the mid-Jan to late-Apr. And this wintering site was the last place to stay for the White-fronted Geese along the Nagdong River before the return of the migration to north.

## **282 Linkhart, Bock, Reynolds & Reich**

Determining habitat quality from long-term demography in breeding Flammulated Owls. BRIAN D.

LINKHART, CARL E. BOCK, *Dept. Environ., Pop. & Organ. Biol., Univ. Colorado, Boulder, CO*, RICHARD T. REYNOLDS, *USDA For. Ser., Ft. Collins, CO*, and ROBIN REICH, *Dept. For. Sci., Colorado State Univ., Ft. Collins, CO*.

Basing the determination of habitat quality on long-term demography is generally regarded as a valuable approach for understanding how animal populations use space, but it has little empirical support. From 1981 - 1999, we determined demographic performance of a Flammulated Owl population in central Colorado, and we used demographic parameters that distinguished among territories to infer relative territory quality. Territories differed in total breeding years and productivity, but did not differ in survival or mate fidelity. Availability of cavity-trees primarily determined where owls established territories, while forest type and structure determined whether a territory was more often occupied by breeding pairs or by bachelor males. Monitoring of predation on artificial nests and relative prey abundance revealed no patterns among territories differing in productivity. High-quality breeding habitat was characterized as mature, relatively open stands of ponderosa pine/Douglas-fir that contained sufficient cavity trees for nesting. Habitat correlations with bachelor years differed markedly from correlations with productivity, indicating that inferring habitat quality based on abundance or duration of territory occupancy would be misleading. Our findings suggest that Flammulated Owls are adapted to forests that were historically maintained by fire.

### **283 Radomski**

Monitoring Double-crested Cormorants within the catfish production areas of Arkansas: 1999 - 2003. ANDREW A. RADOMSKI, *USDA, Agri. Res. Ser., H. K. Dupree Stuttgart Natl. Aquaculture Res. Center, Stuttgart, AR*.

Increasing numbers of Double-crested Cormorants at commercial aquaculture production facilities have resulted in biological, economical, and social conflicts. Aerial surveys by fixed-wing aircraft were conducted to monitor and quantify the wintering cormorant numbers from 1999 - 2003. Observations were conducted during the last 3 hr of sunlight and encompassed catfish production areas. A minimum of 2 surveys/mon was conducted along a fixed route. Survey flights were usually conducted on consecutive days. Aerial counts were validated with ground observations the following morning at specific roosts for accuracy. A minimum of 16,000 cormorants was observed during each survey, with the exception of early Jan 2000 and 2001. Cormorant numbers peaked (>26,000) in early Feb 2001 and a total of 12 to 15 night roost sites were monitored during 1999 - 2003. Cormorants roosted in bald cypress trees almost exclusively. Some roosts were protected from human disturbances, but some were adjacent to highways or adjacent to high recreational areas. Similarities in numbers of cormorants counted in the evening by aircraft and the following morning by ground observers at the same roost allows for increased confidence that the estimates are reasonably accurate. It is important to monitor cormorants to better understand the population trends, movements during the winter, roost site selection, roosting behavior, and changes that may occur with a national, regional, state, or local management plan.

### **284 Radomski, Fenech & Lochmann**

Diet analyses of Double-crested Cormorants and largemouth bass from an Arkansas oxbow lake. ANDREW A. RADOMSKI, *USDA-ARS, Stuttgart, AR*, AMY S. FENECH and STEVE LOCHMANN, *Univ. Arkansas-Pine Bluff, Pine Bluff, AR*.

Diets of Double-crested Cormorants have been the subject of several studies, often without regards to other piscivores within the ecosystem. Description of the diet from regurgitated pellets and fecal material rely heavily on diagnostic hard parts. Diet characterization from 455 wintering cormorant and 273 largemouth bass stomachs were examined. The purpose of this study were to determine the effects that over wintering cormorants and largemouth bass had on crappie and other fish populations and to describe the diet of wintering cormorants from intact prey items and diagnostic hard parts and compare this estimate with the diet described using only intact prey items. Cormorants consumed <1% of the crappie population, whereas bass consumed between 0.03 and 3.0%. Overall, gizzard shad and yellow bass were the most important species in the cormorant diet using both diet examination methodologies. Approximately 1371 prey items were identified from intact remains or hard parts. In fall, based on intact remains alone, gizzard shad were the most numerous and frequently occurring prey taxa, and had the highest relative importance. In the fall, based on hard parts and intact remains, cyprinids were the most

numerous taxa and had the highest relative importance. Gender-based diet differences were not affected by choice of method. Length frequency distributions did not differ. We have determined it is sufficient to use only intact remains for diet characterization of cormorants unless specific seasonal information is required.

### **285 Nooker & Sandercock**

Male behavior on Greater Prairie-Chicken leks. JACQUELINE K. NOOKER and BRETT K. SANDERCOCK, *Div. Biol., Kansas State Univ., Manhattan, KS.*

Greater Prairie-Chickens have a lek mating system where males gather at arenas to display and attract mates. Only 1 or 2 dominant males obtain most of the copulations. Male behavior may determine lek position and be used by females as a cue of male quality. During 10 min focal observations, we quantified male behavior on leks from early Apr through early May, corresponding to before, during, and after the peak of the female visitation to leks. Tallies were taken of number of males approached, fights, boom vocalizations, cackle calls, and flutter jump displays. Time spent in 3 main behavior categories (display, fighting, and other) were calculated. Presence or absence of females during the focal period was noted. We found that dominant males participated in more fights and spent less time displaying than subordinate males. When females are present on the lek arena, both subordinate and dominant males spend more time displaying, and boom at a faster rate.

### **286 Bernick**

Foraging ecology of Black-crowned Night Herons in the New York City area. ANDREW J. BERNICK, *City Univ. New York-GSUC/Coll. Staten Island, New York, NY.*

Over 1,500 pairs of colonial wading birds (e.g. herons, egrets, and ibis) breed and forage in the industrialized ecosystem of metropolitan New York City. Wader colonies are located on 7 islands, from w. Staten Island to Long Island Sound. The Black-crowned Night Heron (*Nycticorax nycticorax*), a mainly nocturnal forager, is the predominant breeding wader in these colonies, and has been undergoing population declines both locally and region-wide. Research on foraging success and habitat use, important components of reproductive success, has concentrated on diurnally foraging waders in the New York City area; foraging of nocturnal species (e.g., *N. nycticorax*) has not been examined to the same extent. From Mar to Aug 2002, I conducted weekly surveys by car and canoe to describe *N. nycticorax* night-time abundance and foraging success (via focal foraging observations) at 30 sites of 3 habitat types (shoreline, salt marsh, freshwater) in the Staten Island area. In 2002, salt marsh habitats had fewer foraging *N. nycticorax*/ha than either freshwater or shoreline habitats. Conversely, salt marsh and shoreline foragers had higher strike rates and capture success than freshwater foragers. By describing foraging habitat use and foraging success for *N. nycticorax*, more inclusive conservation and management plans for local wader populations are possible.

### **287 Santora & Veit**

Physical and biological determinants of Antarctic krill and seabird aggregations at Elephant Island, Antarctica. JARROD A. SANTORA and RICHARD R. VEIT, *Biol. Dept., Coll. Staten Island, City Univ. New York, New York, NY.*

The distributions of Antarctic krill (*Euphausia superba*) and seabirds north of Elephant Island (61° S, 55° W) were mapped during Dec 2001 using a towed acoustic array and observers with binoculars. We used the resulting data set to ask questions about what physical and biological factors were influential to the formation of aggregations of krill predators. Time series methods and spatial statistics were used to interpret the observed patterns in a multi-scalar perspective. We found substantial congruence between distributions of krill and birds, though some large krill swarms seem to have been largely ignored. Krill swarms and seabird feeding aggregations were closely associated with a hydrographic front that likely was part of the Weddell-Scotia Confluence. Compared to other seasons, we saw relatively few penguins and fur seals, and the seabird community was dominated by Cape Petrels (*Daption capense*).

### **288 Klatt & Stutchbury**

Incubation feeding by male Scarlet Tanagers: a removal experiment. PAUL H. KLATT, *Dept. Biol., Univ. North Dakota, Grand Forks, ND*, and BRIDGET J.M. STUTCHBURY, *Dept. Biol., York Univ., Toronto, ON*.

We observed pairs of Scarlet Tanagers to assess the importance of mate guarding and incubation feeding in the mating system. Males stayed close to their mates during the fertile period and often followed them to and from the nest area during nest building. Almost all males (13 of 15) were seen feeding their mates during the incubation period. Females seldom gave "chik-burr" calls during regular incubation observations, and often actively begged from the male. We temporarily removed males (n = 6), for 2 hr, to determine the female's response to her mate's absence during incubation. All 6 females gave long bouts of "chik-burr" calls the first time they came off the nest while their mate was absent. One female even permanently abandoned her eggs and the territory during the removal. This suggests that males who do not attend their mate closely during incubation risk being deserted. We expect to find few extra-pair fertilizations due to the close association of the pair and high incubation feeding by the male.

## **289 Morton**

Settlement patterns of Ovenbirds onto territories in northwestern Pennsylvania. EUGENE S. MORTON, *Migratory Bird Center, Natl. Zool. Park, Smithsonian Inst., Washington, DC*.

In nw. Pennsylvania, Ovenbirds occupy regenerating forest edge habitat rather than the typical forest interior habitat used elsewhere. At the Hemlock Hill Biological Research Area, excellent forest interior habitat exists that has not been used by Ovenbirds over the past 28 yr of surveys. Playbacks of Ovenbird song were presented in this habitat in summer of 2001 and spring of 2003 to see if conspecifics would be attracted to settle. No Ovenbird settlement was noted in the spring following the summer playbacks or during the spring playbacks of 2003. Return rates were high to previously occupied territories in edge habitat. A major predator, chipmunks, was uncommon in occupied habitat and it suggests that the unusual settlement pattern for Ovenbird in this site may reflect nest predation by chipmunks.

## **290 Kammin, Mankin, Warner & Hoffman**

Conservation buffer filter strips as habitat for grassland birds in Illinois. LAURA A. KAMMIN, PHIL C. MANKIN, RICHARD E. WARNER and CATHERINE L. HOFFMAN, *Dept. Nat. Res. & Environ. Sci., Univ. Illinois, Urbana, IL*.

Conservation buffer filter strips are being widely established in the Midwest as part of farm conservation programs. Filter strips are linear grass areas established adjacent to waterways. They are promoted for soil and water conservation and also for wildlife habitat. We studied filter strips in e.-central Illinois, which is among the most intensively row-cropped areas in the U.S. For this setting, our objectives were to consider selected characteristics of filter strips and the landscape surrounding filter strips relative to 1) the diversity and abundance of birds; and 2) nest success for selected species. 62 filter strips in Champaign and Ford Cos. were studied during 2002 - 2003. 89 species of birds were recorded during bird censuses conducted 4 times in 2002. In 2002, 411 active nests (17 species) were monitored; 76% of the nests were destroyed by predation. Using the Mayfield method, nest survival was calculated for the 2 most abundant species, Red-winged Blackbird and American Robin, as 8% and 6%, respectively. Trends in species occurrence and nest success were similar for 2003. The preliminary findings suggest that while filter strips are attractive to many species of farmland birds in the region, they are marginally suitable as breeding habitat.