

PROGRAM AND ABSTRACTS

**WILSON ORNITHOLOGICAL
SOCIETY**

AND

**ASSOCIATION OF FIELD
ORNITHOLOGISTS**

JOINT MEETING – 2009

08-12 April 2009

Pittsburgh, Pennsylvania

ABSTRACTS – PLENARY & SYMPOSIUM PRESENTATIONS**THE FORGOTTEN SCIENCE—A ROLE FOR NATURAL HISTORY IN THE 21ST CENTURY**

Bruce M. **Beehler**, Center for Applied Biodiversity Science, Conservation International

Not to be confused with *Environmentalism*, the professional study of *Natural History* seems to be a disappearing vocation in the university realm—at some peril to the Earth. The world needs a healthy population of field naturalists to be measuring the pulse of the planet and to be speaking and advocating on behalf of Nature. Educators in the United States need to consider how to integrate more fully the appreciation and study of natural history into the formal array of coursework. A strong knowledge of natural history makes working academic biologists better researchers and better citizens. How can we best infuse the spirit of exploration and discovery, exemplified by the work of Wallace and Darwin, into our educational system? I use examples from 35 years of natural history study on the island of New Guinea to support this thesis.

RADAR ORNITHOLOGY AT DIFFERENT SPATIAL SCALES

Sidney A. **Gauthreaux, Jr.**, Department of Biological Sciences, Clemson University, Clemson, Sc 29634

I have used different types of radar to study the movements of birds in the atmosphere at different spatial scales (United States, the northern coast of the Gulf of Mexico, southeastern Texas and southwestern and southeastern Louisiana, and at several study sites in these areas). Studies at each scale have validated information gathered at the next larger scale. My presentation will review the discoveries that have resulted from these studies. At the smallest spatial scale (meters) marine radar with a fixed conical-beam directed vertically can measure the altitude of birds, bats, and insects flying through the field of view (4.8°) of a thermal imaging camera (or telescope) pointed vertically. This technique can be used to measure accurate migration traffic rates (the number of birds crossing a mile of front per hour) and direction of flight during the day and at night. Marine surveillance radar with an elevated (different angles above the horizontal), rotating, conical beam (2-4°) can detect birds moving through the atmosphere within a range of 1-14 kilometers and record the departure of migrants from different types of habitat within a few kilometers of the radar. With raw radar capture and digital processing, echoes can be tracked, and for each echo in a track, data on GPS coordinates, flight (ground) speed, altitude, and reflectivity is recorded. Doppler weather surveillance radar (WSR-88D) can detect concentrations of birds aloft out to 140-200 km. The radial velocity of targets can be measured to identify the type of target (migrating birds and bats, insects, foraging bats and birds) and reflectivity from the targets can be used to measure the density. At the beginning of a migratory movement (exodus) within 60 kilometers of the radar, the clusters of echoes from concentrations of departing birds can delimit the geographical distribution of migration stopover areas, and satellite imagery can be used to identify the type of vegetation that characterizes these areas. At the largest spatial scale, the national network of WSR-88D radars can be used to sample and monitor bird migration patterns over the United States at different altitudes on an hourly basis. The latter achievement is significant because it provides a means of monitoring the season-to-season and year-to-year variation in the patterns of migration at different altitudes for different geographical regions and the nation as a whole.

S1 THE USE OF DIGITAL AVIAN RADARS IN MONITORING BIRD MIGRATION AND MOVEMENTS.

Robert C. **Beason**, Accipiter Radar Technologies, Fonthill, ON, Canada.

Radar provides a useful and powerful tool to ornithologists. The ability of radar to detect birds has been known for more than 75 years but modern systems are capable of obtaining and analyzing data in ways only dreamed of by ornithologists just 20 years ago. With these capabilities comes the potential for errors on a scale not previously possible. Many types of radars have been used to research bird movements including weather and air traffic control (ATC) surveillance radars, vertically scanning radars, Doppler radars, and single-target tracking radars. Here, we focus on the strengths and limitations of *avian* surveillance radars that use marine radar front-ends integrated with digital radar processors to provide 360 degrees of coverage. Historically, the PPI display of the marine radar was used to observe and record data. Modern digital radar processors automatically extract target records with various target attributes such as location, speed, heading, and intensity as a function of time, which can be stored indefinitely, providing a rich resource for ornithologists. Interpreting these data in view of the sensor's characteristics is the key to correctly deriving and exploiting application-specific information about the movements of birds. Confounding factors ornithologists need to be aware of will be discussed including surface and volume clutter, undesired target clutter, and approaches to clutter mitigation. The increase in use of avian radars to monitor bird migration and daily movements for environmental evaluations, habitat use, and population monitoring behooves researchers to be familiar with the strengths and limitations of digital and analog avian radars.

S5 AUTOMATED ACOUSTIC MONITORING OF WHIP-POOR-WILLS.

Russell A. **Charif**, Michael Pitzrick, Harold Figueroa, and Andrew Farnsworth*, Cornell Laboratory of Ornithology, Cornell University, Ithaca, NY 14850.

Populations of whip-poor-wills and other caprimulgids appear to be declining in parts of their ranges, but reliable data on population trends are difficult to obtain. Whip-poor-will breeding biology provides an excellent opportunity to employ remote acoustic monitoring, in that territorial vocalizations are distinct, loud and stereotyped, and the nocturnal acoustic environment is relatively uncluttered. We used autonomous digital audio recorders and automated call detection software to monitor vocal activity of whip-poor-wills from sunset to sunrise over periods of 45 days at three widely separated sites in New York and New Jersey. Comparisons of detector results to manual inspection of the data in sample periods indicate that the software correctly detects a very high percentage of recorded whip-poor-will phrases with very low false alarm rates. Whip-poor-will calls were consistently detected even around the time of the new moon, when traditional survey protocols would prohibit data collection. Call rate was significantly correlated with time relative to sunset and sunrise, lunar phase, lunar altitude, and estimated lunar illumination. Although these results are consistent with correlations that have been recognized for decades, our data reveal patterns of whip-poor-will vocal activity with a precision not previously obtainable. The use of autonomous recording systems and call detection software can support efforts to monitor populations of vocally active nocturnal birds by (a) providing data on availability for detection to inform traditional observer-based survey protocols, and (b) providing a cost-effective alternative to traditional survey methods, especially at sites that are difficult to access at night.

S6 CALLS OF INDIVIDUAL TRANSIENT SWAINSON'S THRUSHES DURING FLIGHT AND STOPOVERS

W.W. **Cochran**, A. Raim, D.A. Enstrom*, Illinois Natural History Survey, Institute of Natural Resource Sustainability at the University of Illinois, Champaign, IL 61820 and Larry Pater, US Army Engineer Research and Development Center (ERDC), USACERL, 2902 Newmark Drive, Champaign, IL 61822.

The topic of flight calls is well summarized in Farnsworth's review (*Auk* 122, 2005): *Many passerine birds and their relatives utter flight calls, species-specific vocalizations given primarily during sustained flight, especially during migration. References to flight calls appeared in the ornithological literature as early as the 1890s, but some of the most basic features of these calls remain poorly known, including their functions, origins, ontogeny, distances over which they are used, and how much individual variation exists in the characters of the calls and their rates. With improved knowledge of these vocalizations, flight calls possibly will have a variety of applications. Identifying their function could illuminate how birds refine migration strategies during crucial decision-making periods. Because flight calls are relatively simple vocalizations, compared with many others that birds use, they provide useful characters for future evolutionary and comparative analyses. Monitoring flight calls can be a powerful method for studying nocturnal migration.* One gram microphone transmitters attached to six Swainson's thrushes provided vocalization data for comparison of the character of flight calls within and between individuals. We assign S4, S5, S6, S7, S8, and S9 designators to these birds following the presentation of their wing beat patterns and flight maps in Cochran et al. (*Integrative and Comparative Biology* 48, 2008). Data from these six birds were compared with a sample of calls of Swainson's thrushes overflying ground based microphones (Evans and O'Brien 2002 *Flight Calls of Migratory Birds*, a CD). Variation in call durations and spectral characteristics were high and similar within and between individuals, between daytime and migratory flight, and between the individuals and the overflying birds. Calling rates among individuals varied from 3.8 per hour to 46.2 per hour during migratory flight and were appreciably lower but also highly variable during daytime. Females called more often than males in daytime and during nocturnal migration. The high variability in virtually all aspects of calling must tell us something about what the function of calling is or is not, but we haven't figured that out yet.

S9 PATTERNS OF NOCTURNAL BIRD MIGRATION IN THE CENTRAL APPALACHIANS, DOCUMENTED THROUGH SOUND RECORDING.

Deanna **Dawson***, USGS Patuxent Wildlife Research Center, Laurel, MD 20708, Emma DeLeon and Lewis Grove, Powdermill Avian Research Center, Rector, PA 15677, and Tim Jones, USFWS Atlantic Coast Joint Venture, Laurel, MD 20708.

Concerns have arisen about the potential impacts of wind power development in the Appalachians on migrating birds, creating a critical need for information on their distribution as they pass through the region. During five migration seasons (Fall 2005, Spring and Fall 2006-2007), we studied nocturnal migration at >30 locations in the Appalachian Region of MD, VA, and WV, recording the calls made by migrating birds in flight in order to index their abundance in the lower airspace. Nightly counts of birds passing over each site are being analyzed to identify

temporal and geographic factors associated with migrant abundance. The outcome will be a model that predicts where and when low-flying migrants are likely to be abundant, providing guidance for decisions on wind turbine siting and operation, and context for interpreting results of surveys of migrants at proposed wind development sites in the region. We report preliminary findings, describing temporal and spatial patterns observed in Spring and Fall 2006. In both seasons, the number of migrants detected varied considerably among nights and sites, but sites generally agreed on which were the peak nights of migration.

S8 COMPARING BIOACOUSTICS AND BANDING: SIMILARITIES AND DIFFERENCES IN SEASONAL DATA PATTERNS.

Emma **DeLeon***, Lewis Grove, Andrew Vitz, and Michael Lanzone, Carnegie Museum of Natural History, Rector, PA 15677.

Bioacoustic analysis of nocturnal flight calls is an emerging tool for monitoring songbird populations and migration patterns. Historically such monitoring has relied on analyses of data from banding stations. We compared results of bioacoustical and banding data collected during August through October of 2004-2008 in southwestern Pennsylvania. We compared 3,155 hours of recordings made over the course of 260 nights against 398 days of banding data. 218 of the recording nights matched up directly with a banding session the following morning. Over 100,000 call detections and 37,000 banding records were considered. We examined inter- and intra- seasonal trends for the entire data set as well as for smaller sections of time and species complexes. We also assessed the variability of the data sets and how well they correlated on a finer scale. Preliminary analysis suggests that banding and bioacoustical data show similar overall patterns but that both techniques have high rates of daily variation. This variation may be responsible for more pronounced differences at short term and species complex levels. However, our seasonal level analysis suggests that sampling the migratory bird population using bioacoustics and mist netting yields comparable results for the overall peaks and duration of migration.

S11 REMOTE ACOUSTIC RECORDING AND MONITORING OF BIRDS AT THE INDIVIDUAL AND COMMUNITY LEVELS.

D.A. **Enstrom***, M.P. Ward, A. Celis and Jill Deppe, Illinois Natural History Survey, Institute of Natural Resource Sustainability at the University of Illinois, Champaign, IL 61820.

We are using three remote audio recording systems to study bird vocalizations at different levels of organization, ranging from individuals to communities. We use ≥ 1.0 gram acoustic radio transmitters (JDJC Inc.) to continuously record the vocalizations of individuals in their natural environment. Here we present results from a study comparing male and female song behavior in Northern Cardinals (*Cardinalis cardinalis*). We are also using a quadraphonic Soundscape Recording System (SRS, Celis Murillo et al. 2009) to record avian community vocalizations from fixed locations in a fashion analogous to point counts. We present preliminary data from a study conducted using this system in the Yucatan Peninsula, Mexico. Finally, we have developed a wireless microphone array where each microphone is placed at a fixed point and attached to a radio transmitter. Data from all microphones are simultaneously transmitted to a single receiver and then stored as synchronized wave files. The positions of vocalizing birds in the habitat are established through trilateration. This system is capable of monitoring all vocalizing individuals in a relatively large area. We present preliminary data collected with this system. We also discuss the benefits and challenges of using all of these systems to study the vocalizations of birds.

S2 AN EVALUATION OF THE POTENTIAL FOR USING ACOUSTIC MONITORING TO REMOTELY ASSESS FLYING ANIMAL COLLISIONS AT INDUSTRIAL WIND ENERGY FACILITIES.

William R. **Evans**, Old Bird Inc., Ithaca, NY 14850.

Human surveyors currently carry out most flying animal fatality monitoring at commercial wind energy projects. But, such methods are obviously not feasible for offshore wind farms. Expansion of wind energy offshore in Europe and similar offshore development plans in North America has led to the need for alternative means for assessing flying animal collisions. Remote thermal imaging equipment has been tested successfully for this purpose at offshore wind turbines in Europe. However, the equipment is costly and is ineffective in dense fog, a condition when birds may be more susceptible to collision. This presentation reports on an investigation into the potential of using acoustic monitoring as a remote method for documenting flying animal strikes at wind turbines. The pros and cons of three methods of documenting collision sounds are discussed and audio recordings of indirectly confirmed avian collision sounds are presented. The acoustic characteristics of these sounds (at least direct hits) suggest that they would be distinctive amidst other sounds produced by wind turbines and could be remotely monitored with audio equipment.

S10 NOCTURNAL BIRD MIGRATION IN THE WESTERN UNITED STATES: SPECIES COMPOSITION AND CALLING PHENOLOGY DATA GATHERED USING AUTONOMOUS RECORDING SYSTEMS.

Andrew **Farnsworth***, Michael Powers, Anne Klingensmith, Lewis Grove, and Ken Rosenberg, Conservation Science Program, Cornell Laboratory of Ornithology, 159 Sapsucker Woods Rd., Ithaca NY 14850.

Hemispheric-scale migrations involve billions of birds, but much migration takes place at night, inaccessible by most traditional data collection techniques. Recording species-specific flight calls of nocturnal migrants allows for economical monitoring and assessment of diversity and abundance of these species. We surveyed nocturnal migration using an autonomous system to record migrant flight calls between August and October 2007 at seven sites in the western United States, a region for which scant phenological information on nocturnal passage is available. Here we present the species inventory from these recordings from 5-11 September 2007 and compare species lists and call counts per hour between locations and dates. There is extensive variation in call counts among sites and nights, with coastal sites exhibiting higher call counts than interior locations. Species composition is similar across sites, with prevalence of numerous small passerines including Savannah Sparrow, White-crowned Sparrow, Common Yellowthroat, and Orange-crowned Warbler. As we continue to improve these acoustic technologies and to employ them with complementary monitoring methods, we will increase our knowledge of species-specific timing and use of stopover locations, ultimately targeting localized and unsurveyed locations that are high priorities for conservation.

S7 MID-SUMMER DISPERSAL, NOCTURNAL MOVEMENTS, AND MOLT-MIGRATION OF CHIPPING SPARROWS IN COLORADO: IMPLICATIONS FOR THE VALIDITY OF *SPIZELLA PASSERINA BOREOPHILA* OBERHOLSER, 1955.

Ted **Floyd**, American Birding Association, 2009 South Fork Drive, Lafayette, CO 80026.

During the summers and falls of 2007–2008, I quantitatively documented a heavy nocturnal passage of Chipping Sparrows over Boulder County, Colorado. Sustained nighttime overflights were underway by late July, and the passage peaked in late August. This early-season dispersal led me to hypothesize that Chipping Sparrows in the western interior of the United States are molt-migrants, a result I have confirmed with field observations of adults at molt-migration sites away from the breeding grounds; adults arrive at these sites in worn alternate plumage, and they commence their prebasic molt soon thereafter. Chipping Sparrows farther north apparently do not engage in sustained early-season dispersal, a result that has possible bearing on the validity of the “Canadian” Chipping Sparrow (subspecies *boreophila*). Most current authorities treat Canadian *boreophila* under western *arizonae*, but the results of my study suggest a closer behavioral affinity with nominate (eastern) *passerina*. A review of other behavioral traits, a photographic analysis of museum specimens, and a priori biogeographic reasoning also suggest that *boreophila* should be treated under *passerina*, not *arizonae*. This study highlights the potential for nocturnal migration studies to illuminate previously unsuspected aspects of avian biology—in this case molt, migration, and taxonomy of the Chipping Sparrow.

S3 AUTOMATED AVIAN TRACKING VIA RADIO-FREQUENCY TIME OF ARRIVAL MEASUREMENTS.

Robert **MacCurdy***, Rich Gabrielson and David Winkler, Cornell Laboratory of Ornithology, Cornell University, Ithaca, NY 14850.

Traditional radio tracking efforts require field personnel to manually determine lines of bearing to the target animal. Several notable systems have automated this process and allow unattended tracking using direction of arrival receivers. We have developed a new method, similar to GPS, which uses radio-frequency time of arrival measurements to determine transmitter location. This system uses fixed receiver stations with single element antennas, can track several hundred transmitters simultaneously, yields position estimates accurate to within 20 meters, and enables ultra-low power transmitters with multi-year lifetimes. A four receiver network can cover a 25 km² area, depending on the topography. The system can track birds in real time when the receivers are networked via terrestrial or satellite data links. We have demonstrated prototypes of this system in Ithaca, NY as well as the Dutch Wadden Sea. This presentation will discuss the operating principles of the system, its current capabilities, and our development plan.

S4 APPLYING NESTER (NETWORKED ENVIRONMENTAL SONIC-TOOLKITS FOR EXPLORATORY RESEARCH) TO THE ANALYSIS OF BIRD RECORDINGS.

David **Tcheng***, Automated Learning Group, National Center for Supercomputing Applications, University of Illinois at Urbana-Champaign, David Enstrom, Illinois Natural History Survey, Institute of Natural Resource Sustainability at the University of Illinois at Urbana-Champaign, Stephen Downie, Graduate School of Library and

Information Science at the University of Illinois at Urbana-Champaign, and Michael Ward, Illinois Natural History Survey, Institute of Natural Resource Sustainability at the University of Illinois at Urbana-Champaign. We present NESTER (Networked Environmental Sonic-Toolkits for Exploratory Research), an open source, scalable, web accessible system that uses advanced machine learning methodologies to analyze large collections of bird recordings. The NESTER system has discovered sex based differences in vocalization patterns, produced accurate syllable transcription, and identified rare flight calls in migrating bird recordings. To use today's massive computing power to achieve high accuracy, the system uses optimization methods to search for the ideal combination of spectral representation and learning algorithm control parameter settings for each given prediction problem. Parallel processing is employed at both the machine level (multiple cores) and cluster level using cloud computing techniques to fully utilize all available computing resources. The system is implemented in Meander, the parallel data flow language at the heart of the SEASR (Software Environment for the advancement of Scholarly Research). In a typical NESTER application, a signal / no signal model is first built to rapidly parse a recording into interesting and non-interesting segments. The interesting segments then become the focus for the manual tagging of events. Once enough events are tagged, a final model is built to tag events in new recordings.

ABSTRACTS – ORAL PRESENTATIONS

Arranged by first author's last name

43 ^SPOST-FLEDGING SURVIVORSHIP ACROSS AN URBANIZING LANDSCAPE.

Ian **Ausprey*** and Amanda Rodewald, School of Environment and Natural Resources, The Ohio State University, Columbus, OH 43210.

Despite a growing literature regarding the ecology of birds in urbanizing landscapes, the post-fledging period remains poorly understood. Because urbanization creates a novel selective environment that may impact survivorship, we asked 1) how does post-fledging survivorship vary across an urban-to-rural landscape gradient, and 2) to what extent do fledgling condition, habitat selection, and local predator communities explain that variation? During the summer of 2008 we placed radio transmitters on fledglings of Northern Cardinal (*Cardinalis cardinalis*; n = 24) and Acadian Flycatcher (*Empidonax vireescens*; n = 14), species that respectively represent urban adaptors and avoiders. Tagged fledglings occupied 17 riparian forest fragments embedded within agricultural and urban landscapes in central Ohio. Cumulative survivorship over 64 days was low for cardinals ($\phi = 0.29 \pm 0.10$ SE), with the majority of mortality resulting from predation. In contrast, survivorship over 21 days was high for flycatchers ($\phi = 0.86 \pm 0.10$ SE). The amount of urbanization within the surrounding landscape was included in the top model set explaining survivorship for flycatchers ($\Delta AIC_c = 0$, $\omega = 0.297$, $\beta_{\text{urban}} = -0.56$, 95%CI [-1.88, 0.76]) but not cardinals. Preliminary habitat analysis indicated that cardinals remained low in the canopy and used areas with more honeysuckle (*Lonicera maackii*) cover than randomly-paired plots ($t = 6.44$, $p < 0.001$). Flycatcher fledglings remained in the upper forest canopy and did not use areas with extensive honeysuckle cover ($t = 1.00$, $p = 0.322$). Our future efforts include an additional field season and more robust analyses regarding the relationship between survivorship, condition at time of fledging, and habitat selection.

17 ^SCANADA WARBLER HABITAT SUITABILITY IN AN ACTIVE INDUSTRIAL FOREST IN WEST VIRGINIA.

Douglas **Becker**,* West Virginia Cooperative Fish and Wildlife Research Unit, Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV 26506 and Petra Bohall Wood, U.S. Geological Survey, West Virginia Cooperative Fish and Wildlife Research Unit, West Virginia University, Morgantown, WV 26506. Canada Warbler (*Wilsonia canadensis*), a woodland breeding songbird of conservation concern, has been declining range-wide by 3.3% since 1990. Canada Warblers primarily use moist mixed coniferous-deciduous forests but can be higher elevation disturbance specialists in the southern portion of their range, including West Virginia, suggesting that timber harvests might be an effective management option. Our objective was to determine whether harvests are viable management tools in an actively harvested forest. We conducted point counts at the Wildlife and Ecosystem Research Forest (WERF) from 1996–1998, 2001–2003, and 2007–2008 and modeled how changing landscape metrics and landcover influenced warbler abundance using a regression tree approach. Additionally, we monitored Canada Warbler nests and measured changes in microhabitat. Forested habitats on the WERF decreased from 93% to 42% since 1996, while harvested areas increased from 3% to 53%. Recent nests had more shrubs, woody debris, saplings, poles, and canopy cover <6m, but fewer trees >7.6cm DBH and more high canopy cover than nests from 1996-1998. The amount of partial harvests on the landscape had the greatest influence on warbler abundance models. Unexpectedly, abundance and nest success both declined, potentially resulting from small sample sizes, differences in yearly count locations, or region-wide abundance declines. Overall, results indicate that warblers are selecting harvested sites that provide higher quality habitat due to greater understory vegetation density and foraging sites, suggesting that timber management, especially partial harvests, is a viable management tool. Additional research is necessary to clarify observed declines in abundance and nest success.

2 ^SDARLING, IS THAT YOU?: VOCAL MATE RECOGNITION IN WILD PARROTS.

Karl S. **Berg***¹, Soraya Delgado¹, Rae Okawa¹, Steven R. Beissinger² and Jack W. Bradbury¹. ¹Macaulay Library, Cornell Laboratory of Ornithology and Department of Neurobiology & Behavior, Cornell University, 159 Sapsucker Woods Road, Ithaca, NY 14850. ²Department of Environmental Science, Policy & Management, U.C. Berkeley.

Abstract.- Individual vocal recognition is thought to be widespread in birds and essential for coordinating numerous daily activities between individuals. In parrots, evidence for vocal signatures is accumulating, however, there has been only one study of vocal recognition in wild individuals. We studied vocal mate recognition in a marked population of Green-rumped Parrotlets (*Forpus passerinus*) of Venezuela. We recorded 38 males on 225 visits to active nests. Females performed all of incubation and were visited by males about every hour. Males usually gave loud contact calls upon arrival; if other individuals were nearby they tended to produce warbling sounds. About a

third of the time, the male entered and commonly fed the female; the remainder of the cases the female left the cavity to join the male where they preened and or copulated. Females responded by ascending or vocalizing on about 2/3 of mates' visits. If females responded vocally it was more likely to happen after the fertile period, they usually stayed inside and males were more likely to subsequently enter and feed. Males gave mainly two call types upon arrival and each showed sufficient structural repeatability to make individual recognition plausible. Calls from 18 males were broadcast to incubating females. Females responded more often to calls of their mates than to controls. We conclude that contact calls are used in mate recognition by female parrotlets. The diversity of call types used and the multiple female responses are discussed in lieu of potential functions of contact calls beyond individual recognition.

30 LONG-TERM AVIAN COMMUNITY DYNAMICS IN SUCCESSIONAL, FORESTED, AND MANAGED PLOTS IN A REFORESTING LANDSCAPE.

David N. **Bonter***, Cornell Lab of Ornithology, Ithaca, NY, and Elizabeth W. Brooks, Braddock Bay Bird Observatory, Rochester, NY.

Reforestation of marginal agricultural lands undoubtedly leads to dramatic changes in avian communities, yet few long-term studies have documented the influence of agricultural abandonment on avian community dynamics. We examined a 35-year transition in the breeding bird community at a successional study site in a reforesting landscape. Changes in the successional plot were compared with changes in two additional census plots, one located in undisturbed forest and the other in a managed tree farm. The territories of 7,429 singing males were mapped on the census plots. The most dramatic changes in community structure were recorded in the successional plot where the total number of territories declined, grassland/scrub nesting species were nearly extirpated, and the number of Neotropical migrant territories increased. In contrast, the number of Neotropical migrant territories declined in the undisturbed forest plot where the avian community otherwise remained relatively stable. The number of territories increased in the managed plantation largely due to increases in temperate zone migrants and resident species. Counts of individual species in the census plots were not highly correlated with counts from regional Breeding Bird Survey routes.

36 ^SDEVELOPMENT AND EVALUATION OF AN *IN VIVO* PENTOSIDINE AGING TECHNIQUE FOR DOUBLE-CRESTED CORMORANTS (*PHALACROCORAX AURITUS*)

Crissa **Cooley*** and James Anderson, Wildlife and Fisheries Resources, Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV, 26506. Brian Dorr and Katie Hanson, United States Department of Agriculture, Wildlife Services, National Wildlife Research Center, Box 6099, Starkville, MS, 39762. Hillar Klandorf, Animal and Nutritional Science, Division of Animal and Nutritional Science, West Virginia University, Morgantown, WV 26506

A live sampling protocol to age birds by measuring pentosidine (Ps) in the skin has not previously been attempted. Considerations include biopsy location, amount of skin to process, and closure method of the wound. We developed a minimally invasive protocol for live sampling Double-crested Cormorants (*Phalacrocorax auritus*). Comparison of Ps concentrations (pmol/mg collagen) between the patagium ($\bar{x} = 10.6 \pm 1.10$) and breast ($\bar{x} = 11.2 \pm 1.10$) of deceased cormorants revealed similarities ($P = 0.10$, $n = 63$). Pentosidine was marginally higher in 6-mm ($\bar{x} = 12.6 \pm 1.19$) than 20-mm diameter ($\bar{x} = 11.3 \pm 1.23$) patagial skins ($P = 0.02$, $n = 50$). We took 6-mm diameter biopsy samples *in vivo* from the breast and patagium of 7 living cormorants. Wounds were closed with sutures ($n = 4$) or tissue glue ($n = 3$). Pentosidine was similar between the breast ($\bar{x} = 14.7 \pm 2.70$) and patagium ($\bar{x} = 12.2 \pm 1.82$) ($P = 0.20$). Healing time (days) was similar between the breast ($\bar{x} = 15.9 \pm 1.36$) and patagium ($\bar{x} = 15.8 \pm 1.85$) ($P = 0.79$). Wounds closed with tissue glue ($\bar{x} = 14.5 \pm 1.12$) healed faster than with sutures ($\bar{x} = 17.3 \pm 0.66$) ($P < 0.001$). Live sampling birds for Ps analysis is a viable technique and estimates age within 2½ years of actual age, suggesting that this technique can be useful for aging long-lived birds. We recommend taking 6-mm skin samples from the patagium and closing the wounds with tissue glue.

48 ^STHE INFLUENCE OF ENERGETIC CONDITION ON MIGRATORY DECISIONS OF BLACKPOLL WARBLERS DURING SPRING MIGRATION

Kristen M. **Covino***, School of Science and Humanities, Husson University, Bangor, ME 04401; Rebecca L. Holberton, School of Biology and Ecology, University of Maine, Orono, ME 04469; and Sara R. Morris, Department of Biology, Canisius College, Buffalo, NY 14208.

Energetic condition influences migratory decisions made by songbirds, however, few studies have investigated this during spring migration in New England. We used release tests to investigate how various components of energetic condition relate to migratory decisions of Blackpoll Warblers (*Dendroica striata*) at a stopover site along Maine's

coast. Specifically, we were interested in determining which components are related to initiation of migratory flight and which are related to the direction of flight once a bird has departed. Our results indicate that the amount of fat a bird has at the time of release, within-day changes in body mass, and size-corrected body mass influence the decision to initiate a flight while plasma triglyceride levels were not. None of the condition variables used in this study was related to directional decisions of Blackpoll Warblers. It is not surprising that fat score and body mass influence whether to depart or not. We were unable to detect a relationship between plasma triglycerides and flight initiation possibly because they provide little information about the amount of currently available energy. Since blackpolls are relatively close to the end of their migration at our field site, the location of their breeding grounds may have a stronger influence on directional decisions than condition, which may explain why condition was not related to flight direction in our study. Further study is needed to understand how birds integrate a variety of intrinsic cues available to them.

31 PATTERNS OF NATAL DISPERSAL IN A HYBRID CHICKADEE POPULATION.

Robert L. **Curry***, Department of Biology, Villanova Univ., Villanova, PA 19085.

Dispersal of birds from their place of birth to their first breeding site is a critical component of avian demography. However, it is a phenomenon that is inherently difficult to study because information is invariably incomplete. I took advantage of a system of artificial nest snags to examine patterns of natal dispersal among resident chickadees at Nolde Forest, a site within the hybrid zone between Black-capped and Carolina chickadees in southeastern Pennsylvania. Study over 10 years involving banding of >1875 nestlings yielded 53 adult chickadees of known origin; the sample included significantly more males (67%) than females (33%). Neither relative fledging date nor brood size affected the likelihood of a chickadee remaining within the site. Average dispersal distance for males (425 m) was less than for females (620 m). The distribution of male dispersal distances was not distinguishable from a null pattern based on distances among all snags, but female dispersal distances were greater than expected. These patterns suggest that the dispersal of male chickadees is sufficiently short for many birds to remain within Nolde Forest, whereas many females probably disperse away from the site. These results support female-biased natal dispersal, but while the analytical approach yields inferences about the shape of sex-specific distributions, it provides no insight about the frequency of longer dispersal that may disproportionately influence the structure and dynamics of hybrid zones via introgression.

54 ^STHE EFFECT OF OFF-ROAD VEHICLES ON MIGRATING SHOREBIRDS.

Katherina **Forgues***, Department of Biology, Trent University, Peterborough, ON, Canada.

Dramatic declines in shorebirds populations have sparked a flurry of research aimed at improving conservation efforts. However, there are still large gaps in knowledge concerning the causes of shorebird declines. Evidence from recent studies shows that recreational activities pose a significant threat to shorebirds. Understanding how recreational activities affect shorebird populations is critical to piecing together the puzzle behind their decline. From 2007-2008, we examined the effect of off-road vehicles on shorebirds during the spring and fall migration seasons at Assateague Island National Seashore in Maryland. Species diversity showed a steady decrease as the volume of off-road vehicles on the beach increased. Likewise, the abundances of commonly occurring species significantly declined with increasing off-road vehicle presence, while rarer species avoided areas with off-road vehicles entirely. Habitat quality was also affected by off-road vehicles, evidenced by declines in roost abundances and food availability with increasing off-road vehicle presence. In addition to providing useful information for shorebird conservation efforts, these findings will also be incorporated into National Park Service management plans to minimize disturbance to migrating shorebirds. Future studies to conserve shorebirds and minimize the threat of recreational activities should be focused on fitness aspects such as physical condition of migrating shorebirds in areas with recreational activities compared to those without.

28 ^STHE APPLICATION OF BIOLOGICAL CONDITION INDICES TO AVIAN MONITORING DATA.

Sarah E. **Goodwin*** and W. Gregory Shriver, Department of Entomology and Wildlife Ecology, University of Delaware, Newark, DE 19711.

Monitoring ecological condition is a complex and challenging endeavor that is often undertaken by land management organizations. The National Park Service Inventory and Monitoring program is charged with monitoring the condition of park natural resources. Here, we apply avian biological condition indices (BCIs) developed by O'Connell et al. (2003) and O'Connell et al. (2000) to assess the integrity of the forest breeding bird communities in the National Capital Region of National Parks. We used repeat visits to 386 point counts to estimate avian abundance and create a single metric of forest bird integrity for each location. At count locations,

proportional species representation in a suite of guilds was used to score the location. Specialist guilds were ranked more favorably than generalist guilds, and the ranks for each guild were summed for a final score for the point. In the Appalachian bird conservation region, standardized BCI scores range from 7.9 to 77.0, with an average score of 49.0 in 2007 and 47.8 in 2008. These scores correspond to a classification of “moderately disturbed” for both years. In the Piedmont and Coastal Plain bird conservation regions, BCI scores range from 3.7 to 100.0, with an average score of 64.8 in 2007 (“naturalistic”) and 63.3 in 2008 (“largely intact”). We then compared BCI scores to a suite of habitat variables to test the sensitivity of the BCI score to patch and landscape variables. The BCI approach to analyzing broad-scale avian monitoring data holds much promise for a rapid assessment of avian integrity.

46^SEVALUATION OF A MOLT-MIGRATION TACTIC IN WOOD THRUSH.

Elizabeth **Gov***, Bridget Stutchbury, Department of Biology, York University, ON, M3J 1P3, and Kurt Kyser, Department of Geological Sciences and Geological Engineering, Queen’s University, ON, K7L 3N6

Stable hydrogen isotopes are commonly used to determine the molting latitude of feathers but inference of geographic breeding origins of wintering birds could be compromised if molt-migration overlap is common. In northwestern Pennsylvania, we evaluated the possibility that Wood Thrush undergo molt-migration by (1) capturing birds during the molting period and measuring δD on freshly grown feathers and (2) sampling a sequence of flight feathers from returning birds in spring. Many Wood Thrush did not begin to molt until mid to late August, and are candidates for molt-migration overlap since molt takes about 4-5 weeks to complete. There was wide variation in δD values for feathers assumed (first primary) or known to have grown on the study site (-79 to -40‰) and δD varied significantly between years. Approximately 20% of all Wood Thrush adopted a molt-migration tactic. Occasional flight feather loss does not likely explain low δD_f values since many individuals had multiple feathers (primary, secondary, rectrix) corresponding with the southern U.S. or Central America. We suggest that when assigning geographic origin that multiple primary feathers be sampled to account for molt-migration overlap.

8 TRACING MERCURY AND CALCIUM THROUGH FOOD WEBS TO TERRESTRIAL FOREST BIRDS: CAUSES AND CONSEQUENCES.

Ralph S. **Hames*** and James D. Lowe, Laboratory of Ornithology, Cornell University, 159 Sapsucker Woods Road, Ithaca, NY, 14850

Burning of hydrocarbons, particularly coal, releases acid ions and mercury as by-products. Forest breeding birds across broad reaches of Eastern North America, especially those at higher elevations, must cope with the resulting acid rain and mercury deposition. These pollutants lead to reductions in the number and size of calcium-rich invertebrates needed as supplements for breeding adults and to provision nestlings, as well as the contamination of these prey with mercury. We traced mercury through living leaves, leaf litter and soil, invertebrates and breeding terrestrial birds in five forested regions of New York. To do so, we trapped birds of four common Eastern species (Black-capped Chickadee, White-breasted Nuthatch, Red-eyed Vireo, and Ovenbird) that were selected because of differences in their migratory habit and feeding substrate. We sampled blood and feathers to test for mercury contamination and calcium content and found ubiquitous low-level mercury contamination in sampled birds. At each level from soil to bird, we found strong correlations between mercury, calcium content and acidity as well as region and species. We show that uptake of gaseous elemental mercury by growing leaves may be an important gateway into Eastern deciduous food webs. The amount of mercury contamination varied with tree species, suggesting that vegetation type may play an important role in the level of mercury contamination of birds at a given site. We discuss current and future research which that addresses the fitness consequences of low-dose mercury for populations and the individuals.

6 REPEATABILITY OF HEMATOCRIT IN GRAY CATBIRDS.

Margret I. **Hatch***, Penn State Worthington Scranton, Dunmore, PA 18519 and Robert J. Smith, Dept. of Biology, University of Scranton, Scranton, PA 18510

Hematocrit, the ratio of packed red blood cells to total blood volume, is increasingly being reported as a measure of condition in wild birds. However, recent reviews call into question the reliability of these measures due to many variables that may influence hematocrit. We examined the repeatability of hematocrit in Gray Catbirds (*Dumetella carolinensis*) to determine whether among individual variation was greater than within individual variation over several time scales. We found hematocrit to be repeatable at both short (between captures within a year) and long (between years) time scales but not at an intermediate time scale (between months within a year). Repeatability in catbirds was higher than in two other species for which repeatability of hematocrit has been reported. Our results suggest that hematocrit in Gray Catbirds was a reliable measure of individual differences in physiology across years and weeks, but not months.

44 ^SPOSTFLEDGING MOVEMENT BEHAVIOR AND HABITAT USE OF ADULT FEMALE SALTMARSH SHARP-TAILED SPARROWS.

Jason **Hill***, Ecology Program, Pennsylvania State University, State College, PA 16802, and Chris Elphick, Ecology and Evolutionary Biology Department, University of Connecticut, Storrs, CT, 06268.

These findings represent the first explicit postfledging movements and habitat use for adult female Saltmarsh Sharp-tailed Sparrows. Movement behavior was best predicted by models incorporating the amount of artificial ditch and natural channel margins, but we were unable to demonstrate preferential use of these features within female home ranges. This study identified a shift in habitat use from the nesting period (as reported in other studies) to the postfledging period. Even in such a relatively simple and species-poor system as salt marshes, individual females demonstrated different preferential use of individual habitat components. The overall pattern of habitat use, however, was strikingly different from that previously described for Saltmarsh Sharp-tailed Sparrows during other periods of their life. This new suite of microhabitat components that describes postfledging habitat use consists of relatively tall and structurally varied vegetation, at locations relatively close to the marsh edge, and with relatively greater amounts of bare ground and *S. alterniflora* (tall form). Previous attempts to estimate Saltmarsh Sharp-tailed Sparrow population size in Connecticut have been hindered by a lack of knowledge concerning the home range size, movement patterns and habitat use of this species. These data should facilitate the creation of demographic models that could provide valuable insight into conservation actions and into the processes that regulate Saltmarsh Sharp-tailed Sparrow populations.

53 AN ON-GOING STUDY OF RUBY-THROATED HUMMINGBIRDS, *ARCHILOCHUS COLUBRIS*, ON NON-BREEDING GROUNDS IN GUANACASTE PROVINCE, COSTA RICA.

*Bill **Hilton Jr.** and Ernesto Carman Jr., 1Hilton Pond Center for Piedmont Natural History 1432 DeVinney Road York, SC

Since December 2004 we have spent 49 winter field days capturing and color marking Ruby-throated Hummingbirds (RTHU), *Archilochus colubris*, in northern Guanacaste Province, Costa Rica, as part of the first intensive banding study of this species in the Neotropics. Our study sites at Cañas Dulces and Liberia are organic *Aloe vera* plantations that concentrate RTHU in dense enough numbers to allow for productive mist netting; a few birds were trapped. Through 2009 we applied U.S.-issued bands to 509 individual RTHU; of these, three (two males and a female) returned in a later year—the first evidence of site fidelity by RTHU within their non-breeding range. We also made extensive observations of RTHU territoriality and molt sequencing, and of nectar flower usage outside the aloe fields. We have not recaptured any RTHU banded on their North American breeding grounds; however, a female RTHU we banded in Guanacaste in January 2008 was encountered five months later at Baxley, Georgia, about 2,400km north. This is the first hummingbird of any species known to be banded in the tropics and later encountered in the U.S. or Canada. Other non-hummingbird Neotropical migrants caught incidentally in Guanacaste were also banded and released. As a complement to our Costa Rica work, in November 2008 Hilton captured the first RTHU ever banded in El Salvador (two birds) and in Guatemala (57). Field assistance and financial support for the project comes primarily from groups of citizen scientists from the U.S, Canada, and Costa Rica, with additional support from Holbrook Travel.

13 ^SSURVIVAL IN A CREATED LANDSCAPE: RADIO-TRACKING FLEDGLING BLUEBIRDS ON GOLF COURSES.

Allyson K. **Jackson*** and Daniel A. Cristol, Department of Biology, College of William and Mary, Williamsburg, VA 23187.

As more natural land is developed, wildlife must either adapt to urbanization, be pushed into marginal habitats, or perish. Golf courses, while manicured and artificial, could be an oasis of green in an increasingly paved landscape, but little is known about how this created habitat affects the birds that settle there. Many birds, including the once declining Eastern Bluebird (*Sialia sialis*), successfully breed on golf courses, but little is known about what happens to nestlings once they fledge. In 2008, 71 Eastern Bluebird fledglings were radio-tracked on golf course and reference sites in Williamsburg, Virginia and individual instances of mortality were documented in 22 cases, which fell into three main categories: *hawk predation*, *snake predation*, and *unpredated* (body recovered intact). Postfledging survivorship, calculated using a Kaplan-Meier estimator, showed that birds that fledged from nests on golf courses had significantly higher initial mortality rates ($t=2.24$, $p=0.029$). Fledglings on golf courses exhibited 24% mortality in the first 10 days postfledging, compared to only 6% mortality during the same time for reference fledglings. Many of the early golf course mortalities were due to predation by hawks, suggesting that the open, manicured environment makes it easier for hawks to catch weak-flying young bluebirds. By understanding what

aspect of the habitat is particularly risky for young bluebirds, using GIS-based spatial analysis, we can make recommendations to golf courses and other recreational areas for changes (i.e. tree planting or nest box placement) that can greatly increase avian juvenile survival.

47^S SEASONAL DIFFERENCES IN ENERGETIC CONDITION OF BLACKPOLL WARBLERS.

Jason D. **Jacobs***, Department of Biology, Canisius College, Buffalo, NY 14208; Kristen M. Covino, School of Science and Humanities, Husson University, Bangor, ME 0440; and Sara R. Morris, Department of Biology, Canisius College, Buffalo, NY 14208.

During fall, Blackpoll Warblers (*Dendroica striata*) make extensive over-water flights, requiring substantial fat stores. Our goal was to determine if the condition of Blackpoll Warblers captured during spring migration differed from that of birds captured during fall migration and to determine whether these results were location specific, typical of coastal locations, or a general pattern in this species. We used banding data from four sites; two inland (Braddock Bay Bird Observatory and Long Point Bird Observatory) and two coastal (Appledore Island Migration Station and Block Island Bird Observatory). During spring blackpolls had higher average fat scores than during fall at all four sites ($p < 0.001$). Likewise, average mass and average condition index at all four sites were higher during spring than fall (all $p < 0.001$). Additionally, our data show that both males and females had a higher mass and condition index during spring than fall at three of the four stations. At Block Island Bird Observatory however, only males had a higher condition index during spring ($p < 0.05$). Our results were somewhat unexpected, and indicate that this pattern of better condition during spring than fall may be typical of northern stopover sites. The substantial fat stores seen during spring may indicate that migrating blackpolls do not use all their acquired fat stores during spring flights. These remaining energy stores may provide additional energy to survive inclement weather at the beginning of the breeding season and/or to use for activities related to reproduction.

25 EVIDENCE FOR A MATERNAL EFFECT BENEFITING EXTRA-PAIR OFFSPRING IN THE HOUSE WREN.

L. Scott **Johnson***, Jessica L. Brubaker, Bonnie G. P. Johnson and Brian S. Masters, Dept. Biology, Towson Univ., Towson, MD 21252.

Females are hypothesized to engage in extra-pair copulations to secure alleles that enhance offspring fitness potential. To test this, researchers typically compare fitness-related attributes of extra-pair (EP) and within-pair (WP) half-siblings. Often neglected, however, is the possibility that females provide EP offspring with non-genetic advantages. In species in which eggs hatch asynchronously, females may place EP offspring amongst earlier-laid eggs in the clutch. Because they tend to hatch first, chicks from earlier-laid eggs are often larger and more developed than their nestmates and thus have a competitive advantage. We tested for an association between offspring paternity and position in the laying sequence in House Wrens (*Troglodytes aedon*). Eggs in this population always hatch asynchronously over 24-48 h, usually in the order laid. This sets up a stair-step-like size hierarchy within broods early in the nestling stage with chicks from earlier-laid eggs being larger than chicks from later-laid eggs. This allowed us to use chick mass relative to that of its nestmates as an index of chick position in the laying sequence. We compared masses of EP and WP offspring shortly after hatching in 27 broods with mixed paternity. On average, EP offspring weighed 14% more than their WP counterparts, a highly significant difference. This suggests that EP offspring are more likely than WP offspring to appear in earlier-laid eggs. We recommend that, when comparing EP and WP half-siblings in species in which eggs hatch asynchronously, researchers test for this potential maternally derived effect on offspring performance.

32^S DNA BARCODING IS FOR THE BIRDS: USING AN OLD TECHNIQUE IN NEW SITUATIONS: A CASE STUDY FOR ASIAN VULTURES.

Yula **Kapetanakos**, Cornell University, Ecology and Evolutionary Biology, E. 146 Corson Hall, Ithaca, NY 14850. DNA barcoding, the identification of taxa based on short conserved regions of DNA, can provide a quick and accurate means of species identification. Cytochrome c oxidase I (COI), a region of the mitochondrial gene, has been used successfully to discriminate between bird species, and can serve as a field tool to identify taxa that may be difficult to monitor by visual census counts alone. As part of a larger non-invasive mark-recapture project, DNA barcoding has been instrumental in identifying species of Asian vultures through genetic material obtained from feather samples. In light of new sequencing technologies, DNA barcoding may become particularly useful for bird ecologists in studying and monitoring mixed species assemblages.

42^S ASSOCIATIONS BETWEEN ACTIVITY LEVELS OF NEST PREDATORS AND SONGBIRD NEST PLACEMENT IN URBAN FORESTS.

Laura J. **Kearns*** and Amanda D. Rodewald, School of Environment and Natural Resources, The Ohio State University, Columbus, OH 43210.

Although nest predation is widely recognized to profoundly influence reproductive success in birds, the extent to which birds adjust nest-placement decisions based on activity of predators is poorly understood. In this study, we assessed (a) spatial variation in activity levels of common nest predators, (b) the degree to which nesting birds may respond to perceived differences in predation pressure, and (c) associations between nesting success and activity levels of predators. To do this, we mapped locations of common nest predators within 14 riparian forests in Columbus Ohio in 2008. In addition, we located and monitored 10-20 nests of Northern Cardinals (*Cardinalis cardinalis*) at each site. To analyze activity patterns of potential nest predators, a fixed kernel estimation with least squares cross validation using Hawth's Tools in ArcGIS was used to create utilization distributions (UD) from sightings of species such as Cooper's Hawk (*Accipiter cooperii*), Blue Jay (*Cyanocitta cristata*), Common Grackle (*Quiscalus quiscula*), gray squirrel (*Sciurus carolinensis*), raccoon (*Procyon lotor*), and domestic cat (*Felis catus*). The spatial distribution of cardinal nests was related to activity levels of predators, such that cardinals seemed to avoid placing nests in those areas receiving the greatest visitation by predators. Nest success was inversely related to activity levels of some (e.g., gray squirrel and blue jay), but not all, nest predators. These findings provide preliminary support for the idea that birds adjust nest placement in ways that minimize risk to predation.

15 FOREST MIGRANTS IN SHORT-GRASS PRAIRIE OF NEW MEXICO: HABITAT USE WHEN HABITAT IS (NEARLY) ABSENT.

Gregory S. **Keller***, Department of Biology, Gordon College, Wenham, MA 01984, and Julian D. Avery, Department of Ecology and Evolution, Rutgers University, North Brunswick, NJ 08902

In short-grass prairie of eastern New Mexico, woodland habitat accounts for less than 3% of all land area, perhaps presenting a challenge to forest-dwelling songbirds during migration. We examined songbird use of woodland habitat during spring and fall to determine what strategies migrants use while moving through eastern New Mexico. Our objectives were to analyze patterns of species richness, guild richness, and species abundance in different wooded habitats. We also monitored behavior of Wilson's (*Wilsonia pusilla*), Orange-crowned (*Vermivora celata*), and Yellow-rumped Warblers (*Dendroica coronata*) during fall migration to identify differences in foraging patterns and success. We conducted point counts in: 1) natural cottonwood (*Populus* spp.) and elm (*Ulmus* spp.) patches; 2) invasive salt cedar (*Tamarix ramosissima*) patches; and 3) residential wooded habitats. Total richness and richness of Nearctic-Neotropical migrants were significantly higher in natural cottonwood patches compared to other habitats during both seasons. Yellow-rumped Warblers had greater foraging success in cottonwood patches, but we found no differences in foraging of Wilson's and Orange-crowned Warblers. For individual species, insectivores (e.g., Wilson's Warbler) and Nearctic-Neotropical migrants (e.g., Bullock's Oriole [*Icterus bullockii*]) were more commonly encountered in cottonwood patches. However, several migratory species used these habitats with no significant difference in abundance, illustrating the potential stopover value of all woodland patches in this region.

38 USE OF SPYCAMS IN NEST BOXES REVEALS THAT FEMALE HOUSE WRENS GIVE FEEDING CALL TO JUST-HATCHED AND YOUNG NESTLINGS.

E. Dale **Kennedy*** and Douglas White, Department of Biology, Albion College, Albion, MI 49224.

Different types of vocalizations have been observed and investigated in many species of birds, often with the goal of determining functions of songs and calls. In House Wrens (*Troglodytes aedon*), male songs and some vocalizations of females, nestlings, and fledglings have been reported and described. In 2008, we placed minicameras with infrared illumination and built-in microphones inside lids of nest boxes to record female behaviors during incubation. On several occasions, we recorded hatching of nestlings, and we observed from videos that females entering nest boxes with food gave a different type of call to newly hatched young. On hearing this call, blind young nestlings often raised their heads to receive food. We used Avisoft SAS-Lab Pro to analyze different vocalizations of female wrens given in nest boxes during incubation and compared them with feeding calls given by females with food to young nestlings. We describe this feeding call as a different type of vocalization than those previously recorded for female House Wrens. Use of spycams in nest boxes has revealed new information about behavior of wrens during both incubation and nestling periods.

33 ^SGENOME-WIDE LEVELS OF INTROGRESSION AND DIVERGENCE ACROSS MEXICAN TOWHEE HYBRID ZONES.

Sarah E. **Kingston***^{1,2}, William Fagan¹, Michael J. Braun^{1,2}. ¹BEES Program, University of Maryland, College Park, MD 20742, ²National Museum of Natural History, MSC A2000, 4210 Silver Hill Rd., Suitland MD 20746

Hybrid zones are unique interfaces that can help us understand both population level and species level evolutionary processes. Stable regions of hybridization between two species of towhee, *Pipilo maculatus* (Spotted Towhee) and *P. ocai* (Collared Towhee), in Mexico have been previously delineated using morphological characters and isozyme loci. There are two main hybrid gradients; where these two gradients intersect, the two parental forms live sympatrically without hybridizing. Unraveling the architecture of this hybrid complex on a genomic level can offer insight into the broader implications of interspecies gene flow. Specifically, testing the porosity of the species boundary can help us assess the evolutionary importance of interspecies gene flow between these lineages. Specimens of *P. maculatus*, *P. ocai*, and their hybrids have been collected along the Teziutlán (~1200km, 11 locations, 167 total specimens) and Transvolcanic (~700km, 6 sites, 169 total specimens) gradients. The AFLP assay (genome survey) was run on the genomic DNA. Individuals were also sequenced at the mtDNA locus ND2 (1027 bp). Multi-locus analyses reveal not only geographic differentiation among parental types, but also divergence of populations within the areas of hybridization. A signature of bi-directional introgression across the species boundary indicates this boundary is porous to a portion of the genome. In combination, these results suggest gene exchange between species may be an important factor along the evolutionary trajectory of lineages.

21 ^SCONTEXT-DEPENDENCE OF THE RELATIONSHIP BETWEEN EXTRA-PAIR PATERNITY AND BREEDING SYNCHRONY IN THE HOUSE WREN *TROGLODYTES AEDON*.

Katie **LaBarbera***, Paulo Llambias, and Irby J. Lovette, Fuller Evolutionary Biology Lab, Cornell Laboratory of Ornithology, Cornell University, Ithaca, NY 14850

Despite much research, the forces driving intra- and interspecific variation in avian extra-pair (EP) paternity rates remain unknown, in part because of differing contexts of EP paternity that follow from the particular life history of a population. If context alters the effect of a given variable on EP paternity rates, this contextual variation may obscure the dynamic relationship between the variable and EP paternity. For example, breeding synchrony - the degree of overlap of females' fertile periods - could have different effects in migratory vs. non-migratory species. In migratory species arrival time is an indicator of male quality and migration imposes time constraints on breeding, neither of which applies to non-migratory species. We explored whether the relationship between breeding synchrony and EP paternity rates varies with the context of synchrony in two populations of House Wren (*Troglodytes aedon*): the Northern migratory subspecies breeding in upstate New York, and the Southern non-migratory subspecies resident in Buenos Aires Province, Argentina. In both populations, asynchronously early nests contained the fewest EP offspring, but in New York synchronous nests contained the most EP chicks whereas in Argentina most EP chicks were in late asynchronous nests. The low EP paternity rate in New York for early nests may be due to fewer males being present early in the season, or to early-nesting females being mated to higher-quality males. The peak EP rates seen in New York synchronous nests could be due to the trade-off for males between mate-guarding and seeking EP copulations when many females are simultaneously fertile. In Argentina, males foraging to feed nestlings late in the season could range farther than males advertising for mates at nest sites early in the season, increasing encounters between EP males and late fertile females and accounting for the late-peaking EP paternity. Most centrally, the differing relationship between EP paternity rate and breeding synchrony in these two populations suggests that their effects are context-dependent.

50 A HIGH FREQUENCY GSM TELEMETRY DEVICE FOR TRACKING WILDLIFE.

Michael **Lanzone***, Carnegie Museum Of Natural History, Rector, Pa 15677, Casey Halverson, Cellular Tracking Technologies, 129 Powdermill Rd., Rector, Pa 15677, and Todd Katzner, The National Aviary, Pittsburgh, PA 15212.

Satellite telemetry has long been the standard for tracking raptors. Currently, these telemetry units are capable of collecting not less than hourly data points for no more than 12-15 points per day. While these units have allowed researchers to track animals across the world and have helped to answer a variety of questions, many questions cannot be adequately answered with such a limited frequency of data collection. Additionally, once deployed, researcher communication with and reprogramming of these units is not possible. To address these problems, we developed a GSM tracking device capable of collecting data at user determined frequencies down to as little as 30-seconds intervals. One additional benefit of this new technology is that it allows for real-time communication with and re-programming of the device post-deployment. Although currently, this technology is limited to tracking animals in excess of 1000g, eventually we will be able to track much smaller species. The fine scale resolution of these new tracking data, not only opens up whole new horizons in the field of telemetry studies, but also allows for, among others, validation and refinement of home range modeling methods. The applications are endless and only limited by the imagination of the researcher. Here, we present data collected from a study tracking Golden Eagles to illustrate the capabilities of this new and exciting technology.

45^S NATURAL HISTORY OF THE BLACK CATBIRD (*MELANOPTILA GLABRIROSTRIS*) IN QUINTANA ROO, MÉXICO.

Joshua B. **LaPergola*** and Robert L. Curry, Department of Biology, Villanova University, Villanova, PA 19085, Blanca Roldán Clarà, El Colegio de la Frontera Sur, Chetumal, Quintana Roo, México, and Juan Esteban Martínez Gómez, Instituto de Ecología, Xalapa, Veracruz, Mexico.

Avian behavioral ecology suffers from what Stutchbury and Morton called the “temperate zone bias”: the majority of bird species inhabit the tropics, yet most theory in behavioral ecology derives from temperate zone studies. The Black Catbird, *Melanoptila glabrirostris*, is a poorly known mimid endemic to the Yucatán Peninsula and its adjacent islands. We report here preliminary findings of field research on the Black Catbird’s natural history in the Sian Ka’an Biosphere Reserve and on Isla Cozumel. Breeding occurred in May through August. Clutch size averaged 2.44 eggs \pm 0.50 SD (range = 2–3, N = 39). Predominant nest-tree species varied between sites (66% of nests in *Thrinax radiata* in northern Sian Ka’an and 54% in *Pithecellobium keyense* in southern Sian Ka’an). Catbirds often cooperatively mobbed predators in groups of as many as 7 adult birds, but 79.03% (N = 62) of nests nevertheless failed because of predators. In northern Sian Ka’an, several concurrently active nests were as close as 3 meters or less. Including nests with one or both parents banded, our site at the Sian Ka’an Visitors’ Center hosted \geq 14 different breeding pairs in 0.7 ha, or 34.3 adults/ha. This estimate represents the highest known breeding density for any mimid. Other naturalists in Mexico have similarly noted “colony-like” breeding aggregations of Black Catbirds. The spatio-temporal clustering of catbird nests may represent a formerly undocumented level of social organization for the Mimidae. We will investigate this phenomenon and other aspects of the catbird’s behavioral ecology further during 2009.

41^S NEST SITE SELECTION AND NEST THERMAL PROPERTIES OF COMMON NIGHTHAWKS ON THE TALLGRASS PRAIRIE OF KANSAS.

Rebecca G. **Lohnes*** and Janis L. Dickinson, Department of Natural Resources, Cornell University, Ithaca, NY, 14850, and Brett K. Sandercock, Division of Biology, Kansas State University, Manhattan, KS 66506.

Our research uses a behavioral ecology approach to understand Common Nighthawk (*Chordeiles minor*) declines and to inform nest site restoration efforts in urban and suburban landscapes. The objectives of this study were to determine if nighthawks are choosing to nest non-randomly in respect to the distribution of types of vegetation and substrates within a natural landscape, and to establish the thermal properties of nest sites for biologically-informed restoration efforts. These two objectives were designed to identify nest site characteristics that could be used to design suitable nesting substrates in urban and suburban landscapes. We found that the birds were selecting areas with bare ground and rock at a significantly greater frequency than they occur in the surrounding landscape, and that they were avoiding shrubs. Within a single month, the nesting substrate can experience temperatures that range from 14.5°C to 60°C. When we compared the vegetation versus the nest site we found that the average daily temperature and the high daily temperatures were significantly cooler in the vegetation during the day. Based on these observations we recommend that natural areas be managed to increase rock and gravel patches and that urban restoration efforts test patches that maximize the amount of shade available during the day.

3 DO MALE COMMON LOONS SIGNAL AN ELEVATED WILLINGNESS TO ATTACK WITH LONGER YODELS?

Jay **Mager**, Department of Biological & Allied Health Sciences, Ohio Northern University, Ada, OH 45810, Charles Walcott, Department of Neurobiology and Behavior, Cornell University, Ithaca, NY 14853

Through both field observations and acoustic playback experiments, we empirically investigated the traditional belief that male common loons (*Gavia immer*) communicate a greater willingness to attack, if necessary, by adding repeat phrases to territorial yodels. From over 3500 hours of field observations of 84 individually-banded males between 2002 and 2004, we found that males produced yodels having more repeat syllables when the probability that a social interaction (ranging from conspecific flyover to conspecific approach and ‘social gathering’) would result in physical chase/attack increased. Additionally, we found that males assumed the upright ‘vulture’ posture when yodeling (in contrast to the ‘crouch’ posture) when the probability of attack was greater. In an acoustic playback study, we found that territorial pairs (N = 38) responded sooner to, and with more tremolos and yodels to, yodels having more repeat (7) phrases. This study is one of a few to demonstrate the ability of birds to communicate greater aggressive motivation by lengthening acoustic threat signals, and raises interesting questions regarding the selective factors responsible for maintaining signal honesty in this non-oscine bird.

11 ^SIMPACT OF INVASIVE MORROW'S HONEYSUCKLE REMOVAL ON THE NESTING SUCCESS OF FIELD SPARROWS IN A WESTERN PENNSYLVANIA SHRUBLAND.

Holly M. **McChesney***, Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV 26506, James T. Anderson, Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV 26506, and Constance A. Ranson, National Park Service, Fort Necessity National Battlefield, Farmington, PA 15437

The National Park Service is dedicated to controlling exotic species if they interfere with natural processes or habitats, disrupt accurate presentations of cultural landscapes, or hamper park management. Morrow's honeysuckle (*Lonicera morrowii*), an exotic invasive, has invaded 24 ha of old field at Fort Necessity National Battlefield, Farmington, Pennsylvania. Honeysuckle removal began in spring 2007 with large-scale mowing on 7 ha. A foliar application of 2% glyphosate was applied during fall 2007, with persistent shrubs treated with herbicide again in fall 2008. In 2007 and 2008, we examined nesting success and territory number of field sparrows (*Spizella pusilla*) in honeysuckle treatment areas and in control areas (non-treated) to assess the impact of honeysuckle removal on nesting songbirds. Preliminary data indicate that Mayfield nesting success is significantly greater in treatment areas (50.4%) than in control plots (5.6%). This suggests that removal procedures do not impact nesting birds in the short-term. Spot-mapping was performed to assess territory number. Between 2007 and 2008 the number of territories in the treatment area stayed consistent, whereas the number of territories in the untreated area decreased by 22.2%. If areas dominated with Morrow's honeysuckle continue to show a decrease in territory number over time in conjunction with very low nesting success, there would be a negative impact on field sparrow populations. Additional research is needed to assess long-term impacts of honeysuckle treatment on songbird nesting success and to assess the overall impact of Morrow's honeysuckle on populations of field sparrows.

37 INCIDENCE AND PREVALENCE OF SCALY LEG MITE IN PASSERINES AT A CENTRAL ARKANSAS (USA) SITE.

M. Victoria **McDonald**, Department of Biology, University of Central Arkansas, 201 Donaghey Ave, Conway, AR 72035.

The occurrence of scaly leg disease, caused by infection with the mite *Knemidokoptes* spp. (Acari: Knemidokoptidae) in North American is known in poultry and pet birds. Very few reports of this disorder can be found for wild birds, however, especially in Passerines. Since 2002 I have captured and banded over-wintering White-throated Sparrows (*Zonotrichia albicollis*) and American Robins (*Turdus migratorius*) exhibiting symptoms of the scaly leg disease at a site on the campus of the University of Central Arkansas, Conway, Faulkner Co., Arkansas. This paper summarizes my findings, and is the first known report of this disorder in *Zonotrichia*. It is also the first known report of scaly leg disease in wild Passerines in the Arkansas-Texas-Missouri-Tennessee-Mississippi region. At the Arkansas banding site the severity of the disorder ranged from barely discernable hyperkeratosis of the tibiotarsus and toes, to extreme crustiness (>7 mm in breadth), bowing of legs, and missing toes. The incidence in birds at the Arkansas site has been temporally clumped, e.g., within a week of one year nearly every bird captured exhibited some degree of the disorder, and yet throughout other years (e.g., 2007-2008) no incidences were detected. The current season, 2008-2009 has seen an increase in proportions of birds infected. The establishment of a North American database for banders to report occurrence of the disorder is proposed, along with a suggested data reporting format.

18 ^SEFFECTS OF HABITAT CHANGE AND RESTRICTING BREEDING BIRD SURVEY ROUTES TO ROADS ON CERULEAN WARBLER POPULATIONS IN THE CENTRAL APPALACHIANS.

Patrick **McElhorne***, West Virginia Cooperative Fish and Wildlife Research Unit, Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV 26506, Petra Bohall Wood, U.S. Geological Survey, West Virginia Cooperative Fish and Wildlife Research Unit, West Virginia University, Morgantown, WV 26506, and Deanna Dawson, U.S. Geological Survey, Patuxent Wildlife Research Center, Laurel, MD 20708.

We examined changes in land cover and fragmentation metrics at 1,525 stops on 28 Breeding Bird Survey (BBS) routes in the core Cerulean Warbler breeding range of Ohio, West Virginia, and Kentucky using the 1992 and 2001 National Land Cover Dataset (NLCD). From 1992 to 2001 within a 300 m buffer around each BBS stop, amount of deciduous forest, maximum size of forest patch, and amount of interior forest decreased for all stops surveyed and for the subset of stops that had a Cerulean Warbler detected in at least one time period (N=344). Cerulean Warbler detections did not change between 1990-1994 and 1999-2003 for all BBS stops, but decreased for presence-only stops. Some degree of edge habitat may have a positive influence on habitat suitability for Cerulean Warblers because detections increased in the presence-only analysis as edge density increased. We also compared land cover and fragmentation metrics from the 2001 NLCD and Cerulean Warbler detections during 1999-2003 between BBS

stops (N=1,575) and off-road point count stops (N=1,375). Amount of deciduous forest, maximum size of forest patch, amount of interior forest and edge density were greater on off-road stops, however more Ceruleans were detected on roadside BBS stops. In presence-only analysis, most habitat variables and Cerulean Warbler detections did not differ between BBS (N=253) and off-road (N=169) stops. From these results, we suggest that although habitat along BBS stops is different than off-road areas, Cerulean Warblers are able to find similar amounts of suitable habitat near roads.

51 FLIGHT CHARACTERISTICS OF GOLDEN EAGLES (*AQUILA CHRYSAETOS*) MIGRATING THROUGH EASTERN NORTH AMERICA AS DETERMINED BY GPS TELEMETRY.

Tricia **Miller***, The Pennsylvania State University, University Park, PA 16803 and Carnegie Museum of Natural History, Rector, PA 15677 USA. Michael Lanzone, Carnegie Museum of Natural History, Rector, PA 15677. Robert Brooks, The Pennsylvania State University, University Park, PA 16803, and Todd Katzner, The National Aviary, Pittsburgh, PA 15212 USA.

Golden Eagles that breed in northeastern Canada migrate south each year to their wintering grounds in the central and southern Appalachians. As part of a larger ongoing study of the effects of underlying topography and weather (e.g., wind speed and direction) on the routes and flight behaviors of eastern Golden Eagle during migration, here I present preliminary results on the spring and fall migration of seven Golden Eagles captured and telemetered from November 2006 to October 2007. I collected hourly GPS data to examine timing, distance, flight speed and altitude. These preliminary data suggest that certain flight characteristics such as flight speeds are consistent among individuals, but that other flight characteristics such as daily and total distances traveled during migration are highly variable.

49 USING AUTOMATED MULTIPLE-TOWER TELEMETRY TO MONITOR NOCTURNAL ACTIVITY OF PASSERINES DURING MIGRATION STOPOVERS

Alex **Mills***, Atlantic Cooperative Wildlife Ecology Research Network (ACWERN), Acadia University, Wolfville, Nova Scotia, B4P 2N5; Beth Thurber and Stuart Mackenzie, Department of Biology, University of Western Ontario, London, Ontario, N6A 5B7; and Philip Taylor, ACWERN and Bird Studies Canada (BSC), Port Rowan, Ontario N0E 1M0

Passerine migration proceeds by endurance flights, usually at night, with intervening resting and refueling periods of varying duration known as stopovers. Our knowledge of migration stopover ecology mostly comes from studies at small spatial scales. For effective conservation, however, stopover habitat requirements at multiple spatial scales are likely to be critical. Although recent telemetry studies of migrants during stopovers have been able to track small-scale movements, calculate home ranges, and infer departures, the spatial features of stopover ecology at the landscape level remain largely unexplored. We established three automated telemetry towers along a 29 km length of Long Point on Lake Erie, housing ten antennas arranged to sample the airspace along the point. We tagged 29 Swainson's and 39 Hermit Thrushes during fall 2009 and monitored their spatial behavior using this integrated array of receivers. In most cases, the departure flights of tagged birds were recorded at the towers (sometimes on 2 or 3 towers). In addition, we recorded numerous nocturnal flights that were not departure flights. The patterns of some of these flights indicate that they were meso-scale relocation flights (measurable in km), while the pattern of others are consistent with either migratory restlessness or prospecting.

52 BANDING TOGETHER: AN UPDATE ON THE ACTIVITIES OF THE NORTH AMERICAN BANDING COUNCIL.

Sara R. **Morris***, Department of Biology, Canisius College, Buffalo, NY 14208.

The North American Banding Council (NABC) was established in 1996 to promote sound and ethical bird banding principles and techniques. The Council includes representatives of North American professional ornithological societies and major bird banding associations. The NABC meets annually to develop materials for training and evaluation, to establish procedures for evaluating banders' skills, to plan outreach activities, and to make recommendations about banding and banding data. The initial work of the Council was to prepare manuals for bird banders. NABC manuals include a Bander's Study Guide, a Trainer's Guide, and taxa-specific manuals for landbirds, hummingbirds, raptors, and shorebirds. These manuals are available in English, French, and Spanish and may be freely downloaded from the NABC website. Additional manuals are currently being prepared. In 1999, the NABC began certifying the skills of bird banders. Evaluation may certify candidates at the assistant, bander, or trainer level. We have now held numerous evaluation sessions covering a variety of taxa – passerines, hummingbirds, raptors, and waterfowl. The evaluation process includes a written exam and a practical exam that covers trapping techniques, anatomy, bird handling, banding and measuring, and age and sex determination.

Banders may be evaluated as part of an organized session or individually by two Trainers. Most participants in evaluation sessions also learned new skills during the sessions. Given the need of field biologists to demonstrate skills needed for handling animals, NABC certification may provide an opportunity for banders to document their skills, especially for Institutional Animal Care and Use Committees.

4 BIRDS CAN ADJUST THEIR ANTI-PREDATOR BEHAVIOR IN RESPONSE TO SOCIAL INFORMATION ACCURACY.

Joseph J. **Nocera***, OMNR, Trent University, Peterborough, ON K9J 7B8 and Laurene M. Ratcliffe, Biology Department, Queen's University, Kingston, ON K7L 3N6.

Animals can reduce their uncertainty of predation risk by attuning to anti-predator behavior of others or assessing the risk for themselves. Although it has never been empirically examined, we predicted that animals combine information gleaned from others with their own sampling experience to estimate predation risk. To test this prediction, we assessed the responses of migrant and resident songbirds at a fall migration stopover site in eastern Canada to stimuli simulating a range of predation risk situations. We presented individuals with social cues in the form of playbacks of Black-capped Chickadee (*Poecile atricapillus*) mob-calls conveying graded information about predator size in combination with a predator model (one of two owl species) that rendered the call information either correct or incorrect. Both migrant and resident birds stayed longer at experimental trials when presented with erroneous information. In particular, response duration of birds presented with a low-threat chickadee mob-call and a high-threat model (understating the risk) increased substantially, suggesting that individuals were capable of Bayesian updating by devaluing the social cue and acting on their own assessment. We suggest that the inclination and ability to second-guess social information about predators likely extends beyond birds to any taxa that communicate alarm signals as an anti-predator behavior.

19^S A BIRD'S EYE VIEW OF FOREST CANOPY STRUCTURE: HOW DOES CANOPY OPENNESS AFFECT CANOPY-NESTING SPECIES?

Felicity L. **Newell*** and Amanda D. Rodewald, Terrestrial Wildlife Ecology Lab, School of Environment and Natural Resources, The Ohio State University, Columbus, OH 43210.

Today, eastern deciduous forests in North America tend to be closed-canopy mature second-growth. In contrast, an open forest canopy may have been important in pre-settlement forest ecosystems. Changes in forest structure are of special concern given that oaks (*Quercus* spp.) cannot regenerate effectively in closed-canopy stands. Forest management efforts now aim to promote oak regeneration which requires a more complete understanding of the ecological processes associated with canopy disturbance. Partial harvesting provides one way to study the importance of canopy openness. Our research examined the short-term response of canopy-nesting songbirds to shelterwood harvesting (50% stocking). From 2007-2008 we studied the extent to which canopy structure was related to settlement, abundance, and reproductive success for a guild of five sensitive canopy-nesting species in southeastern Ohio. We found limited differences in settlement patterns between shelterwood stands and closed-canopy mature second-growth. Densities of canopy-nesting species were slightly higher in shelterwood stands, although responses of the Cerulean Warbler (*Dendroica cerulea*) varied widely. Avian reproductive success (>500 nests) was not affected by harvesting but tended to vary between species. Collectively our data suggest that canopy-nesting species respond weakly to partial-harvesting that retains abundant overstory trees for foraging and nesting sites. We caution that long-term responses of birds to partial harvesting may differ from those documented here while management for oak regeneration will typically remove all canopy trees later in the cutting cycle.

1^S GEOGRAPHIC VARIATION IN THE CALLS AND DUETS OF A NONPASSERINE, THE BARRED OWL (*STRIX VARIA*).

Karan J. **Odom*** and Daniel J. Mennill, Biology Department, University of Windsor, Windsor, Ontario N9B 3P4, Canada.

Geographic variation in bird song can provide insight into the ecology and evolution of animal vocalizations and vocal behavior. Research on temperate songbirds has provided the foundation for what is known about regional dialects and has connected dialect formation to patterns of vocal learning and dispersal. Although it is assumed that most suboscine and nonpasserine birds possess innate vocalizations, few studies have examined and verified the clinal and reduced vocal geographic patterns that should be associated with non-song-learning species. Moreover, even fewer studies have looked at the patterns of vocal geographic variation in complex avian vocalizations, such as coordinated duets between male and female mated pairs. This study explores the differences in patterns of vocal geographic variation between the presumed innate calls and the complex duets of a nonpasserine, the Barred Owl (*Strix varia*). We recorded Barred Owl calls and duets from 13 locations across five southeastern United States

within a single subspecies range. Our research shows Barred Owl duets possess a specific syntax with distinct male and female components. Our results are preliminary, but geographic patterns of calls and duets provide interesting implications for differences in how birds acquire these vocalizations.

20 ^SCALCIUM AND FOREST BIRD HABITAT QUALITY.

Sarah E. **Pabian*** and Margaret C. Brittingham, School of Forest Resources, The Pennsylvania State University, University Park, PA

Birds require large amounts of calcium to reproduce. For forest songbirds, calcium may be especially limiting because these birds do not use stored calcium for reproduction, their normal diets contain insufficient amounts of calcium for reproduction, and many forests in Eastern US have low and declining calcium levels resulting from land use history and acid deposition. Little is known of how calcium availability changes might affect forest birds, so the purpose of this research was to investigate how calcium availability affects a common forest bird of Pennsylvania, the Ovenbird (*Seiurus aurocapilla*). We measured Ovenbird territories at 14 sites across Central Pennsylvania representing a range of natural soil calcium levels. We also collected information on invertebrate prey items, soils, and vegetation at these sites. We combined these observations with a liming experiment to show causality. The same parameters were measured at four study sites before and for five years after liming with two control and two lime-treated sites. Ovenbird territory size was negatively related to soil exchangeable calcium and snail abundance. Liming resulted in increased soil calcium availability, increased snail abundance, and increased density of Ovenbird territories. Areas of limed sites that were unused by Ovenbirds before liming became used within five years after liming. These results suggest that Ovenbird habitat quality is likely related to soil calcium availability and indicate that forest soil quality needs to be considered when planning conservation and management activities for forest songbirds.

40 INFLUENCE OF LANDSCAPE AND HABITAT FEATURES ON THE ABUNDANCE AND NESTING SUCCESS OF BROWN CREEPERS IN THE SOUTHERN SIERRA NEVADA.

Kathryn **Purcell***, Craig Thompson, and Douglas Drynan, US Forest Service, Pacific Southwest Research Station, Sierra Nevada Research Center, 2081 E. Sierra Ave., Fresno, CA 93710.

Brown Creepers (*Certhia americana*) are widely distributed in coniferous forests in North America but little is known of key aspects of their breeding biology. Creepers are generally considered forest interior specialists but studies have shown inconsistent responses to fragmentation. We studied Brown Creepers breeding in four forest types over an elevational gradient in the southern Sierra Nevada. The forest types included ponderosa pine (1024-1372 m), mixed conifer (1707-2012 m), true fir (2170-2347 m), and lodgepole pine (2469-2774 m). Abundance increased with increasing elevation but nest success was highest in the middle of their elevation range. Sites with more high and medium quality habitat and smaller amounts of high-contrast edges supported higher abundances of Brown Creepers than sites with less high and medium quality habitat and more high-contrast edges. Most nests were in snags and a wide variety of species were used. Brown Creepers nested further from edges than expected. They avoided hard or moderate edges when selecting nest sites, but were unaffected by soft edges. Nest survival varied with the age of the nest. Nest survival dropped slightly early in the incubation period and decreased sharply at the end of the nestling period. Successful nests were in areas with lower canopy cover, in large-diameter snags with less bark, and were further from moderate or hard edges compared to failed nests. Taken together, our results showed consistent negative effects of edge in terms of abundance, nest location and reproductive success.

35 ^SEVOLUTIONARY INSIGHTS ABOUT NECTARIVORES' BILLS STRUCTURES.

Alejandro **Rico-G.** Department of Ecology and Evolutionary Biology, University of Connecticut, Storrs, CT 06269
Studying specialized nectarivorous birds, I have found a set of morphological traits that seems to be involved in their feeding performance and social organization. Features improving feeding efficiency include structures finely tuned by physical laws in the nectar extraction process. Traits related to social systems are proposed sexually dimorphic weapons employed in fights for resources. For many years it has been believed that minute serrations on the tomia of some nectarivores serve in capturing small arthropods. A different hypothesis about serrations involved in nectar robbing was proposed more recently. My results contradicted the idea that serrate tomia are used for arthropod capture (in some groups) or nectar robbing. Interestingly, independently evolved nectarivores share similar bill serrations; this evolutionary convergence in tomial serrations suggests a new hypothesis about their function. Serrate tomia seem to be used to fully extract any previously gathered nectar that remains on the tongue, allowing all of the liquid to be retained inside the bill. In a few nectarivores however, I found a different kind of serrations and other structures in the bill tip (i.e., hooks and "daggers") that are in most of the cases sexually dimorphic. I propose those traits are sexually-dimorphic weapons, having some empirical evidence of their functional significance. Those

traits seem to be morphological convergences non-directly related to nectar extraction but to specialized social structure in nectarivorous birds. It would constitute the first set of sexually dimorphic weapons in bills of any bird, and the second (beside spurs) described for the whole class.

22 ^SEGG EJECTION AND HATCHING ASYNCHRONY INFLUENCE EGG SIZE IN THE GREATER ANI (*CROTOPHAGA MAJOR*), A COMMUNALLY BREEDING CUCKOO.

Christina **Riehl**, Department of Ecology and Evolutionary Biology, Princeton University, Princeton, NJ 08544
Maternal investment in offspring size has important effects on offspring fitness. Life history theory predicts that females should allocate resources to offspring in ways that maximize their own lifetime reproductive success, so mothers are expected to skew their investment when siblings in a brood differ in their likelihood of survival due to hatching asynchrony or other inequalities. The Greater Ani (*Crotophaga major*) is a communally breeding cuckoo in which two to four socially monogamous pairs cooperate to build a single joint nest. Females synchronize their laying behavior and compete for reproduction by ejecting early-laid eggs from the communal nest. Eggs are extremely large (up to 18% of female body mass) and exhibit pronounced size variation both within and among females. In this study, I investigated whether egg size, a measure of maternal investment, is influenced by position in the laying order. Data from 86 communal nests on Barro Colorado Island, Panama, show that both first- and last-laid eggs are less likely to survive than eggs laid in the middle of the sequence: first-laid eggs are at risk of ejection by other group members, while last-laid eggs are at risk of hatching later than the rest of the clutch. I found that position in the laying order was the only significant predictor of egg mass, and that egg mass followed the same pattern as survivorship, with first and last-laid eggs being significantly smaller than middle eggs. These findings support the hypothesis that female Greater Anis bias their investment in eggs according to the risk of egg ejection and hatching asynchrony, and that reproductive competition among joint-laying females explains a large amount of the variation in egg size in this species.

23 ^SLOSS OF BRIGHTNESS IN AMERICAN GOLDFINCH BILLS IN RESPONSE TO ACUTE IMMUNE RESPONSE.

Malcolm F. **Rosenthal**^{1*}, Troy G. Murphy², Nancy Darling³, and Keith A. Tarvin¹; ¹Department of Biology, Oberlin College, Oberlin, Ohio 44074; ²Department of Biology, Queen's University, Kingston, Ontario K7L 3N6, Canada; ³Department of Psychology, Oberlin College, Oberlin, OH 44074

Both male and female American Goldfinches (*Carduelis tristis*) have orange bills during the breeding season. The coloration of goldfinch bills is due mainly to carotenoid pigments. Carotenoids are also known to play immunostimulant roles and to act as antioxidants, so there is an expected fitness trade-off between sequestering carotenoids for use in bill coloration and maintaining high blood-levels of carotenoids for use in an immune response. We caught wild male and female goldfinches at feeder sites in Lorain County, Ohio and housed them in individual cages at Oberlin College. We injected half of the birds with lipopolysaccharide (or LPS), an *E. coli* cell extract that is known to elicit a transient inflammatory immune response, and the other half with saline as a control. We objectively measured bill color twice-daily for five days following the injection, and video-recorded behavioral activity of each bird for 30 minutes once a day. Video recordings confirmed significant behavioral differences between the LPS and saline groups in the first 24 hours after injection, with LPS birds showing increased lethargy as expected. All birds exhibited significant changes in bill coloration characterized by a shift in hue from orange towards yellow, a decrease in brightness, and an increase in yellow saturation over the five days they were monitored. Only brightness was affected by LPS, with treatment birds exhibiting a more rapid decrease in brightness than control birds. This study demonstrates that bill color in goldfinches can change quickly, and suggests that bill color may be an active indicator of current immunological state or other aspects of condition.

9 ^SAVIAN RESPONSE TO GAS WELL DEVELOPMENT IN THE CENTRAL APPALACHIANS: FIRST YEAR RESULTS.

Jim **Sheehan*** and Gregory A. George, West Virginia Cooperative Fish and Wildlife Research Unit, Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV 26506, and Petra Bohall Wood, U.S. Geological Survey, WV Cooperative Fish and Wildlife Research Unit, Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV 26506.

Natural gas deposits across much of the central Appalachians are a valuable commodity due to increased energy costs and technological advancements. The forests of the central Appalachians are also key areas for conservation of avian populations. Drilling activities result in heavy equipment disturbance, well pads and ponds, and access roads within the forest-dominated habitat matrix common in this region. To quantify the potential impacts on breeding birds, we conducted songbird point counts, raptor broadcast surveys, and habitat assessments during 2008 within

approximately 3,600 hectares of the Lewis Wetzel Wildlife Management Area in West Virginia presently open to drilling. We present first year results that establish baseline information for the breeding birds of the ridge and stream habitats where drilling is occurring and explore past and current patterns of habitat alteration. Numerous birds of conservation interest are abundant in these habitats, including Acadian Flycatcher, Louisiana Waterthrush, Cerulean Warbler, and Wood Thrush. Of the approximately 41 km of stream reaches surveyed across 15 1st to 3rd order streams, visual assessment and a habitat suitability index indicate that 5.8 km (14%) are currently impacted by drilling activities. Avian species abundance and composition compared between undisturbed forest and forest impacted by roads, clearings, and forestry activity indicate few negative effects on forest-interior species at the current level of habitat disturbance and an increase in species richness and habitat for early-successional species. These data will provide a valuable baseline for considering avian response within this changing landscape.

10^S HOW DOES ANTHROPOGENIC DISTURBANCE AFFECT AVIAN COMMUNITIES?

Bethany K. **Stephan***, Anna Marie Parise, Canisius College, Buffalo, NY, Michael Hamilton and Robert L. DeLeon, Buffalo Ornithological Society, Buffalo, NY, H. David Sheets and Sara R. Morris, Canisius College, Buffalo, NY.

The Buffalo River is listed as one of 47 Areas of Concern (badly polluted with highly toxic waste) around the Great Lakes. As part of an effort to establish protocols for restoring the health of the river and thereby delisting it, we studied avian use of the river and its tributaries. In 2005 and 2006, we characterized the avifauna along three riparian environments- Buffalo River (highest degradation), Buffalo Creek (moderate degradation), and Cazenovia Creek (lowest degradation). We conducted point counts at 10 points per location in June for 10 minutes at each point. Cazenovia Creek had the highest species richness for both years (56 in 2005 and 59 in 2006), and lowest at the Buffalo River (35 in 2005 and 39 in 2006). Similarly, the species diversity was lowest at the Buffalo River site for both years (Shannon-Weaver $H' = 2.867$ in 2005 and 2.847 in 2006) and highest at Cazenovia Creek for both years ($H' = 3.381$ in 2005 and 3.405 in 2006). To confirm the results of traditional analyses rarefaction analysis was performed. Rarefaction analysis also verified that the Buffalo River had the lowest species diversity, and that Cazenovia Creek had the highest species diversity. Our two year study documents differences in the avifauna at the three different locations. By using the moderate and least degraded areas as benchmarks, we can establish recommendations for avian species richness and diversity to assess remediation efforts in the Buffalo River.

14^S CHARACTERISTICS OF URBAN CROW ROOSTS IN THE NORTHEASTERN UNITED STATES.

Grant T. **Stokke*** and Margaret C. Brittingham, School of Forest Resources, The Pennsylvania State University, University Park, PA, 16802.

Urban crow roosts, which occur in winter and often contain tens of thousands of crows tightly packed into several hectares, are found across North America. Such large, dense aggregations of crows can cause numerous problems, and roost management programs are often initiated to minimize crow-human conflicts. To better understand crow roosting behavior and guide management activities, we studied the characteristics of urban crow roosts in the eastern United States. Environmental conditions at roosts were compared to conditions at randomly selected non-roosts. We used GIS software to identify characteristics of urban crow roosts at multiple spatial scales. Across the eastern United States, crows select cities for roosting that are lower in altitude, closer to large streams or bodies of water, and produce large amounts of light pollution than randomly selected non-roost cities. Roost cities are surrounded by heterogeneous, patchy landscapes that provide a diversity of foraging habitat and usually contain abundant agriculture. Within roost cities, roosts are located in high-density urban areas that are significantly more well-illuminated and subjected to greater human disturbances. Understanding the environmental characteristics of urban crow roosts should help predict where roosts are likely to occur, and may help guide managers that aim to modify crow roosting locations by altering habitat to decrease or increase the attractiveness of areas for roosting by crows.

7 EFFECTS OF PARTIAL HARVEST ON CERULEAN WARBLERS AND OTHER PARTNERS IN FLIGHT PRIORITY SPECIES.

Scott **Stoleson**, U.S. Forest Service, Northern Research Station, 335 National Forge Road, Irvine, PA 16329

Widespread declines in populations of many forest-breeding songbirds have occurred even in extensively forested landscapes such as those of the Appalachians; most notable among these is the Cerulean Warbler *Dendroica cerulea*. In these regions there is concern that timber harvesting practices may degrade the value of forests as habitat for Ceruleans and other forest birds. In this study I examined the effects of shelterwood cutting in mixed oak forests in northwestern Pennsylvania, USA, on Cerulean Warblers and 16 other species designated by Partners in Flight as high regional priorities for conservation. I used spot-mapping and nest monitoring to compare density and

nest success in four replicate sites each having a fenced shelterwood stands, an uncut stand adjacent to shelterwood (for edge effects) and an uncut control. Ceruleans bred only in shelterwoods, supporting the idea that they are disturbance-dependent species of mature forests. Early successional species and species that nest in forest understories were more abundant in shelterwood stands than in either uncut treatment. Collectively these shrub species had significantly higher nest success in shelterwoods than in uncut stands. Canopy-nesting species showed varied responses, but none was significantly less abundant in shelterwoods than in control stands. I found no evidence of edge effects. Partial harvest may be an option for sustainable timber harvest while maintaining or even enhancing habitat for birds of high conservation concern.

27 ASSESSING MONITORING TECHNIQUES FOR AVIAN SPECIES RICHNESS.

Amy **Tegeler-Amones*** and Joseph M. Szewczak, Department of Biology, Humboldt State University, Arcata, CA 95521

Point count surveys are widely used to infer avian species richness. Recent advancements in bioacoustic technology enable automated survey alternatives that can expand the landscape coverage with equivalent personnel resources. We compared standard point count surveys with automated recording units (ARU's) for detecting avian species. We sampled bird species richness at 112 point count stations in thirteen Sierra Nevada montane meadows, May-August 2006, with each point surveyed eight times. We placed twelve ARU's at 50 point count stations throughout the field season and left them at each location for seven concurrent days. We compared species richness, by meadow, between point counts and ARU's. Species accumulation curves showed an asymptote in species richness was achieved for both methods. ARU's proved to be a practical and comparable alternative to traditional point count data collection for species richness. Advantages provided by ARU'S include fewer personnel hours per survey, the ability to record for long durations in the field (increasing the potential detection of rare species), and permanent documentation of survey data to scrutinize for questionable or unexpected results.

16 MID-CONTINENTAL HABITAT AVAILABILITY AND SHOREBIRD USE OF NATURAL AND ANTHROPOGENIC WETLANDS.

Nathan E. **Thomas**, Department of Biology, Shippensburg University, Shippensburg, PA 17257 and David L. Swanson, Department of Biology, University of South Dakota, Vermillion, SD 57069.

The availability and quality of wetland stopover sites can influence the diversity of shorebirds that use the sites. We investigated the macro- and microhabitat use by shorebirds during fall migration through the mid-continental Prairie Pothole Region of the United States. During fall migration seasons of 2002-2005, We observed 28 species of shorebirds from 9 different foraging guilds. Within mudflat macro-habitat, shorebirds were found in wet-mud (saturated soil habitat surrounding the body of water at mid-continental wetlands) microhabitat 59% of the time. Shorebirds were found in water 32% of the time and dry-land (dry soil habitat surrounding the saturated soil habitat) 9% of the time. There were no biologically significant differences in shorebird use of microhabitat when natural and managed wetlands were compared. Small shorebirds accounted for the largest proportion of birds, comprising 53% of all shorebirds surveyed. Medium-sized shorebirds comprised 46% and large shorebirds made up less than 1% of the total observed birds. Four foraging guilds had members that only used one type of macro- or microhabitat throughout the study while the other five guilds used multiple microhabitats. Small and medium aquatic-gleaner probers made up 76% of the total birds observed. These results demonstrate that habitat availability for shorebirds was similar between natural and managed wetlands in the mid-continent. Additionally, habitat use by shorebirds was also similar for the two wetland types during fall migration. This suggests that anthropogenic wetlands can be properly managed to provide a reliable habitat supplement for migrating shorebirds in a highly degraded landscape.

34 EXTENSIVE RANGEWIDE MITOCHONDRIAL INTROGRESSION INDICATES SUBSTANTIAL CRYPTIC HYBRIDIZATION IN THE GOLDEN-WINGED WARBLER.

Rachel **Vallender***, Evolutionary Biology, Cornell Lab of Ornithology, Ithaca, NY 14850, Steve VanWilgenburg, Environment Canada, Saskatoon, SK, Lesley Bulluck, Department of Biology, Virginia Commonwealth University, Richmond, VA, Amber Roth, School of Forest Resources & Environmental Science, Michigan Technological University, Houghton, MI, Ronald Canterbury, Department of Biological Sciences, University of Cincinnati, Cincinnati, OH, Jeffery Larkin, Department of Biology, Indiana University of Pennsylvania, Indiana, PA, and Irby Lovette, Evolutionary Biology, Cornell Lab of Ornithology, Ithaca, NY 14850

Widespread population declines of the Golden-winged Warbler (*Vermivora chrysoptera*) are thought to be due in part to hybridization with the expanding Blue-winged Warbler (*V. pinus*), which predictably replaces Golden-winged Warblers at breeding sites where the two species come into contact. However, the mechanism by which this replacement occurs remains unresolved. Recent genetic work has indicated that even in areas where the two species

have been in contact for a short period, introgression of Blue-winged mitochondrial (mtDNA) and nuclear genes into Golden-winged individuals is common. To explore this process on a broader scale, we screened nearly 500 individuals from nine states and three provinces to examine geographic patterns of mtDNA introgression. The only population where all phenotypic Golden-winged Warblers had species-appropriate mtDNA haplotypes, and where there are no breeding Blue-winged or hybrid individuals, was in the province of Manitoba, near the north-western edge of the species' breeding distribution. The near ubiquity of mitochondrial introgression suggests that there are far fewer genetically pure populations of Golden-winged Warblers than previously believed, a finding with important implications for this threatened species. Continued sample collection and screening with a panel of nuclear DNA markers is required to obtain a comprehensive understanding of the Golden-winged Warbler's changing population dynamics throughout its breeding range.

26 BRIGHTER EGGS ARE BETTER IN THE HOUSE WREN.

Lindsey A. **Walters***, Department of Biology, Canisius College, Buffalo, NY 14208, and Thomas Getty, Department of Zoology and Kellogg Biological Station, Michigan State University, Hickory Corners, MI 49060. Recent work suggests that avian egg color could be a sexually selected signal to males related to female condition, female genetic quality, or costly maternal investment in the egg. When female quality or investment is high, a male's own investment in his offspring should yield high fitness returns, so egg color could potentially influence parental investment decisions. Some experimental support for this hypothesis has been found for species that lay blue eggs containing the pigment biliverdin, a potentially costly antioxidant. However, the brown eggshell pigment protoporphyrin, a pro-oxidant associated with poor female condition, has received less attention as a potential predictor of female quality or investment. We performed a cross fostering experiment in the house wren (*Troglodytes aedon*), a species that lays brown eggs, to test whether egg color was related to female condition or maternal investment in the eggs and whether male provisioning of chicks was related to egg color. We found that brighter eggs (i.e. those with less brown pigment) were heavier, and that nestlings that hatched from brighter eggs were fed at higher rates by their foster mothers but not their foster fathers. These results suggest that females who lay brighter colored eggs also invest more in those offspring through maternal effects on egg content and post-hatching provisioning, although males do not seem to respond to this potential cue. This study highlights the need for more research into the relationship between brown egg color and parental investment.

39 VARIATION IN ONSET OF INCUBATION IN HOUSE WRENS

Douglas **White*** and E. Dale Kennedy, Department of Biology, Albion College, Albion, MI 49224
Initiation of incubation is a costly physiological transition with important reproductive consequences. Early onset of incubation relative to the last egg should reduce embryo exposure to suboptimal temperatures and shorten the nesting period at the cost of spreading hatching times. We hypothesized that if energy tradeoffs influence the onset of incubation, then incubation schedules should vary with female condition and environmental temperature. We used miniature temperature loggers (iButtons) and daily censuses to monitor incubation and hatching in a double-brooded population of cavity-nesting House Wrens (*Troglodytes aedon*) in Michigan over four breeding seasons. Rather than beginning discretely, incubation began intermittently and increased in duration until persistent warming was achieved; in about 75% of nests it began on the day of the penultimate egg. In most other cases, continuous incubation began on the day of the antepenultimate egg or final egg. As expected, early incubation shortened the nest interval and modestly increased hatching asynchrony. Early starts to incubation were more common in late versus early clutches, and average hatching asynchrony was a half day greater in late clutches. No association existed between clutch size and incubation pattern, and females did not disproportionately replicate incubation schedules between early and late clutches. However, variation in onset of incubation correlated well with variation in ambient and internal box temperature; incubation was advanced by warmth and retarded by cold. Better data on variation in hatching times, female condition, and incubation costs may help resolve the causes and consequences of differences in incubation patterns.

5 SONG DIVERGENCE IN MANGROVE WARBLERS (*Dendroica petechia castaneiceps*): RESPONSE TO HABITAT STRUCTURE AND CULTURAL EROSION DUE TO FRAGMENTATION.

Robert C. **Whitmore*** Division of Forestry, Program in Wildlife and Fisheries, West Virginia University, Morgantown, WV 26506-6125 and Michael M. Whitmore, Moss Adams Corporation LLP, 601 West Riverside, Suite 1800Spokane, WA 99201-0663

Song variation in Passerine birds arises due to vocal learning by young birds and the acoustic characteristics of their occupied habitats. We recorded the songs of all male Mangrove Warblers (*Dendroica petechia castaneiceps*) in all known mangrove stands between Bahía Islote de San Lucas and the southern end of Bahía Concepción, Baja

California Sur, Mexico. Comparisons between these recordings and archived recordings of Yellow Warblers (*D. p. spp.*) collected in a variety of habitats in the western United States indicate that the former have shorter songs, fewer song elements, and elements with lower frequencies which are more widely spaced than the latter. Moreover, the structure of individual Mangrove Warbler's song elements is sufficiently different from that of the western Yellow Warblers to be readily distinguishable using cluster analysis. Morphological measurements show that Mangrove Warblers are significantly larger than American races and this may be related to the lower frequency song elements. Finally, Mangrove Warbler songs may be finely tuned to the vegetation structure of their occupied habitats, but in addition may be the result of cultural erosion due to the extremely small numbers of widely scattered non-migratory individuals and declining suitable mangrove habitat.

12^S BIRD POPULATION RESPONSES TO CONSERVATION PROGRAM GRASSLANDS IN PENNSYLVANIA .

Andrew **Wilson**, School of Forest Resources, The Pennsylvania State University, University Park, PA 16802. Conservation program grasslands have been demonstrated to provide enormous benefits for grassland bird population in the Midwest and great plain states. However, away from these regions, evidence of benefits for bird populations is lacking. Enrollment in conservation programs in eastern states has increased during the last 10 years due to the introduction of the Conservation Reserve Enhancement Program (CREP). I present evidence from four studies that some grassland bird populations in Pennsylvania have benefited from CREP since it was rolled out in 2000. In addition to benefiting grassland nesting birds, such as the Eastern Meadowlark, there is evidence that CREP grasslands are now important winter foraging resources for birds of prey, in particular the Northern Harrier. However, there is currently little evidence that some key target species are benefiting from the program. In light of this I suggest that more regionally specific research is needed if the potential benefits of these programs are to be fully realized.

24^S HYBRID CHICKADEES SHOW HIGHER SURVIVORSHIP THAN CAROLINA CHICKADEES IN SOUTHEASTERN PENNSYLVANIA.

Stephanie G. **Wright*** and Robert L. Curry, Department of Biology, Villanova University, Villanova, PA 19085. The narrow band where Black-capped (*Poecile atricapillus*) and Carolina (*P. carolinensis*) chickadees hybridize is a rare example of a moving hybrid zone: it is shifting northward, but the exact causes for this movement are unknown. Research on both Carolina and hybrid chickadees has been sparse in comparison to their Black-capped relatives. Our goal was to use a model selection approach and program MARK to investigate the influence of site, sex, and year on the survival and recapture rates of Carolina and hybrid chickadees. For this analysis we looked at resident breeding birds monitored from 1998-2008 at two sites, a Carolina Chickadee-only site and a hybrid-only site. Hybrid chickadees showed higher average survival rates (0.593 for males, 0.587 for females) with no difference in recapture rates between the sexes, while Carolina Chickadees exhibited lower survival rates (0.476 for males, 0.468 for females) and a wide range in recapture rates. These data indicate that there may be a difference in survival between Carolina and hybrid chickadees that is not influenced by extrinsic factors and that hybrid chickadees may have survival advantages over Carolina Chickadees despite evidence that they may be reproductively less successful. The evolutionary divergence between Carolina and the Black-capped Chickadee clade is at least 2.5 million years, a number in agreement with estimates for the minimum divergence required for the hybrids of two avian species to show hybrid vigor. This indicates the potential for some hybrid vigor, a trend not yet noted in the chickadee literature.

29^S AVIAN DIVERSITY IN A HIGH ELEVATION PEATLAND OF WESTERN MARYLAND.

David **Yeany II*** and Frank Ammer, Ph.D., Department of Biology, Frostburg State University, 101 Braddock Rd., Frostburg, MD 21532-2303

Given that most North American peatlands exist in the boreal region, the majority of avian studies in peatlands have occurred at these northern latitudes (50° N to 70° N). However, a number of peatlands exist as part of the High Allegheny Wetlands ecological system in the Appalachians of West Virginia and Maryland. Studies have documented the high biodiversity in these wetlands, but the focus has been on plant communities and not the importance of avian diversity and factors influencing it in these habitats. Similarly, few studies have compared peatland breeding bird diversity to that of more common, adjacent habitats. Using dependent double-observer point-counts and intensive vegetation sampling, these areas were investigated at Finzel Swamp Preserve in western Maryland. Mean avian richness and Shannon diversity were compared across peatland, upland forest, and old field habitats and linear regressions were constructed to determine habitat components affecting avian diversity. Avian richness was significantly higher in the peatland than in both the upland forest ($p < 0.001$) and the old field ($p =$

0.067), and Shannon diversity in the peatland was significantly higher than in the upland forest ($p < 0.001$). Simple regressions showed the importance of habitat heterogeneity and cumulative percent groundcover, while stepwise regressions revealed a positive relationship with eastern hemlock tree stems and peatland floristics. These results demonstrate the peatland's significance to local and regional avian diversity and the essential role that eastern hemlock, peatland habitat diversity, and peatland plant species composition play in supporting a high diversity of breeding birds.

ABSTRACTS – POSTER PRESENTATIONS

Arranged by first author's last name

P31 ^SMALE COMMON LOONS VARY THEIR YODELING RATE WITH TIME OF YEAR AND STAGE OF BREEDING SEASON

Virginia **Abernathy***, John Mager III, Department of Biology, Ohio Northern University, Ada, OH 45810, Charles Walcott, Department of Neurobiology and Behavior, Cornell University, Ithaca, NY 14853, and Walter Piper, Department of Biology, Chapman University, Orange, CA 92866.

The male territorial call of the common loon (*Gavia immer*), called the yodel, is thought to communicate the identity of a male, its fighting ability, and the degree to which it is willing to engage in an aggressive encounter should an intruder land on its territory. We investigated whether loons yodeled more frequently at certain times of the Julian calendar week and whether the rate of yodeling varied with the stage (pre-nesting, nesting, and post-hatching) of the breeding season. Believing that males should yodel more frequently when the territory is most valuable to them, we predicted that males would yodel more often when territories are being reestablished and when a loon pair is in the first few weeks of raising chicks. From more than 3,636 hours of observation of 45 individually-banded male common loons breeding on single-territory lakes in Oneida County, Wisconsin, between 2001-2007, we found that although there was significant variation between the yodeling rate of individuals during a year, as a whole males yodeled significantly more at the beginning of the breeding season when territories were being reestablished and during the pre-nesting and nesting periods of the breeding season. While previous studies have found peaks in yodeling rate during the nesting periods, we provide evidence that loons additionally yodel frequently during territory reestablishment, indicating that the yodel may be important for males to communicate to returning individuals (both male and female) the identity, fighting ability and motivation of the signaler.

P32 ^SSUBOPTIMAL INCUBATION TEMPERATURE SHOWS NO EFFECT ON IMMUNITY IN BOBWHITE QUAIL (*COLINUS VIRGINIANUS*).

Alyssa K **Ackerman*** and Daniel Ardia, Department of Biology, Franklin & Marshall College, Lancaster PA 17603
Avian species, especially chickens (*Gallus gallus domesticus*), are widely studied models of vertebrate immune systems. However, little data has been collected on innate immunity prior to hatching, or the impact of temperature on early immunological development. In this experiment, bobwhite quail (*Colinus virginianus*) eggs were incubated at either optimal (37.6°C) or suboptimal (36°C) temperatures. Blood, yolks, and embryos were collected from eggs at four times during incubation (13, 16, 19 and 22 days out of a 24 day incubation period) to assess innate immunity over time and as a result of developmental temperatures. We predicted that suboptimal incubation temperatures would reduce innate immunity due to prior research, which suggested that nest temperature during incubation influences the bactericidal ability of tree swallow nestlings. However, we not only found no significant impact of incubation temperature on immunity, but little to no innate immune response from embryos of either temperature group. Whole blood collected from the quail had no bactericidal ability against *E. coli* or *S. aureus*, and most embryos displayed little to no levels of antibodies or complement proteins. We propose that quail embryos prior to hatching do not express high levels of innate immunity despite the existence of various structural components and maternal protection. Further examination of immune systems after hatching is needed to better understand the immune development in avian species.

P52 AN ONLINE SURVEY ASSESSMENT OF THE PAINTED BUNTING OBSERVER TEAM CITIZEN SCIENCE PROJECT IN THE CAROLINAS.

Andrew L. **Almeter** and James A. Rotenberg, Department of Environmental Studies, University of North Carolina Wilmington, Wilmington, NC 28403.

The relationship between citizens and science is a rapidly expanding, innovative approach to conducting research at a variety of levels, and is termed Citizen Science. These citizen scientists gather data from the field that is then analyzed by researchers to answer scientific questions. The most notable benefit of citizen science projects is their cost-effective ability to cover large areas, including private lands that otherwise would not be accessible. One such project is the Painted Bunting Observer Team (PBOT) of North and South Carolina. For this conservation study, PBOT members observe, record, and report sightings of the Eastern Painted Bunting (*Passerina ciris*) at backyard birdfeeders. Currently, Painted Bunting populations are in decline and the bird is listed as a focal species by the USFWS and as a highly ranked species at risk (4.29/5.00) by Partners in Flight. These data assist our more traditional surveys (i.e., banding, point counts) with our ability to track species status. Past studies have found that participation in citizen science projects can increase volunteer awareness and knowledge of conservation issues.

Our focus is to evaluate the effectiveness of our project by measuring volunteer's conservation behaviors via a questionnaire. We administered an online survey to two groups: our volunteers and to a comparison group within the species geographic breeding range. We predicted that conservation behavior or behavior modification favorable towards the species would be more common among our volunteers. Here we report our preliminary findings, and offer recommendations for future citizen science efforts.

P3 AVIAN COMMUNITY COMPARISONS AND HABITAT RELATIONSHIPS AT FINZEL SWAMP, MARYLAND.

Frank K. **Ammer*** and David Yeany II*, Department of Biology, Frostburg State University, 101 Braddock Rd., Frostburg, MD 21532-2303

During the summers of 2007 and 2008, dependent double-observer avian point-counts and vegetation sampling were conducted at Finzel Swamp Preserve in western Maryland. Avian community structure was determined across old field, upland forest, and peatland habitats using non-metric multidimensional scaling (NMS) and indicator species analysis for 46 bird species. Avian communities were tested for significant differences across habitats using multi-response permutations procedure (MRPP). Stepwise linear regressions were constructed for each bird species using 30 physiognomic and 24 floristic habitat variables and species' mean abundances. The NMS ordination and indicator species analysis revealed three distinct avian communities across the three habitats. The NMS procedure resulted in a two dimensional configuration with a low stress value of 9.509 that was significantly different from random ($p = 0.005$) and in which 93.3% of variance in community structure was determined by habitat type. The MRPP revealed avian communities that were significantly different from one another ($p < 0.001$). Regression models for peatland associated birds were the most explanatory. Peatland birds were generally positively related to eastern hemlock tree stems, speckled alder, great laurel, and highbush blueberry shrub stems, water cover, and litter depth. Most peatland birds had relationships with upright sedge, cinnamon fern, southern arrowwood, highbush blueberry, and lake-bank sedge as groundcover species, but not all relationships were positive. Trends were less apparent for both upland forest and old field birds. These results demonstrate the distinctiveness of an Appalachian peatland breeding bird community and indicate the importance of certain habitat components to its constituent species.

P20 ^STHE EFFECTS OF MATING SYSTEMS ON THE PHYSIOLOGICAL STRESS OF TWO CLOSELY-RELATED SONGBIRDS; THE POLYGYNANDROUS BICKNELL'S THRUSH (*CATHARUS BICKNELLI*) AND MONOGAMOUS SWAINSON'S THRUSH (*CATHARUS USTULATUS*).

Hubert **Askanas*** and Antony Diamond, Department of Biology, University of New Brunswick, Fredericton, New Brunswick, Canada.

Does having extra male helpers at the nest reduce the physiological stress of birds? The maintenance and activation of the immune system are energetically-expensive processes which can be inhibited by low food intake and intense exercise. Parental care is physiologically-expensive and can affect a bird's white blood cell composition. High physiological stress results in a high heterophil to lymphocyte ratio (hereafter H:L). Furthermore, the amount of a bird's parental effort may be dictated by its mating system. Bicknell's Thrushes are polygynandrous, meaning that males mate with many females and females mate with many males, usually resulting in one to four males feeding chicks at one nest. Swainson's Thrushes are socially monogamous, with only one male feeder at the nest. The difference in the number of male feeders at the nests of these species imply different levels of parental effort in the two species, creating a unique opportunity to study the effects of mating systems on physiological stress. If Bicknell's Thrush experience less physiological stress than Swainson's Thrush, then they will have lower H:L ratios. All the Bicknell's Thrush nests found in summer 2008 in the Christmas Mountains, north-central New Brunswick, Canada, had at least three male feeders. We tested for the effect of feeding effort on H:L ratios of males, females, and hatchlings of both species. We monitored 3 nests of each species in 2007-2008, and drew blood from 2 nestling, 22 male, and 3 female Bicknell's Thrush, as well as 12 nestling, 31 male, and 14 female Swainson's Thrush.

P39 ^SDO SEX AND AGE EXPLAIN VARIATION IN THE FAT STORES OF SPRING MIGRATING WARBLERS AT A GREAT LAKES STOPOVER SITE?

Bethany **Bashaw***, Rebecca Jones, and Mark E. Deutschlander. Dept. of Biology, Hobart and William Smith Colleges, Geneva, NY 14456.

Although migratory birds deposit extra fat stores (in some cases, up to 50% of their body weight) to fuel migration, many birds arrive at their breeding grounds with excess fat or more fat than was necessary for migration. According to the breeding performance hypothesis, excess fat from migration may help birds meet the energetic challenges necessary for successful breeding. Egg production is extremely costly. Therefore, the breeding performance predicts

that females should carry more fat upon arrival at the breeding grounds than males. Because many species breed at extremely high northern latitudes, often difficult to reach for field studies, much of what ornithologists know about neotropical migrants comes from monitoring migration at stopover sites between the coast of the Gulf of Mexico and northern breeding grounds. Using data from the Braddock Bay Bird Observatory, a stopover site located on the southern shore of Lake Ontario, we will determine if fat stores and energetic condition (i.e., mass/wing chord) vary between males and females in multiple species of warblers. In species that are reliably aged, we will analyze patterns in energetics using analysis of variance to determine whether sex and age influence the fuel stores within warblers. Strong patterns of sexual dimorphism in the fat stores and energetic condition of warblers, regardless of their distance of migration, would provide support for the breeding performance hypothesis for excess arrival fat in migrants. Age variation in fuel stores may be biologically significant because of age-dependent reproductive behaviors.

P47 SOME ALTITUDINAL RECORDS FOR BIRDS.

Robert C. **Beason**, P.O. Box 737, Sandusky, OH 44871, Sandra E. Wright*, USDA/APHIS/Wildlife Services, 6100 Columbus Ave., Sandusky, OH 44870, and Michael J. Begier, USDA/APHIS/Wildlife Services, 1400 Independence Ave., SW, STOP 3402, Washington, DC 20250

The objective of our study was to document the migration and daily movements of Tundra Swans (*Cygnus columbianus*) and other waterfowl near Pocosin Lakes National Wildlife Refuge (NWR), North Carolina. North Carolina, including the northeastern coastal plain, is a known over-wintering site for many species of swans, geese, and ducks. The area surrounding Pocosin Lakes NWR provides winter habitat for several of these species, most notably Tundra Swans and Snow Geese (*Chen caerulescens*). Using the automatic data-logging capability of a digital avian radar we continuously monitored movements of waterfowl at a study site in Washington County, NC during November 2006 – March 2007. Selected radar targets were identified to species by field observers in contact with the radar operator. Local movements between foraging and roosting locations of Tundra Swans, Red-winged Blackbirds (*Agelaius phoeniceus*), and Ring-billed Gulls (*Larus delawarensis*) were the most abundant diurnal observations. Almost all nocturnal movements were migratory and few associated with the movement of birds to or from the Pocosin Lakes NWR. Based on radar data Tundra Swans began arriving on migration in mid-November and reached peak arrival numbers in early December. During December and January both north-ward and south-ward nocturnal waterfowl movements were recorded. The north-ward exodus of swans began in late January and continued until mid-March. Other waterfowl, predominantly ducks, continued to emigrate until late March and early April.

P61 EFFECTS OF BREEDING STAGE, AGE, AND BEHAVIORAL CONTEXT ON THE SINGING BEHAVIOR OF INDIGO BUNTINGS.

Matt **Beckett**, Gary Ritchison, and Brad McLeod*, Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475.

The vocal repertoire of male Indigo Buntings (*Passerina cyanea*) consists of a single song type. To better understand the possible functions of singing by male buntings and how males vary their singing behavior to convey different information, we examined the possible effects of breeding stage, male age, and behavioral context on the singing rates and singing behavior of male buntings. Buntings were studied from 26 April – 20 August 2004 and from 19 May – 5 June 2005 in Madison Co., Kentucky. During observations, we recorded all songs and noted the behavior and breeding status of focal males. Singing rates were highest prior to pairing and declined significantly after pairing, suggesting that song plays a role in mate attraction. Males were often observed counter-singing with neighboring males and chasing conspecifics near territory boundaries while singing, suggesting that singing also functions in the establishment and defense of territories. Male Indigo Buntings routinely varied the duration of their songs by adding and deleting figures and phrases. We found that bunting songs were significantly shorter in duration prior to pairing than after pairing and, in addition, that males typically uttered longer songs during and after aggressive encounters with other males. These results suggest that males primarily use longer, more complex forms of their single song type during aggressive interactions with conspecific males, and shorter, less complex forms to attract mates.

P59 VARIATION IN THE CHARACTERISTICS OF CHIMNEY SWIFT NESTS

Michael **Bennett**, Gary Ritchison, and Louise Peppe*, Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475.

Adult Chimney Swifts (*Chaetura pelagica*) construct their nests on vertical or nearly vertical surfaces using small twigs and saliva. Nests resemble half-saucers or cups and the dimensions of nests constructed by different pairs are

known to vary. However, factors contributing to this variation are unknown. During the 2006 and 2007 breeding seasons, we examined the possible effects of clutch size, egg-laying dates, and year on the characteristics of swift nests in Madison Co., Kentucky. Female swifts initiated egg-laying over an 8-week period and analysis revealed that clutch-initiation date had no effect on nest characteristics. However, pairs with larger clutches (6-7 eggs) constructed nests that were significantly longer and heavier than pairs with smaller clutches (3-5 eggs). Larger clutches likely require larger nests, but nest volume could be increased by increasing dimensions other than length. However, longer nests (in contrast to wider nests that extend further from the vertical surface) (1) have more surface area in contact with the vertical surface to provide a stronger attachment and (2) keep a nest's center of gravity closer to the vertical surface (reducing the stress placed on attachment points between the nest and wall and reducing the likelihood that a nest will detach and fall as nestlings increase in size and mass). Nests built in 2006 and 2007 had similar dimensions, but 2007 nests were lighter with fewer sticks. Temperatures were higher in 2007 than 2006 and nests with fewer sticks might enhance air flow through nest walls and aid in nestling thermoregulation.

P6 ^SONSET OF INCUBATION IS NOT THE ONLY MECHANISM CONTROLLING HATCHING SYNCHRONICITY IN AMERICAN GOLDFINCHES.

Glennon A. **Beresin**^{1*}, Troy G. Murphy², and Keith A. Tarvin¹, ¹ Department of Biology, Oberlin College, Oberlin, Ohio 44074, ² Department of Biology, Queen's University, Kingston, Ontario K7L 3N6, Canada.

A generally accepted paradigm among ornithologists is that hatching synchronicity is determined by the timing of onset of incubation. However, in 2007, we found that clutches of female American Goldfinches (*Carduelis tristis*) with experimentally diminished bill color tended to hatch asynchronously, and clutches of females with augmented bill color hatched synchronously. However, the bill color manipulations were done after incubation onset. One possible mechanism that could account for this pattern is that variation in male attentiveness to females during incubation could influence female incubation consistency. It is possible that males feed dull-billed females less, and such females must leave the nest more often to forage on their own. The resulting incubation disruptions may cause asynchronous hatching, which is in contrast to the paradigm. Because we did not control for onset of incubation in our earlier study, in 2008 we determined onset of incubation and tested whether it predicted hatching patterns. We monitored female incubation via thermocouples placed in nests during egg laying. We examined nightly temperature profiles and defined the date of incubation onset as the first night the nest was substantially warmer than ambient temperature. We then compared those onset dates to the female's laying and hatching schedule. We found that clutches that experienced the same time period between incubation onset and the laying of the final egg exhibited either synchronous or asynchronous hatching. Therefore, the onset of incubation cannot be the sole factor controlling hatching synchronicity, and post-laying incubation consistency or other factors may shape hatching patterns.

P62 WINTER MOVEMENTS AND HOME RANGES OF ADULT NORTHERN GOSHAWKS IN THE CENTRAL APPALACHIANS.

David F. **Brinker**, Natural Heritage Program, Maryland Department of Natural Resources, Annapolis, MD. In North America, winter movements of adult Northern Goshawks (*Accipiter gentilis*) have only recently been documented with previous studies occurring in Wyoming, Utah and Minnesota. Between 2001 and 2007, winter movements of 4 pairs of breeding adult goshawks were monitored using 30 gram platform transmitter terminals (PTTs) and satellite-telemetry in PA, MD and WV. No goshawk moved more than 30 km from their core nesting area. Three of 4 males occupied an expanded version of their breeding territory throughout the winter. Female winter home ranges were larger than male winter home ranges. Females were recorded making brief visits to breeding territories during the winter. These data suggest that males may play a greater role in territory retention than females. Northern Goshawks that breed in the central Appalachians appear to be permanent residents wintering in close proximity to their nest sites. Therefore, during all but invasion years, goshawks observed at autumn hawk watches in the central Appalachians are mostly dispersing juvenals and non-breeding sub-adults.

P29 ^SCHARACTERIZING AVIAN TROPHIC WEBS IN COASTAL GEORGIA USING STABLE ISOTOPES OF CARBON AND NITROGEN.

Ross **Brittain**^{*}, Christopher Craft, Indiana University School of Public and Environmental Affairs, and Arndt Schimmelman, Indiana University Department of Geological Sciences, Indiana Univ., Bloomington, IN Vegetation, invertebrates and avifauna $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ stable isotope signatures were measured in five habitats (saltmarsh, tidal-freshwater forest, maritime scrub-shrub, maritime oak forest and maritime pine forest) of coastal Georgia to characterize avian trophic webs. Shrub ecotone birds and Marsh Wrens ate prey from the high saltmarsh ecotone between the saltmarsh and uplands, outside of their associated habitats, indicating dynamic overlapping of

the high saltmarsh with adjacent low marsh and shrub habitats. Painted Buntings, the species of highest concern in the region, were almost as dependent on saltmarsh vegetation as they were on shrub and forest vegetation (~40%). Marsh Wrens are likely feeding on spiders that prey upon flying insects (e.g. diptera) that originated in the high saltmarsh zone, while Painted Buntings appear to forage within the marsh. Greater dependence of young of year Yellow-throated Warblers, White-eyed Vireos and Brown-headed Nuthatches on high saltmarsh vegetation suggests the high saltmarsh ecotone may be providing an important source of protein for nestling birds across all upland habitats due to timing of invertebrate emergence. While White-eyed Vireos that nest in shrub habitat may easily forage in the high saltmarsh zone, Brown-headed Nuthatches and Yellow-throated Warblers likely had saltmarsh prey items come to them. Avian conservation efforts in coastal Georgia should include nearby saltmarsh not only to provide the necessary food resources for forest interior species during the crucial breeding season, but also for shrub-associated species. Carolina Wren, Clapper Rail, Eastern Screech Owl and Northern Parula had little overlap with habitats they did not occupy.

P33 ^STHE SYNERGISTIC EFFECTS OF CAROTENOIDS AND IMMUNE ACTIVATION ON STRESS RESPONSES IN THE ZEBRA FINCH (*TAENIOPYGIA GUTTATA*).

Deanna **Broughton*** and Dr. Daniel Ardia, Department of Biology, Franklin and Marshall College, Lancaster, PA 17604.

Because resources are finite, organisms must make tradeoffs between competing demands. One important tradeoff that is common in vertebrates is between health and attractiveness. Thus energy allocated towards mate attraction displays is not available for fighting disease. These tradeoffs can differ among individuals due to different responsiveness to stress, as corticosterone (CORT) is immunosuppressive. Given the potentially negative effects of reduced immune response, animals may allocate resources away from other physiological functions to restore immune function. One possible mechanism of immunostimulation is carotenoid pigments, which can act as immunomodulators that increase immunocompetence. However, because carotenoids are also involved in sexual signaling they too are subject to tradeoffs. My research tested how carotenoid supplementation affects the relationship between immune response, corticosterone levels, and bill color in captive zebra finches (*Taeniopygia guttata*). I tested how activating the immune system through the acute phase fever response affected CORT and whether carotenoid supplementation reduced the effect of immune activation on CORT. In addition, I examined the effect of carotenoids on the interaction between immune system activation and bill color. Lastly, because males and females differ in their allocation of carotenoids to bill color, I compared sex differences in the effect of supplementation on immunity and display.

P18 FORAGING BEHAVIOR OF THE BLACK-CAPPED CHICKADEE IN RELATION TO SEASONAL CHANGE.

Lily **Calderwood** and John Kricher*, Biology Department, Wheaton College, Norton, MA 02766

Foraging behavior of Black-capped Chickadees (*Poecile atricapillus*) was observed for one-hour segments, three days a week, September through November of 2008. Foraging was hypothesized to become increasingly precise, a narrowing of the foraging niche, as winter approached. The hypothesis is based on the assumption that colder, harsher meteorological conditions will select for increased optimal energy expenditure. In this preliminary study, foraging bouts by individual birds were timed and foraging strata recorded as mixed species foraging flocks progressed through the evergreen-deciduous forest behind Wheaton College in Norton, Massachusetts. Black-capped Chickadees were observed as the nucleus species of their foraging flocks, often joined by other species such as the Tufted Titmouse (*Baeolophus bicolor*). Due to the unusually mild autumn and short study period, the hypothesized narrowing of foraging niche by Black-capped Chickadees was not confirmed. However, a trend toward more focused foraging in the upper canopy was evident as the study progressed. Further study is thus warranted, particularly during the height of winter.

P60 TAIL PUMPING BY EASTERN PHOEBES: AN HONEST, PERSISTENT PREDATOR-DETERRENT SIGNAL?

Michelle L. **Carder** and Gary Ritchison*, Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475.

Eastern Phoebes (*Sayornis phoebe*) persistently pump their tails when perched, and the function of this behavior is unclear. During 2006 and 2007 in Madison County, Kentucky, we tested four hypotheses concerning possible functions of tail pumping, including the (1) balance hypothesis, (2) signal-aggression-to-conspecifics hypothesis, (3) foraging-enhancement hypothesis, and (4) predator-deterrent hypothesis. Phoebes were observed, with tail-pumping

rates, wind velocity, and perch characteristics recorded, and several experiments conducted. Our results supported only the predator-deterrent hypothesis. Phoebes increased tail-pumping and calling rates in the presence of a predator (Eastern Screech-Owl), suggesting that tail pumping and calling inform predators that they have been detected and a successful attack is less likely. Phoebes, however, tail pump regardless of whether a predator has been sighted and such movement could make phoebes easier to detect. If so, and if a detected phoebe provides no additional cues (calling) to indicate awareness of a predator, an attack might actually be more likely. However, tail pumping may be beneficial, regardless of whether a predator has been detected, if it serves as a continuous, honest predator-deterrent signal. This would be the case if predators like Sharp-shinned and Cooper's hawks learned to associate tail pumping with phoebes and also learned that phoebes, with their alert posture, small size, and impressive aerial maneuvering abilities, represent low reward, difficult-to-capture prey. If so, then both phoebes and predators would benefit, with phoebes less likely to be attacked and predators not initiating attacks that would waste time and energy and alert other potential prey to their presence.

P51 BREEDING BIRD RESPONSES TO WOODCOCK MANAGEMENT IN THE NULHEGAN BASIN DIVISION OF THE SILVIO O. CONTE NATIONAL FISH AND WILDLIFE REFUGE.

Jameson F. **Chace***, Department of Biology and Biomedical Sciences, Salve Regina University, Newport, RI 02840, Leslie A. Moffat, Middlebury College, Middlebury VT, and Thomas LaPointe, US Fish and Wildlife Service, Silvio O. Conte National Fish and Wildlife Refuge - Nulhegan Basin Division, 5396 Rte 105, Brunswick, VT, 05905.

In the Nulhegan Basin Division of the Silvio O. Conte National Fish and Wildlife Refuge in northeastern Vermont we explored breeding songbird population responses to woodcock (*Scolopax minor*) habitat management. On two partially harvested sites (Unit 1 and 2, harvested January-April-2007) and one control site (all sites 14.5 - 21 ha) we spot mapped breeding birds during dawn surveys five times during the height of the breeding season (June 1 to July 10). Ovenbird (*Seiurus aurocapillus*), Chestnut-sided Warbler (*Dendroica pensylvanica*) and Hermit Thrush (*Catarus guttatus*) detections and number of estimated territories were greater on treated plots than the control. A large blow down section on the control and blow down section of the untreated portion of Unit 2 increased number of detections and territories of the Canada Warbler (*Wilsonia canadensis*), Black-throated Blue Warbler (*Dendroica caerulescens*), Nashville Warbler (*Vermivora ruficapilla*), and Winter Wren (*Troglodytes troglodytes*). Harvesting did not seem to affect area-sensitive species such as Ovenbirds and Red-eyed Vireos (*Vireo olivaceus*). The harvested forest openings created habitat for Mourning Warblers (*Oporornis philadelphia*), Common Yellowthroats (*Geothlypis trichas*) and Chestnut-sided Warblers that were uncommon or absent in the control. While these findings are preliminary during the first season of a long-term monitoring program, the results of small-scale harvest relative to a large forested landscape reveal positive responses by early successional species of conservation concern while simultaneously maintaining populations of species that require mature closed canopy forest.

P22 ^SCOMPARISON OF THE PROVISIONING BEHAVIOR OF SIZE-DIMORPHIC MALE AND FEMALE EASTERN SCREECH-OWLS

Jason **Courter*** and Gary Ritchison, Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475.

Many species of raptors exhibit reversed sexual dimorphism (RSD), with females larger than males. Hypotheses concerning the evolution of RSD have focused on intersexual differences in foraging behavior in species that exhibit high degrees of RSD, like hawks and falcons. Less is known about the foraging behavior of small species that exhibit less size dimorphism. We examined possible intersexual differences in the provisioning behavior (including sizes of prey delivered) of slightly dimorphic Eastern Screech-Owls (*Megascops asio*), a species where the mass of females averages about 17% greater than that of males. Pairs of Eastern Screech-Owls ($N = 17$) were video-taped at nest boxes during the second half of the 4-week nestling period when both adults provision nestlings. We found no significant differences between males and female in either the amount of biomass delivered per hour or the mean size of prey delivered. However, females tended ($P = 0.09$) to provision nestlings at higher rates ($\bar{X} = 6.2$ visits per hour) than males ($\bar{X} = 4.3$ visits per hour). Our results are not consistent with predictions of the Role Differentiation and Ecological hypotheses for RSD evolution because smaller male screech-owls did not deliver more prey to nestlings than females. One possible explanation for our results is that smaller male screech-owls, being more energetically efficient flyers, are better equipped to forage at greater distances from nests, whereas larger females might forage closer to nest sites and, as a result, provision young at higher rates. In addition, females might remain closer to and forage near nest sites because their larger size makes them more formidable defenders of the nest and young.

P19 ^SGENOME-WIDE SURVEY OF DIFFERENTIATION BETWEEN HYBRIDIZING APPALACHIAN CHICKADEES.

Brian S. **Davidson*** and Michael J. Braun, Program in Behavior, Ecology, Evolution, and Systematics, University of Maryland, College Park, MD 20742 and National Museum of Natural History, Smithsonian Institution, Suitland, MD 20746.

Hybrid zones provide valuable opportunities to study genetic, ecological, and behavioral interactions between differentiated groups, and act as natural experiments that provide information about the formation and maintenance of evolutionary diversity. Molecular methods now allow fast, economical, and genome-wide characterization of gene frequencies, which is instrumental in understanding introgression and gene flow between hybridizing populations. Black-capped and Carolina chickadees (*Poecile atricapillus* and *P. carolinensis*) hybridize along an east-west range interface through the middle of the USA and southward along the spine of the Appalachian Mountains. A previous study demonstrated long-distance bidirectional introgression at one diagnostic autosomal RFLP locus, but not at three other diagnostic loci (all sex linked or mitochondrial). Here, we used AFLP loci to characterize three parental and one introgressed population from the same area in the northern Appalachians (n= ~20 individuals per population). AFLP can generate hundreds of anonymous loci, widely spaced throughout the genome. Many of these loci are likely to be selectively neutral and able to introgress, unless there is a strong and generalized barrier to gene flow. Preliminary AFLP data were generated from ten selective-PCR primer pairs, and yielded roughly two hundred individual loci. A low proportion of loci exhibited differences between populations (~5%), and only very few were fully diagnostic. Identification of differentiated loci will enable characterization of the genomic distribution of selected and neutral regions and their potential to introgress across hybrid zones.

P46 USING WHATMAN® FTA CARDS TO PRESERVE AVIAN TISSUE SAMPLES.

Carla J. **Dove*** and Faridah Dahlan*, Smithsonian Institution, Division of Birds, Washington, DC 20560, and Daniel Rehner, Department of Community and Public Health, University of Maryland, College Park 20742

This study investigates the use of Whatman® Fast Technological Analysis (FTA) card as a way to supplement current collection and storage methods of avian tissue samples. The Whatman® FTA card allows instant “fixing” of DNA and inhibits further degradation of DNA when stored at room temperature for extended periods of time. The cards are small (1 to 4 sample areas per card), lightweight and require no special storage conditions. During a 2004 collecting expedition to Korea, 170 bird tissue samples were collected in the field on FTA cards along with separate frozen tissues and voucher specimens. This poster presents the results of our success at obtaining both mitochondrial (CO1) and nuclear (c-myc) DNA extractions and sequences from these samples representing 51 species and 6 orders birds. The practical use of FTA cards may reduce current burdens of transporting heavy portable tanks, reduce the need for a source of liquid nitrogen in remote areas, minimize storage space and maintenance, and expedite tissue grant transfers between institutions.

P11 ^SMICROHABITAT PREFERENCES OF WINTERING BIRDS IN THE CROSS TIMBERS OF CENTRAL OKLAHOMA.

*P. van **Els**, T.J. O’Connell, Department of Natural Resource Ecology and Management, Oklahoma State University, Agricultural Hall 008C, Stillwater, OK 74078

The Cross Timbers are a woodland-prairie transitional forest belt restricted to a few states in the southern Great Plains states. Originally dominated by post and blackjack oaks (*Quercus stellata*, *Q. marilandica*), a dense midstory of eastern redcedar (*Juniperus virginiana*) developed recently due mainly to fire suppression. We hypothesized that wintering bird abundance and species richness are greater in forests with a redcedar midstory than in oak-dominated forests, because birds may find more shelter from adverse weather conditions and predation in dense redcedar than in more open oak-dominated forests. We sampled the wintering bird population during the winters of 2007-2008 and 2008-2009 in three oak-dominated and three cedar-dominated areas situated around Lake Carl Blackwell, central Oklahoma. The most commonly captured species in all plots were Yellow-rumped (Myrtle) Warbler (*Dendroica coronata* ssp. *coronata*), Dark-eyed (Slate-colored) Junco (*Junco hyemalis* ssp. *hyemalis*) and Red-breasted Nuthatch (*Sitta canadensis*). An increase in body weight in all migratory species was observed during the progression of winter, indicating that these birds build up fat reserves before migrating north. Principal Components Analysis (PCA) revealed that birds caught in oak-dominated habitat had a better overall body condition than those caught in redcedar-dominated areas. Since body condition of the three most abundant species caught in redcedar-encroached forests was lower, this may indicate that forests with a high component of redcedar form an ecological trap for passerines.

P21 ^SSPYING ON INCUBATING HOUSE WRENS: USING MINICAMERAS TO OBSERVE BEHAVIORS IN NEST BOXES.

Amanda **Engelhard***, E. Dale Kennedy, and Douglas White, Department of Biology, Albion College, Albion, MI 49224

We monitored incubation bouts of female House Wrens (*Troglodytes aedon*) using small, programmable temperature data loggers (iButtons) in nests. However, on hot days, high internal nest temperatures made variations in nest cup temperature difficult to interpret. As a second way to document incubation behavior, we used small video cameras with infrared illumination placed inside lids of nest boxes (N = 44). Video images showed that, in addition to sitting on eggs, females displayed a range of non-incubation behaviors that included shaking, preening, repositioning, and egg turning. The frequency of each behavior was not correlated with temperature even though bout lengths decreased with increasing temperatures. On a few occasions birds were observed eating prey items that either flew into their nest box or were found within the nesting materials during another maneuver. As a measure of metabolic activity, we counted the number of breaths taken per ten-second interval as movements of the chest. A significant negative correlation existed between ambient temperature and the number of breaths per minute ($r = -0.529$, $df = 184$, $p < 0.0001$), suggesting that females have to spend more energy on colder days to warm eggs up to incubation temperature.

P16 ^STHE STOPOVER ECOLOGY OF MIGRANT WARBLERS IN MICHIGAN.

Dorothy I. **Fatunmbi*** and Catherine Alford, Biology Department, Canisius College, Buffalo, NY 14208; Brenda S. Keith and Richard S. Keith, Kalamazoo Nature Canter, Kalamazoo, MI49009; and Sara R. Morris, Canisius College, Buffalo, NY 14208

Migration is a physiologically taxing event for birds. Stopover sites provide birds with areas to build or rebuild fat stores used for migration. Our goal was to investigate the quality of an inland stopover site by characterizing its use by migrating warblers during fall. We used banding data from twelve migrant warbler species with over 200 captures each between 1990 and 2007 at a banding station in Vicksburg, Michigan. For each species we calculated the percentage recapture, the average number of recaptures per individual, the minimum length of stopover, and change in mass during stopover. Additionally, we compared these variables among the twelve species. The percent of birds recaptured varied significantly from 5.3% for the Palm Warbler to 22.8% for the Wilson's Warbler ($p < 0.001$). Most recaptured birds were only recaptured once or twice. Minimum stopover length varied from 3.6 ± 3.3 days in Black-and-white Warblers to 6.0 ± 7.1 days in Palm Warblers, and the difference was significant among the twelve species. Of the commonly captured species, only Magnolia Warbler, Yellow-rumped Warbler, Ovenbird, and American Redstart showed statistically significant ($p < 0.05$) increases in mass during the stopover period. The other eight species did not show statistically significant mass changes ($p > 0.05$). Our results indicate regular use of this area by a variety of warbler species migrating through Michigan, but that the use of the site varies among species. These results are similar to those from other stopover sites, both coastal and inland, that indicate differences among species using specific stopover sites.

P50 THE POTENTIAL ROLES OF FOOD AND HABITAT AS LIMITING FACTORS FOR CHIMNEY SWIFT POPULATIONS.

Leah **Finity*** and Joseph J. Nocera, Environmental & Life Sciences Graduate Program, Trent University, Peterborough, ON K9J 7B8

Populations of aerial insectivorous species have recently experienced drastic declines. The cause(s) of these declines are largely unknown, but the predominant hypotheses centre on habitat loss and/or declines of insect prey populations. These hypotheses are not mutually exclusive and likely have synergistically affected insectivore populations. Because there is very little information on long-term temporal trends in insect availability, testing the synergistic habitat-insect hypothesis has been difficult. We have initiated a study to overcome these difficulties and explicitly test the roles of habitat and insect availability for a model aerial insectivore, the Chimney Swift (*Chaetura pelagica*). Chimney Swifts have experienced large-scale habitat change; first after European contact which saw the near-elimination of hollow old-growth trees and then recently with the modernization of chimneys that inadvertently prevents swifts from using them. If habitat is indeed a limiting factor for swifts, then provisioned habitat should become attractive if available nesting chimneys are all occupied. To test this prediction, we are constructing artificial nesting towers and using various methods of attracting swifts (including conspecific attraction methods with audio playbacks and decoys) to determine if, and how, they are settled in relation to nearby habitat. We are also using biochemical analysis to examine stratified fecal samples deposited at roost sites. If diet has changed substantially over recent years (e.g., from soft-bodied to more hard-bodied insects), then this shift should be

observable by changes in stable isotope composition and undigested insect fragments. We conclude by illustrating how this information is relevant to all aerial insectivores.

P9^S UTILIZING BALD EAGLES FOR ECOLOGICAL AND ENVIRONMENTAL MONITORING IN MICHIGAN.

Latice **Fuentes*** and William Bowerman, Department of Forestry & Natural Resources, Clemson Univ., Clemson, SC, David Best, US Fish & Wildlife Service, E. Lansing, MI 48823 and James Sikarskie, College of Veterinary Med., Michigan State Univ., E. Lansing, MI 48824.

The bald eagle (*Haliaeetus leucocephalus*) has been used as an ecosystem monitor under the Great Lakes Water Quality Agreement (GLWQA) for over 10 years. In the past 15 years, the International Joint Commission (IJC) has found that the bald eagle is the best avian indicator species for tracking Bioaccumulative Chemicals of Concern (BCCs). In April 1999, the Michigan Department of Environmental Quality (MDEQ) implemented a bald eagle monitoring program. An important component of this monitoring program calls for the assessment over time of concentrations of selected contaminants including organochlorine pesticides (OCs) and polychlorinated biphenyls (PCBs) using plasma samples and mercury (Hg) using feathers. Because of the trophic status of bald eagles, analysis of representative tissues represent temporal trends of these compounds in the entire food web. The objectives of this study include: 1. Monitoring contaminant levels in wildlife exposed to contaminants from surface waters of the state. 2. Assess whether contaminant levels in fish are changing over time. 3. Assist in the identification of waters that may exceed quality standards and target additional monitoring activities. 4. Evaluate the overall effectiveness of Department of Environmental Quality (DEQ) programs in protecting wildlife from toxic contaminants. 5. Assist the Department of Community Health in the establishment or removal of wildlife consumption advisories. 6. Determine whether new chemicals are bioaccumulating in wildlife.

P2 CONSISTENT FOOTEDNESS IN YELLOW-CROWNED PARAKEETS (*CYANORAMPHUS AURICEPS*).

Mildred **Funk**, Department of Biology, Roosevelt University, 430 S. Michigan Ave, Chicago, IL 60605.

Data from 47 Yellow-crowned Parakeets showed significant individual consistence in foot preference when holding or manipulating objects. Thirty-five of the 47 showed significant lateralization (three out of 4 birds). About two thirds of the lateralized birds were right dominant, a directional bias which, although suggestive was not statistically reliable ($p=.091$), given this small sample. Other investigators have found similar results (consistent individual footedness though no population bias) in smaller budgerigars. Individuals in the present study were from zoos or sanctuaries (New Zealand) or laboratory (US). Subjects were assessed as they fed or performed simple tasks in the lab or as they fed or interacted with each other at the other sites. There have been many studies on the footedness of birds, particularly parrots and crows, in the last few decades and these studies are discussed.

P56 BIOACOUSTICS AND BANDING: SIMILARITIES AND DIFFERENCES IN NIGHTLY MIGRATION PATTERNS.

Lewis **Grove***, Emma DeLeon, Andrew Vitz, and Michael Lanzone, Carnegie Museum of Natural History Rector, PA 15677.

Bioacoustic analysis of nocturnal flight calls and bird banding are both used to track migratory patterns and population trends. We compared results of concurrently collected acoustic and banding data from southwestern Pennsylvania to assess the similarity of the data sets. Nightly 12 hour recordings and daily bird banding took place on 218 days during the 2004-2008 fall migration seasons. We evaluated banding totals against the previous night's acoustic totals to determine whether both methods reported corresponding changes in nightly migration volume. We also considered portions of the nights as well as different species sets from the banding data. Nocturnal flight call detections ranged from zero to over 1000 per night and banding totals for migratory song birds ranged from zero to around 300 per day. Data results from mist netting and acoustic monitoring both have high daily variation. Preliminary analysis shows this variation is not strongly coupled and suggests much of the difference may be due to variables other than changes in numbers of migrating birds. There is some indication that similar trends can be detected by both bioacoustics and banding so it is possible that larger sample sizes, for example from multiple stations, as well as detailed analysis of weather and habitat variables, may be able to separate sampling error from variation due to daily population fluctuations.

P57 COLLISIONS AS IMPORTANT SOURCES OF MORTALITY TO RAPTORS OF THE UNITED STATES AND CANADA.

Stephen B. **Hager**, Department of Biology, Augustana College, Rock Island, IL 61201.

Annual bird mortality in the United States from anthropogenic sources is estimated at 1 billion and ~70% of this is attributed to collisions with buildings and automobiles. Raptors are impacted by these and other factors, but little is known about the relative frequency of these sources within and among species and how these relate to populations inhabiting urban centers. I reviewed the literature on mortality ($N = 69$ published sources) and urban and roadway use ($N = 107$ sources) for the raptors of the United States and Canada. Within the Falconiformes (33 species), vehicle collisions and electrocution were reported for 78.8% and 57.6% of species, respectively, and vehicular and window strikes were the leading sources of mortality in 42.4% and 12.1% of species, respectively. Urban use (e.g., breeding) was documented in 28 species. For the Strigiformes (19 species), vehicular (78.9%) and window (57.9%) collisions were reported in most species, and the top sources of mortality were from vehicles (36.8%) and electrocution (5.3%). Urban use was described for 14 owl species. Considering all raptors, a significant number of urban species experienced window strike mortality, whereas collisions with vehicles affected a large number of urban and non-urban raptors. Vehicle collisions were reported in a significant number of species that use roadways for various activities (e.g., foraging) and those that do not use roadways. Overall, the literature suggested that collisions are an important source of mortality for most raptors. Future work should experimentally assess the possible consequences of collisions on demography.

P24 OWL DIET ANALYSIS: IS SOMETHING MISSING FROM THE MENU?

Marcy **Heacker*** and James F. Whatton, Division of Birds, National Museum of Natural History, Smithsonian Institution, Washington, DC 20013 and Neal Woodman, USGS Patuxent Wildlife Research Station, Division of Mammals, National Museum of Natural History, Washington, DC 20013.

Traditionally, the composition of owl diets has been analyzed by identifying the skeletal remains of prey species in regurgitated pellets. The wide variety of animals that owls prey upon can create different identification challenges for researchers examining prey remains. This study is a survey of twenty years of published diet analyses for North American owls comparing documented taxonomic identification levels between mammal and avian prey. While the majority of articles suggest or state they represent comprehensive diet studies, closer comparison of the published prey lists suggest a chronic bias favoring more specific identifications for mammal prey. Overall, more than 90% of mammal identifications listed were to species or genus levels. In contrast, approximately 42% percent of listed bird identifications were to species or genus. More than 40% of the avian prey items listed were identified to class and simply described as "bird". This less specific level of taxonomic identifications for avian prey has potentially resulted in an incomplete knowledge of the breadth of avian species preyed upon by owls. Possible reasons and solutions for this imbalance in documenting owl prey remains are presented along with comments on varying descriptions of identification methods.

P40 ^SPOTENTIAL REMAINING FLIGHT RANGES OF MIGRANTS AT A GREAT LAKE STOPOVER SITE: HOW MUCH FAT IS EXCESS FAT?

Leslie **Hopke***, Chi Kong Poon, Emily Runnells, and Mark E. Deutschlander. Dept. of Biology, Hobart and William Smith Colleges, Geneva, NY 14456.

According to the "spring fatter" hypothesis, migrants will be fatter during spring arrival at breeding grounds than upon autumn departure. Excess spring fat may increase breeding performance and/or insure migrants against unpredictable conditions at northerly breeding sites. However, much of what is known about the energetics of migration comes from stopover sites. To test the hypotheses for excess spring fat at stopover sites, especially penultimate locations, along a migratory route, it is important to determine exactly how much fat is in excess of what is needed to complete migration. Only then can the probability that birds will have excess fat at their breeding grounds be assessed. The goal of this project is to predict quantitative values of excess fat for several species of migrants at a stopover site on Lake Ontario. Visually-estimated fat scores and mass were collected for *Catharus* thrushes and white-throated sparrows at the Braddock Bay Bird Observatory. Using Odum's (1993) fat-free body masses, the mean increase in mass due to fat was extrapolated for each fat score. The potential remaining flight range for birds in each fat score was determined using a flight simulation model (Pennycuick, 2008). Combining our distance estimates with known orientation of thrushes and sparrows at this stopover site (Deutschlander and Muheim 2009), we predict the "restricted" destination for birds with different fat stores. By considering their breeding ranges, we determine the likelihood that birds with a particular fat score will have more fat than needed (i.e. excess fat) to complete their migration.

P12 ^SSEASONAL DIFFERENCES IN SHORT-TERM MASS CHANGES OF NEARCTIC-NEOTROPICAL MIGRANTS ON APPLIEDORE ISLAND.

Kyle G. **Horton*** and Sara R. Morris, Department of Biology, Canisius College, Buffalo, NY 14208.

Stopover sites provide Nearctic-Neotropical migrating passerines an opportunity to restore and build fat stores needed for extended flight, both over short-term (hours) and long-term (days or weeks) time scales. Most studies of mass changes have been over the longer time scale, so we were interested in investigating mass changes over the short term. Using banding data collected during the spring and fall migration from 1990-2006 on Appledore Island, Maine, we examined the mass gains of the five most common species recaptured on the same day to depict the stopover ecology of these species. These five species included the Common Yellowthroat (*Geothlypis trichas*), American Redstart (*Setophaga ruticilla*), Black-and-white Warbler (*Mniotilta varia*), Magnolia Warbler (*Dendroica magnolia*), and the Red-eyed Vireo (*Vireo olivaceus*). Over the duration of 17 years of banding, 62,521 birds were banded, yet only 2.6 % of all birds banded were recaptured on same day. There were a total of 30,692 birds banded in the spring migration with 972 same day recaptures and 31,829 in the fall migration with 673 same day recaptures. All five species experienced mass increases during the fall migration, however some species gained mass while others lost mass during spring. These results indicate that the Appledore Island stopover site may be utilized differently by migrating passerines during the two seasons. These results corroborate previous studies on Appledore Island that suggest different uses of the site during the two migratory seasons over a longer term time scale.

P44 ^SINVESTIGATING THE ASSOCIATION OF MIGRATORY SCRUB-BREEDING LANDBIRDS WITH SHRUBBY HABITAT IN TOMMY THOMPSON PARK, TORONTO.

Joanna **Jack** and Jim Rising, Department of Ecology and Evolutionary Biology, University of Toronto, Toronto, ON.

The ornithological community has recognized the importance of identifying valuable stopover habitats for passerine migrants in North America, though the results of recent studies investigating changes in habitat use by these birds has been variable. This may be partly due to the differences in available habitats between the studies. To investigate these trends further, I am contributing an analysis of stopover habitat along a coastal area of the Great Lakes. The purpose of this study is to examine the relative abundance of migratory landbirds during stopover in the successional habitat of Tommy Thompson Park, a man-made peninsula extending into Lake Ontario that now represents the largest stopover habitat along the waterfront in Toronto. In this study I am investigating the hypothesis that scrub-nesting bird species will be more narrowly distributed, and present in shrubby habitat, using data collected through standardized banding practices at Tommy Thompson Park Bird Research Station from 2006-2008 as well as data from a vegetation survey I performed in 2008. Through a correspondence analysis of the capture data, I have detected a significant difference in species assemblages captured in the two habitats. These differences in assemblages have a clear relationship with each mist net's habitat characteristics, including percent canopy cover, basal area and shrub density from 0.3-1m, 1-3m and 2-3m above the ground. An analysis of the species assemblages themselves will follow. This study is meant to contribute a general understanding of the distribution of migratory landbirds across habitat structure on stopover sites, and consequently assist management decisions concerning stopover habitat.

P25 EXTRA-PAIR YOUNG IN HOUSE WREN BROODS ARE MORE LIKELY TO BE MALE THAN FEMALE.

L. Scott **Johnson***, Brian S. Masters, and Bonnie Johnson, Dept. Biology, Towson Univ., Towson, MD 21252, Charles F. Thompson, Scott K. Sakaluk, Sheryl S. Soukup, and Shannon J. Forsythe, Dept. Biol. Sci., Illinois St. Univ., Normal IL 61790, and Marcus Neuhäuser, Dept. Mathematics & Technique., Koblenz Univ. of Applied Sciences, 53424 Remagen, Germany.

Sex-allocation theory predicts that females should preferentially produce offspring of the sex with greater fitness potential. In socially monogamous animal species, extra-pair mating often increases the variance in fitness of sons relative to daughters. Thus in situations where offspring sired by a female's extra-pair mate(s) will typically have greater fitness potential than offspring sired by the within-pair mate, sex-allocation theory predicts that females will bias the sex of offspring sired by extra-pair mates towards male. We examined the relationship between offspring sex and paternity over six breeding seasons in an Illinois population of the House Wren (*Troglodytes aedon*), a cavity-nesting songbird. Of the 2345 nestlings that had both sex and paternity assigned, 350 (15%) were sired by extra-pair males. The sex ratio of extra-pair offspring, 0.534, was significantly greater than the sex ratio of within-pair offspring, 0.492, representing a difference of 8.5% in the proportion of sons produced. To our knowledge, this is the first confirmed report of female birds increasing their production of sons in association with extra-pair fertilization. Our results are consistent with the oft-mentioned hypothesis that females engage in extra-pair mating to increase offspring quality.

P28 ^SSEASIDE SPARROW NEST SUCCESS IN RELATION TO PRESCRIBED FIRE FREQUENCIES AT BLACKWATER NWR AND FISHING BAY WMA.

Rebecca **Kern*** and W. Gregory Shriver, Department of Entomology and Wildlife Ecology, University of Delaware, Newark, DE 19716; Dixie L. Birch, Chesapeake Marshlands NWR Complex, U.S. Fish and Wildlife Service, Cambridge, MD 21613; and Laura R. Mitchell, Regional Fire Wildlife Biologist, U.S. Fish and Wildlife Service, Sussex, NJ 07461.

In 2007, the Chesapeake Marshlands National Wildlife Refuge (NWR) Complex and conservation partners initiated a project to evaluate the effects of prescribed winter burning on the secretive marsh bird community at Blackwater NWR and nearby Fishing Bay Wildlife Management Area in Dorchester County, Maryland. Target species, many of which are of conservation concern, include tidal marsh breeding sparrows, rails, bitterns and moorhen. Objectives of the project include: 1) comparing occupancy and estimated density of secretive marsh birds among four fire return intervals and 2) comparing nest success, productivity and nest-site selection of breeding secretive marsh birds among fire return intervals. During two breeding seasons (May – August, 2007 – 2008), we surveyed 60 hectares of tidal marsh (20 plots) stratified into four fire return intervals (annual, 3-5 years, 7-10 years, and >10 years). We detected and monitored 245 nests from seven species. Seaside Sparrow (*Ammodramus maritimus maritimus*) nests were the most abundant (n=215). Seaside Sparrow nest density on annual burns was greater than on 7-10 and >10 year burns (P -values <0.05). Territory density and productivity per ha were also greatest on annual burns and lowest on 7-10 and >10 year burns. Analysis of Seaside Sparrow nest success by the Mayfield Method indicated lower daily survival probability on annually-burned marsh (0.936 ± 0.0091) compared to marsh with longer fire-return intervals (3-5 years – 0.952 ± 0.0085 ; 7-10 years – 0.954 ± 0.0151 ; >10 years – 0.938 ± 0.0167). Differences between daily survival probabilities were not significant (all P -values >0.05).

P36 ^SNETTING METHODS INFLUENCE AGE DISTRIBUTION IN SAMPLES OF CLIFF SWALLOWS.

Kristen M. **Lear***, Department of Zoology, Ohio Wesleyan University, Delaware, OH 43015, Ananda B. Ellis, Department of Biology, Lewis and Clark College, Portland, OR 97219, and Charles R. Brown, Department of Biological Sciences, University of Tulsa, Tulsa, OK 74104.

The way in which an organism is captured may affect the subset of the population sampled. When sampling birds such as the Cliff Swallow, *Petrochelidon pyrrhonota*, mist netting is often the preferred method of capture. Because the birds must fly into the net, the sample population could be biased for traits associated with such flights. We set out to determine whether our netting method affected the subset of the population captured. We allowed Cliff Swallows to fly into mist nets voluntarily and compared those data to data from Cliff Swallows captured by flushing them into the nets. Flushing involved walking through a colony and driving the birds into the net. Flushing may eliminate the potentially skewed results given by voluntary capture. We collected data from 3 sites, using a summed sample size of 3,062 birds, and found that flushed birds tended to be older than birds that made voluntary flights into the nets. This shows that the method of netting can give a skewed perspective of a population's age structure and that researchers who use mist nets should keep this in mind when asking questions about population dynamics.

P10 ^SUSING LONG TERM HISTORICAL DATA TO DEVELOP A SPATIALLY EXPLICIT POPULATION MODEL FOR BALD EAGLES IN MICHIGAN.

Katherine F. **Leith*** and William Bowerman, Department of Forestry and Natural Resources, Clemson University, Clemson, SC 29634

This study will use data from Michigan's long-term biosentinel monitoring program documenting population density, location, productivity, and contaminant load to develop a population model for the Bald Eagle. Because the dataset is large (containing over 8000 recorded breeding events occurring from 1961 to the present) and the monitoring program is on-going, it offers a unique opportunity for robust parameterization of the population model. This study will develop and parameterize several spatially-explicit population models using different geographic designations in addition to a 'control' model, which will conceive of the whole Michigan Bald Eagle population as unified. Because of the large historical body of data, the statistical validity of each model will be assessed using real validation data sets. The resulting spatially-explicit model will then serve as the baseline for future investigations and be used to conduct "Population Viability Analysis (PVA)". This type of model offers increased realism in PVA by detailing the interaction between localized populations, as well as each subpopulation's contribution to the stability of the entire population. PVA will be conducted for several scenarios reflecting the possible impact of habitat loss, habitat degradation, and point-source pollution. An iterative approach will be used in assessing outcome probabilities.

P4 SOCIAL ENVIRONMENT IN CAPTIVITY AFFECTS BEAK COLOR IN HOUSE SPARROWS.

Michael P. **Lombardo***, Patrick A. Thorpe, and Sheila Colpetzer, Dept. Biology, Grand Valley State University, Allendale, MI 49401-9403

Black beak color in male House Sparrows (*Passer domesticus*) is a secondary sexual characteristic whose expression is directly correlated with testosterone levels. We set out to experimentally determine if male-male physical contact affects testosterone levels in captive male House Sparrows as indicated by black beak color because testosterone levels in House Sparrows are influenced by social interactions. We housed wild-caught male House Sparrows either singly ($n = 10$), "Solo" males, or in the company of two other males ($n = 12$), "Group" males, from 26 May - 7 July 2006. All males, regardless of housing arrangement, were in visual and auditory contact with other sparrows of both sexes housed in nearby cages. Starting on 26 May and once a week thereafter we produced digital images of Solo and Group males to monitor their beak color. Beak blackness decreased more quickly and to a greater extent in Solo than in Group males. These results suggest that social environment in captivity affected beak color and suggest that male House Sparrows may require physical interactions with other sparrows to maintain breeding season levels of testosterone.

P7 ^SHUMAN DISTURBANCE IMPACTS ON MIGRATORY SHOREBIRDS AT CRANE BEACH, IPSWICH, MASSACHUSETTS: SEMIPALMATED PLOVERS (*CHARADRIUS SEMIPALMATUS*), SEMIPALMATED SANDPIPERS (*CALIDRIS PUSILLA*), AND SANDERLINGS (*CALIDRIS ALBA*).

Kara **Moody***, M.S. Candidate Conservation Biology 2009, Department of Environmental Studies, Antioch University New England, Keene, NH 03431, and Franz Ingelfinger, Northeast Regional Ecologist, The Trustees of Reservations, Ipswich, MA 01938.

As part of a project initiated by the Trustees of Reservations, data has been collected during the fall migration periods from 2004 through 2008 at Crane Beach in Ipswich, Massachusetts to examine the effects of human disturbances on roosting shorebirds. In 2008, a new pedestrian management program was implemented in attempt to guide beach-users away from resting birds within the Shorebird Protection Zone (SPZ). Additionally, visitor surveys were distributed to evaluate the public's reception to this new management program. Currently, the full analyses of this study are underway but have not yet been completed. Preliminary results show the average number of disturbances (in which flushing occurs) has decreased since 2004. In 2008, the mean number of disturbances was reduced when the SPZ was staffed; however, staffing level did not influence average flushing duration. Further results examining tide level and shorebird location indicate the number of birds located on the upper beach is positively correlated with tide level. In assessing visitor surveys, over 93% of respondents believe protecting shorebirds is "very important." Over 80% of visitors find activities performed by the Trustees in the SPZ to be "very acceptable," and over 65% of respondents were "extremely willing" to adjust their behavior within the SPZ. Further analyses will examine potential relationships between flushing occurrence and date, time, tide level, beach location, disturbance type, magnitude of disturbance, and the influence of previous disturbances. Additionally, duration of flight will be evaluated in relation to type of disturbance, magnitude of disturbance, and influence of previous disturbances.

P15 ^SFALL MIGRATION AND STOPOVER ECOLOGY OF THRUSHES IN KALAMAZOO, MICHIGAN

David G. **Nally***, Canisius College, Buffalo, NY; Brenda S. Keith and Richard S. Keith, Kalamazoo Nature Center, Kalamazoo, MI; and Sara R. Morris, Canisius College, Buffalo, NY

Most studies of stopover ecology have occurred at coastal sites. We were interested in studying the stopover ecology of Hermit Thrush, Swainson's Thrush, Gray-cheeked Thrush and Veery at an inland site in Michigan. We used banding data for the four species from the Pittsfield Banding Station in Vicksburg, Michigan from 1990 to 2007. We calculated the percentage of birds recaptured, minimum length of stopover and mass changes of thrushes during this eighteen year period. The percentage of recapture differed significantly among the four species, ranging from 7.2% in Swainson's Thrush to 33.4% in Hermit Thrush. The average minimum stopover length ranged from 4.1 ± 3.3 days in Veery to 5.5 ± 7.4 days in Hermit Thrush, however, this difference was not significant. Three of the four species showed significant average mass increases and percent mass increases. Gray-cheeked Thrush showed the greatest percent mass increase of $7.6 \pm 10.9\%$ and the Swainson's Thrush showed the lowest percent mass increase of $2.5 \pm 9.6\%$. The Veery did not exhibit average mass increases, and in fact showed slight but non-significant decreases in mass (-0.6 ± 1.8 g) and percent mass ($-1.5 \pm 5.5\%$). Our study suggests that this stopover site is suitable for many thrushes during fall migration. Additionally we may be able to use the information to compare the effectiveness of inland and coastal stopover sites.

P27 ^SPERVASIVE AND PRODUCTIVE? REPRODUCTIVE SUCCESS OF EARLY SUCCESSIONAL BIRDS IN MANAGED PINE HABITATS IN THE SOUTHEAST

Brandon W. **Newcomb*** and Michael D. Collins, Department of Biology, Hampden-Sydney College, Hampden-Sydney, VA 23943, and Erica M. Rutherford, Mark L. Fink, and Alix D. Fink, Department of Biological and Environmental Sciences, Longwood Univ., Farmville, VA 23909.

Natural early successional habitats are declining in the Southeast while intensively managed pine plantations (IMPs) are increasing. To investigate the suitability of IMPs for early successional birds in the Virginia Piedmont, we measured nest productivity of Prairie Warbler (PRAW; n=45 nests), Yellow-breasted Chat (YBCH; n=42), Field Sparrow (FISP; n=31), Indigo Bunting (INBU; n=13), Eastern Towhee (EATO; n=12), and Brown Thrasher (BRTH; n=8) and, using a logistic regression approach, identified factors affecting nest success. In 2004, 2005, and 2008, we monitored 151 nests in 15 sites of varying ages and management intensities. Nest placement varied across species. YBCH, PRAW, INBU, and EATO avoided nesting in pines (G-test; $p < 0.05$ for all species). Height and diameter of nest tree and canopy cover did not differ among species. While nest success did not differ among years or with initiation date, vegetative factors that influenced nest success varied across species: FISP success increased with number of grass stems, and PRAW success increased with canopy cover. Preliminary results indicated that nest success in IMPs was insufficient to maintain stable populations for YBCH (mean number of fledglings/nest = 1.69 ± 0.256), INBU (1.0 ± 0.376), EATO (0.33 ± 0.333), and BRTH (0.63 ± 0.420). Nest success of PRAW (1.64 ± 0.271) and FISP (1.65 ± 0.296) appears sufficient to maintain populations. We tentatively conclude that IMPs are population sinks for some early successional birds and thus local population densities in these anthropogenically modified habitats may require continued immigration from other habitat types.

P54 ROLE OF GRAY CATBIRDS (*DUMETELLA CAROLINENSIS*) IN THE OVERWINTERING OF EASTERN EQUINE ENCEPHALITIS VIRUS.

Jennifer C. **Owen**¹, Mary Garvin^{*2}, Amanda Jo Williams¹, Elizabeth A. Miller², Valerie J. Morley², Alexander R. Krohn², and Frank R. Moore¹, ¹Department of Biological Sciences, Univ. of Southern Mississippi, Hattiesburg, MS 39406, ²Department of Biology, Oberlin College, Oberlin, OH 44074.

Eastern equine encephalitis virus (EEEV) is a pathogen of health concern to human and wildlife populations. While many aspects of the ecology of EEEV are well understood, the mechanism by which the virus overwinters and is reinitiated each spring in temperate regions is not known. One hypothesis is that the virus overwinters in the avian reservoir host as a chronic infection and then reactivates the following spring as a result of stressful conditions. We examined the effects of hormones and artificially induced migratory disposition on cryptic EEEV infections in captive Gray Catbirds. Hatching year catbirds were inoculated with EEEV in October 2007 and then held until January 2008, when birds were either induced to migrate and/or implanted with testosterone, or neither. Both a blood and fecal sample was collected every two days during the experimental period and tested for presence of EEEV via RT-PCR. During the initial infection, peak viremia one day post-infection, ranged between 5.4 – 8.0 log plaque forming units/ml. During the experimental period we detected viral RNA in one fecal sample and none of the blood samples tested. We conclude that recrudescence of latent virus in Gray catbirds is not likely to contribute to annual initiation of the EEEV cycle in temperate regions.

P37 ^SINTER- AND INTRASPECIFIC INTERACTIONS AMONG NEOTROPICAL, MONTANE HUMMINGBIRDS AT FEEDERS.

Meredith **Palmer** and Rebecca Deatsman, Department of Zoology, Ohio Wesleyan University, Delaware, OH 43015.

Competition among hummingbirds for access to food often involves chasing other individuals away. Such chases are energetically expensive, and the “cost of engagement” hypothesis predicts that intruders should be chased according to the potential costs associated with engaging them in aggressive contests, that is, large hummingbirds should be challenged less often than smaller ones. We observed four species of hummingbird at feeders in the cloud forest of Costa Rica and recorded the frequency with which different types of interactions (fighting, chasing, displacing, and sharing) occurred between individuals of the same and different species. The interspecific hierarchy of the species present was circular and did not appear to be based solely on size. Green Violet-ears (*Colibri thalassinus*) tended to displace the larger Magnificent Hummingbirds (*Eugenes fulgens*), which displaced White-throated Mountain Gems (*Lampornis castaneiventris*), which in turn displaced Green Violet-ears. Additionally, intraspecific competition was intense with less sharing and more aggressive interactions than expected. However, aggression between species was less frequent and sharing feeders more frequent than expected by chance.

P14 ^SUSING THE PRESENCE OF BIRD SPECIES TO ASSESS THE QUALITY OF RIPARIAN HABITATS AROUND BUFFALO, NY

Anna Marie **Parise***, Bethany K. Stephan, Canisius College, Buffalo, NY, Michael Hamilton and Robert L. DeLeon, Buffalo Ornithological Society, Buffalo, NY, H. David Sheets and Sara R. Morris, Canisius College, Buffalo, NY.

Avian species patterns can be used to assess habitat quality. The Buffalo River is listed as an Area of Concern in the Great Lakes region. As a part of a plan to delist the river, the use of riparian areas around the river by birds was studied in 2005 and 2006. We used three different areas in the Buffalo River System with varying levels of habitat degradation—Cazenovia Creek (least degradation), Buffalo Creek (moderate degradation) and Buffalo River (highest degradation). We conducted point counts at 10 points per area in June for 10 minutes at each point. In 2005, there were 25 bird species that were present at all three sites and in 2006 there were 30 species present at all three areas. However, we found interesting differences in the species found at the different locations. There were nine species found only in Cazenovia Creek in both years (Black-billed Cuckoo, Ruby-throated Hummingbird, Hairy Woodpecker, Tufted Titmouse, Hooded Warbler, Field Sparrow, Dark-eyed Junco, Bobolink and Eastern Meadowlark). Buffalo Creek and Cazenovia Creek shared two additional species in both years (Great Crested Flycatcher and Blue Jay). In 2005, there were two unique species (Alder Flycatcher and Savannah Sparrow) to Buffalo River and in 2006 there was only one unique species (Savannah Sparrow). Species found in the least degraded area could be taken as indicators of the health of local riparian habitats. These species may be used to establish benchmarks for the remediation plans for the Buffalo River.

P45 ^SPHYLOGEOGRAPHY OF A NEOTROPICAL MIGRANT ISOLATED ON MOUNTAIN “ISLANDS”.

Joel **Ralston*** and Jeremy Kirchman; Department of Biological Sciences, University of Albany, Albany, NY 12222 and New York State Museum, Albany, NY 12230

Studying geographic structure of genetic diversity within species can lead to inferences about the history of populations and species ranges, as well as the processes that lead to speciation. Geographically isolated populations offer an interesting opportunity for the application of phylogeography, as islands, both oceanic and ecological, are natural laboratories of evolution. Despite a mature body of theory and comparative data on the genetics of island birds, few studies have investigated geographic structure of avian populations isolated on mountains, and no study has compared structure among species that breed on mountains in the northeastern United States and Canada. Furthermore, human induced climate warming is causing habitat shifts and species range contractions, placing populations isolated on mountaintops at risk of extirpation. In the face of this threat to biodiversity, it is important to determine genetic structure of vulnerable species, and to determine whether isolated populations represent Evolutionarily Significant Units. Here, we present the phylogeography of Blackpoll Warbler (*Dendroica striata*), a Neotropical migrant with geographically disjunct breeding populations in the North East, based on a 355 bp fragment of Domain I of the mitochondrial control region from a subset of 175 samples collected from throughout the species range. We discuss whether gaps in the breeding distribution represent significant barriers to dispersal and gene flow, and the implications for our understanding of evolutionary processes, and for the conservation of North American migrants isolated on mountains.

P48 INVESTIGATING NOVEL COLONIZATION BEHAVIOUR AND LONG-RANGE DISPERSAL IN AMERICAN WHITE PELICANS.

Matthew **Reudink***, Christopher Kyle, and Joseph Nocera, Department of Forensic Science, Trent University, Peterborough, ON K9J 7B8, and Ministry of Natural Resources, Peterborough, ON K9J 7B8, and Christopher Somers, Department of Biology, University of Regina, Regina, SK S4S 0A2, and Kurt Kyser, Department of Geological Sciences and Engineering, Queen’s University, Kingston, ON K7L 3N6.

Changes in global climate and land-use practices are drastically altering the environment, resulting in large-scale demographic changes in many animal populations. These environmental changes have led to both range expansions and contractions, yet predicting the susceptibility of animal populations to environmental change has remained elusive. Throughout Ontario a unique opportunity now exists to examine a large-scale colonization event. Over the last several years, American white pelicans – previously limited to a single breeding colony at Lake of the Woods – have expanded eastward and northward, establishing at least 4 new colonies in Ontario. Intriguingly, in 2005, pelicans were discovered breeding off Akimiski Island in James Bay – 500km from the previously reported easternmost breeding population. Not only does this represent an incredible long-distance dispersal and colonization event, but it also is evidence of a complete niche shift from freshwater to oceanic breeding. To understand the factors influencing the success of American white pelican colonies, response to large-scale colony die-offs, and to properly administer conservation strategies and recovery efforts, we must develop a technique to track the movement of individuals capable of dispersing hundreds of kilometers. We present preliminary data on the recent range expansion and Arctic oceanic breeding of American white pelicans, with particular emphasis on understanding

the provenance of new colonizers in Ontario. We are using moulted pelican feathers to examine population genetics and biogeochemical profiles (stable-isotopes, trace elements) to develop a genetic and biogeochemical "map" which we can use to assign colonizers to breeding populations across eastern North America.

P1 BLACK RAT SNAKE PREDATION OF SWAINSON'S WARBLER (*LIMNOTHLYPIS SWAINSONII*) NESTLINGS: PREDATOR BEHAVIOR AND PARENTAL RESPONSES.

Mia R. **Revels***, Department of Natural Sciences, Northeastern State University, Tahlequah, Oklahoma, 74464 and Robert Jadin, Amphibian and Reptile Diversity Research Center, University of Texas, Arlington, TX 76019. The Swainson's Warbler (*Limnothlypis swainsonii*) is an elusive, difficult to study species for which little natural history is known, including information about the types of nest predators and parental behavioral responses to those predators. This study describes the depredation of three Swainson's Warbler nestlings and parental behavioral responses to this snake predation event. A Swainson's Warbler nest containing 5-day old nestlings was depredated while being videotaped on the Little River National Wildlife Refuge in McCurtain County Oklahoma in 2003. The entire predation event was filmed as well as approximately 3.5 hours of parental behavior which followed. These behaviors are described in detail. Black Rat Snakes are fairly common in Swainson's Warbler habitat, so similar predation events are probably not rare. Swainson's Warblers are one of North America's most poorly studied migratory bird species. Due to the difficulty of locating and monitoring their nests, very little is known of their breeding biology, particularly nesting behavior. This study was initiated in order to document adult behaviors at the nest, including parental responses to predators. This information will be valuable for conservation and management of Swainson's Warblers.

P35 ^STHE GEOGRAPHY OF COLOR IN PARROTS.

Lauren. A. **Smith*** and Edward. H. Burt, Jr., Department of Zoology, Ohio Wesleyan University, Delaware, OH, 43015.

Feathers that contain melanin degrade more slowly than those that lack melanin, which suggests that melanin strengthens feathers or inhibits microbial degradation. Birds in humid habitats, which facilitate bacterial growth, are more likely to have feather-degrading bacilli in their plumage and are darker than birds in arid habitats. The red, orange, and yellow colors of parrots are based on psittacofulvins, which occur only in parrots, and, unlike the carotenes of songbirds, are synthesized by the parrots at the time of molt. Like the melanic feathers of songbirds, the red, orange, and yellow feathers of parrots resist damage by feather-degrading bacteria. The similar resistance to bacterial degradation of psittacofulvins and melanin suggests that similar biogeographic relationships, for example darker plumage in humid than arid habitats, may exist among differently colored parrots as exist among birds with differing shades of melanic feathers. For each species of parrot in Australia, New Zealand, Africa and Central America we estimated the percent of surface covered by a particular color and compared the humidity, temperature, and rainfall of the species range to its colors and pattern to see if trends in the distribution of color emerged. White plumage is most common and extensive in arid habitats, yellow is negatively correlated with white, and red shows no habitat association.

P17 ^SFACTORS INFLUENCING THE MIGRATORY PATH OF SONGBIRDS CONFRONTED WITH A LARGE WATER BODY.

Jaclyn **Smolinsky*** and Robb Diehl, Department of Biological Sciences, The University of Southern Mississippi, Hattiesburg, MS 39401, and David Delaney, United States Army Construction Engineering Research Laboratory, Champaign, IL 61826.

Every autumn thousands of migrant birds stop along the northern gulf coast to rest and refuel before traveling farther south to wintering grounds. Migration can be a hazardous journey as birds may be unable to predict weather conditions and resource availability along their route, and problems encountered can result in lowered reproductive success and/or death for the individual. Ecological barriers, such as The Gulf of Mexico, may present additional complications for migrating birds, as these areas are generally resource poor or provide no reliable place in which to land. Our project will investigate the circumstances under which migratory birds that stop along the northern gulf coast engage in trans-gulf migration or adopt an alternate strategy for coping with the gulf as a barrier to migration. Specifically, we will determine how factors such as age, energetic condition and weather affect the propensity of Swainson's Thrushes (*Catharus ustulatus*) to engage in trans-gulf flight. We are tracking the movements of thrushes using automated telemetry to determine the timing and direction of migratory departure as well as activity prior to the onset of migratory flight. Preliminary data from 2008 strongly suggest that energetic condition is an important determinant of migratory flight direction. In general, birds with greater fat stores departed south (over water), while leaner birds departed in northerly or easterly directions.

P23 LUNAR EFFECTS ON THE FALL MIGRATION OF THE NORTHERN SAW-WHET OWL (*AEGOLIUS ACADICUS*).

Jackie **Speicher***, Pocono Avian Research Center, Cresco, PA 18326, Lisa Schreffler*, Northampton Community College, Tannersville, PA 18326, Dawn Konkoly and Darryl Speicher, Pocono Avian Research Center, Cresco, PA, 18326.

The purpose of this study was to interpret the influence of the lunar cycle on the migration of the northern saw-whet owl (*Aegolius acadicus*). The study area is an eastern hemlock (*Tsuga canadensis*)/ rhododendron (*Rhododendron carolinensis*) swamp at an elevation of 513 meters. Data were captured during fall migration from 2000-2008. Statistical analysis showed significant differences in capture rates during the latter half of the lunar cycle (full moon to last quarter and last quarter to new moon). This indicates a change in activity levels following the full moon that may be attributed to migratory stopover, vocal lure interactions, or anti-predator activity. Future investigation of prey abundance and behavior as well as predator foraging activities (i.e. great horned owl, *Bubo virginianus*) during the full moon is needed to enhance our knowledge on the influence of the lunar cycle on the northern saw-whet owl.

P41 ^SDO ARRIVAL DATE AND DISTANCE OF MIGRATION INFLUENCE FAT STORES IN SPRING MIGRATING WARBLERS?

Michael **Steiner***, Richard Riggi, and Mark E. Deutschlander. Department of Biology, Hobart and William Smith Colleges, Geneva, NY 14456.

Many migrating passerines arrive in the spring on their breeding grounds with more fat than prior to autumn departure. Sandberg and Moore (1993) suggest that excess spring fat serves as an energetic insurance that will help sustain individuals when environmental conditions are unpredictable or likely to deteriorate at northerly breeding sites. Because harsher climatic conditions are more likely earlier in the spring, the insurance hypothesis predicts that fat stores should be inversely correlated with arrival date within a species. Moreover, intercontinental (“calendar”) migrants would likely not be able to predict the local environmental conditions on or near their breeding grounds as well as short-distance (“weather”) migrants; therefore, intercontinental migrants should carry more fat upon spring arrival to insure against potentially harsh conditions. Using data from the Braddock Bay Bird Observatory, a constant effort banding station on the southern shore of Lake Ontario, we will examine the fuel stores of several related species of migrant warblers to determine if they are indeed fatter in the spring. Arrival fat score and energetic condition (mass/wing chord) will be examined to determine if the energetic strategies of intercontinental and temperate migrating warblers differ significantly. We will also perform regression analyses to determine if spring arrival date is inversely correlated with fuel stores. We expect that intercontinental species will arrive with greater fat scores and in better energetic condition than temperate species, and that earlier arriving individuals will carry more fat than later arriving conspecifics.

P49 GRAVEL NEST PATCHES ON ROOFTOPS AS NESTING SUBSTRATE FOR COMMON NIGHTHAWKS (*CHORDEILES MINOR*)

Rebecca **Suomala***, New Hampshire Audubon, Concord, NH 03301, Timothy Hoppe, Pennsylvania Game Commission, Erie, PA, Brett Amy Thelen, Ashuelot Valley Environmental Observatory, Keene, NH, and Ken Klapper, Antioch University New England, Keene, NH.

Data from the Breeding Bird Survey and statewide breeding bird atlases indicate that Common Nighthawks (*Chordeiles minor*) are declining throughout their range and especially in the East. In cities and towns throughout the Northeast, they historically nested on flat, peastone gravel roofs. In recent years, rubber and PVC have largely replaced peastone roofing, and nesting nighthawks have disappeared from many urban areas. In 2007 and 2008, New Hampshire Audubon, the Pennsylvania Game Commission, and Ashuelot Valley Environmental Observatory installed 58 experimental gravel “nest patches” on flat rooftops as potential nighthawk nesting substrate – 35 in New Hampshire and 23 in Pennsylvania. No nest patches were utilized by breeding birds but male booming displays were observed over three patches in New Hampshire. In Pennsylvania, no nest patches were used, but four nests were located on large-stone roofs, all of which were predated within 11 days after hatch. The potential for predation raises concerns about rooftop patches and requires further investigation. Locating and monitoring any rooftop nest will be an important part of determining the efficacy of nest patches. There was strong community support for the NH nest patch effort indicating great potential for conservation should the nest patches prove successful.

P13 ^SDOES THE PEACE BRIDGE AFFECT BIRD BEHAVIOR?

Brynne A. **Stumpe*** and Sara R. Morris, Canisius College, Buffalo, NY.

The favored design for a new bridge between the US and Canada has raised concerns about the impacts on bird populations. The purpose of this project was to study the movements and behavior of birds past the existing Peace Bridge. Observers watched and recorded all bird movement around the Peace Bridge from the Bird Island Pier in the Niagara River. The type of bird and where it was flying were recorded and chi-squared tests were used to compare the proportion of birds flying above and below the bridge and to compare the proportion of birds in each of three distance categories. A total of 887 birds were observed, and 48% of those were gulls. Bird movements around the bridge did not appear to be random. Most birds observed flew over the bridge (87%). Most birds (62%) flying above the bridge flew at level two--below the support structures of the bridge. Most birds (84%) flying below the bridge flew close to the water. Because the majority of the birds flew over the bridge and most flew at level 2, which did not extend higher than the top of the existing Peace Bridge arch, our results indicate that birds are more likely to fly over the bridge but not at high altitudes. If a new bridge was built with high elevation cables, the birds would have to fly at higher altitudes and this could negatively affect their foraging capabilities if they must expend more energy in finding food.

P30 ^STHE INFLUENCE OF RELATIVE NEST PREDATION RISK ON INTERSPECIFIC VARIATION IN PARENTAL NEST DEFENSE BEHAVIORS.

Heather A. **Szalkowski*** and Brian J. Olsen, School of Biology & Ecology, University of Maine, Orono, ME 04469, and Sarah Warner, Department of Entomology and Wildlife Ecology, University of Delaware, Newark, DE 19717
Nest predation is a strong selective force on the evolution of life history traits, specifically parental behavior. Variation in nest defense is not well understood, and no comprehensive model exists that predicts interspecific variation in parental defense behaviors. We would predict that species should evolve different behavioral adaptations in the face of high versus low nest predation risk. To test for interspecific differences in parental defense behaviors, we studied Coastal Plain Swamp Sparrows, *Melospiza Georgiana nigrescens* (CPSS) and Seaside Sparrows, *Ammodramus maritimus* (SESP), two species that coexist within tidal salt marshes of the Delaware Bay. On our study plots, CPSS nest closer to wooded areas where predators forage while SESP nest closer to the tidal water table where flooding is prevalent. Given the nesting preferences of each species we predict that: 1) CPSS nests will experience higher nest predation rates but similar nest failure rates to SESP and 2) Assuming nest defense behaviors are adaptive, CPSS will show stronger responses to simulated predator approaches. Daily probability of predation was significantly greater in CPSS than in SESP although there was no difference in daily flooding risk. Despite similar overall daily survival probabilities, CPSS exhibited a predation to flooding ratio of 7:1, whereas SESP exhibited a significantly lower ratio of 5:1. Furthermore, CPSS showed stronger responses by approaching nearly twice as close to the observer while mobbing and waiting to flush until the observer was almost nine times closer. Thus, we demonstrate one interspecific comparison where increased predation risk is associated with increased degree of paternal defense behavior.

P58 DESCRIPTIVE PHENOLOGY AND BREEDING BIOLOGY OF BOREAL CHICKADEES (*POECILE HUDSONICA*) IN SOUTHEASTERN NOVA SCOTIA.

Jessica **Trout-Haney*** and Robert L. Curry, Villanova University, Villanova PA 19085.
The Boreal Chickadee (*Poecile hudsonica*) is a common resident throughout the coniferous forests of the northernmost U.S. states and across Canada. The breeding biology of many parid species (chickadees and titmice) have been well studied yet few have sampled the Boreal Chickadee, and as a result, many fundamental phenological questions for this species remain. Our study reports nesting data from populations of Boreal Chickadees on a mainland (Chebogue Point, 1998-2008) and island (Bon Portage Island, 2007-08) field site in southeastern Nova Scotia. We determined social pairs, color banded adults at each nest, and collected blood samples from adults and nestlings for every brood. We then determined clutch size and sex ratios, and recorded timing of nest building, lay, hatch, and fledging dates per brood. First broods were typically laid in late May, and pairs occasionally reared a second brood as well, laying into late July. Other closely related species, such as the Black-capped Chickadee, have been known to rear second broods, however this is the first evidence of double-brooding in the Boreal Chickadee. Phenological results are compared with other members of the Paridae family, and evolutionary implications are discussed.

P42 ^SDO METEOROLOGICAL VARIABLES EXPLAIN YEARLY VARIATION OF FAT STORES OF SPRING MIGRANTS AT A GREAT LAKES STOPOVER SITE?

Maria **Virgilio***, Quinn Schara, Emily Runnells, and Mark E. Deutschlander. Dept. of Biology, Hobart and William Smith Colleges, Geneva, NY 14456.

Studies have shown that some species of passerines arrive on their breeding grounds with excess fat (more fat than is necessary for fueling migration). The insurance hypothesis suggests that fat stores help sustain birds when environmental conditions on or near their breeding grounds are poor or unpredictable. In years when weather and environmental conditions are less favorable (i.e., negatively impact available resources), birds should arrive with higher excess fuel stores than in years when environmental conditions are more favorable. Based on this hypothesis, we predict that yearly variation in temperature and rainfall will correlate with yearly variation in fat stores (e.g. in years with colder temperatures birds should arrive with higher fat stores than in milder years). Data on spring migrating *Catharus* thrushes and white-throated sparrows were collected using constant-effort migration monitoring at the Braddock Bay Bird Observatory. Two estimates of fuel reserves, fat score (visually determined using a scale of 0-5) and energetic condition (mass divided by wing chord) show significant yearly variation between years for these migrants. Daily temperature and rainfall for the area was collected from the National Climatic Data Center. To determine if yearly variation in fuel stores is due to local weather conditions, regressions will be performed on derived variables from daily temperature and precipitation and the average fat score and energetic condition over the past decade. For example, we expect to find a significant inverse correlation between measures of spring temperature and fuel reserves.

P53 EVALUATING SONGBIRD POPULATION DECLINES AND BREEDING PRODUCTIVITY WITH FALL MIGRATION BANDING DATA.

Andrew Vitz*, Robert Mulvihill, and Robert Leberman, Powdermill Avian Research Center, Carnegie Museum of Natural History, Rector, PA 15677.

Numerous species of migratory passerines are thought to have experienced substantial population declines over the last several decades. However, for most species, biologists can only speculate whether declines are a result of events occurring during the breeding, wintering, or migratory periods. It is often suggested that these declines, at least partially, result from an increase in nest predation and brood parasitism that are frequently associated with habitat fragmentation. Despite the detailed information collected on migrating birds at bird banding stations, few studies have used these data to evaluate either population trends or whether population limitations occur on the breeding grounds. We used long-term banding data to evaluate evidence for a (1) decrease in capture rates over time for purportedly declining species, and (2) reduction in breeding productivity for these same species. Productivity was estimated using age ratios (after-hatch-year/hatch-year) of banded birds. Data were collected at the Powdermill Avian Research Center (in western Pennsylvania) between 1961-2007. Powdermill's bird banding station is somewhat unique because, throughout this period, the habitat used for banding has been kept in an early successional state and the landscape remains forested with some agriculture. Preliminary results suggest that banding data can be useful in long-term monitoring of bird populations and, for some declining species, there is evidence for a reduction in breeding productivity over the last several decades.

P43 ^SLOGGING AND MAMMALIAN DEPREDATION AND ITS POTENTIAL IMPACTS ON BICKNELL'S AND SWAINSON'S THRUSH IN NORTHERN NEW BRUNSWICK.

Carl-Adam Wegenschimmel and Jay Malcolm, Department of Forestry, University of Toronto, Toronto, ON, Canada.

Few studies have looked into depredation of Bicknell's Thrushes (*Catharus bicknelli*) and Swainson's Thrushes (*Catharus ustulatus*) in North America and none have taken place in north central New Brunswick. The occurrence of nest depredation across four different sites in the industrial forests of this region was examined to determine whether depredation would differ between thinned stands, dense regenerating stands and older regenerating stands of Balsam Fir. Additionally, the measurements of mammal teeth were taken and teeth imprints were made on modeling clay eggs in order to determine the accuracy of identifying predator species based on its imprinted bite mark measurements and shape.

Thirteen of 48 nests were depredated. Nine clay eggs had identifiable teeth marks. Of these, three had markings that, based on the measurements and impressions, best resemble a pine martin. The incisor widths of the remaining six depredated eggs resemble those from members of the Sciuridae family. The American Red Squirrel (*Tamias striatus*), Eastern Chipmunk (*Tamiasciurus hudsonicus*) and Northern Flying Squirrel (*Glaucomys sabrinus*) are the only species occurring in the region. However, based on the habitat and observed signs in each site, the bite marks were concluded to belong to the Red Squirrel. No difference in depredation between sites studied was found. Future analyses will investigate the difference in nest location and surrounding habitats for the fake nests and those of the two bird species in question. This research will help further the understanding of the ecology of Bicknell's and Swainson's Thrush and their nest predators while generating insight on the dynamics of predator and prey relations within industrial forests.

P55 IDENTIFICATION OF CARBOXYLIC ACIDS AS VOLATILE COMPONENTS OF UROPYGIAL SECRETIONS IN THE GRAY CATBIRD (*Dumetella carolinensis*).

Rebecca J. Whelan¹, Tera C. Levin^{1,2,3}, Jennifer C. Owen^{4,5}, and Mary C. Garvin*², ¹Department of Chemistry and Biochemistry, Oberlin College, Oberlin OH 44074, ²Department of Biology, Oberlin College, Oberlin OH 44074, ³Current address: Department of Molecular and Cell Biology, Univ. of California, Berkeley, Berkeley, CA 94720, ⁴Department of Fisheries and Wildlife, Michigan State Univ., East Lansing, MI 48824, ⁵Department of Large Animal Clinical Sciences, Michigan State Univ., East Lansing, MI 48824

The uropygial gland of birds produces secretions that are important in maintaining the health and structural integrity of feathers. These secretions are believed to serve a number of functions including waterproofing and conditioning feathers, as well as protection from predators and arthropod pests. Volatile components of gland secretions, discovered only recently, are particularly interesting because of their potential importance in olfactory communication within and across species. We used solid-phase microextraction headspace sampling followed by gas chromatography-mass spectrometry to detect and identify volatiles in uropygial secretions of Gray Catbirds (*Dumetella carolinensis*). We detected the following carboxylic acids, listed in order of abundance: ethanoic (acetic), propanoic (propionic), 2-methylpropanoic (isobutyric), butanoic (butyric), and 3-methylbutanoic (isovaleric). Signal strength did not vary for any compound as a result of treatment with exogenous testosterone or migratory disposition. We discuss each acid in light of its potential role in attracting or repelling ornithophilic arthropods.

P8 ^STEMPORAL AND SPATIAL TRENDS OF Hg IN BALD EAGLES IN MICHIGAN.

Michael Wierda*, Katherine Leith, William Bowerman, Amy Roe, Jennifer Thompson, Department of Forestry and Natural Resources, Clemson University, Clemson, SC 29634, Dave Best, USFWS East Lansing Field Office, East Lansing, MI, 48823, Teryl Grubb, USFS Rocky Mountain Research Station, Flagstaff, AZ, 86001, and James Sikarskie, Veterinary Medical Center, Michigan State University, Lansing, MI, 48824

The Bald Eagle (*Haliaeetus leucocephalus*) is one of the most studied birds of North America, and a great amount of life history information, including the response of various stressors on the eagle's ability to reproduce, are well known (Bowerman et al. 2002). The Bald Eagle is a tertiary predator of the Great Lakes Basin aquatic food web. The Bald Eagle, as a species, has also been shown to be an appropriate model to monitor ecosystem contaminant concentrations. Hg concentrations in feathers of Bald Eagles have been previously documented in the Great Lakes region (Bowerman et al. 1994). Samples were analyzed according to U.S. EPA method 245.7 for total Hg by using cold vapor Atomic Fluorescence Spectrometer (AFS, Aurora AI 3200). For this study 958 Bald Eagle samples spanning 1987-1992 and 1998-2008 were analyzed for Hg. These samples represent three sampling cycles during each of which the entire state was sampled. Temporal comparisons of 87-92 vs. 99-08 and 99-03 vs. 04-08 and spatial comparisons of the 04-08 data were made. Hg concentrations from the first sampling cycle (87-92) were greater than those of the second sampling cycle (99-03) however, Hg concentrations from the third sampling cycle (04-08) were greater than those of the second ($P < 0.0001$ and $P = 0.0042$, respectively). Spatially Lake Superior and the inland upper peninsula breeding areas had greater Hg concentrations than Lake Erie breeding areas ($P = 0.0387$). The no-observable-adverse-effect-level (NOAEL) for Hg in eaglet feathers is 36.4 ng/g. Only two samples exceeded the NOAEL for Hg.

P38 ^SAVIAN DIVERSITY IN DISTURBED AND UNDISTURBED COSTA RICAN CLOUD FOREST AND LOWLAND RAINFOREST.

Sean Williams* and Edward H. Burt, Jr., Department of Zoology, Ohio Wesleyan University, Delaware, OH 43015-2930.

Costa Rica's virgin habitat is being converted to housing and farmland, which raises questions about the effect on the country's diverse avifauna. Undisturbed and disturbed habitats were identified and surveyed using point counts to estimate avian diversity. Highland and lowland study sites were established in the Talamanca highlands near Cerro de la Muerte and on the Pacific coast 10 km north of Jacó. We conducted 40 point counts, which showed that avian diversity was greater along transects in disturbed habitat than along those in undisturbed habitat regardless of altitude. Alpha, beta, and gamma diversities were highest in disturbed habitat, as was the Shannon-Weiner diversity index. We propose that this increased diversity in disturbed areas is due to the greater variety of habitats and ecological niches, and greater versatility of species found in disturbed habitat. Disturbed and undisturbed highland sites were less diverse than comparable lowland sites, which supports a general trend in the tropics for diversity to decrease with increasing altitude and decreasing temperature.

P34 ^SDYNAMICS OF *STAPHYLOCOCCUS AUREUS* AND OTHER *STAPHYLOCOCCUS* SPECIES IN AVIAN PLUMAGE.

Meredith P. **Wilson*** and Edward H. Burt, Jr. Department of Zoology, Ohio Wesleyan University, Delaware OH 43015.

Avian plumage harbors a diverse community of microorganisms, among them *Staphylococcus* species, which include potential pathogens. Because of its zoonotic importance, we present an analysis of the seasonal, annual, taxonomic, and ecological dynamics of *S. aureus* and other *Staphylococcus* species in avian plumage. Our analysis is based on samples of *S. aureus* and *S.* species collected from the plumage of 1,431 songbirds of 13 species. *S. aureus* occurred on 70.0% of the birds sampled and *S.* species occurred on 48.7%, but both occurred more often in the summer and early fall than in the winter and early spring, a pattern that is similar to that previously reported for feather-degrading bacilli. From 1995 to 1998 *S. aureus* was unusually abundant whereas *Staphylococcus* species were similarly abundant only in 2004. Birds that foraged on the ground were more likely to harbor *S. aureus* in their plumage than those that foraged on bark, or in foliage. Bark-probing and gleaning guilds were more likely to have *Staphylococcus* species in their plumage than ground foragers. This study is a small step toward understanding the role wild birds play in the dispersal of *Staphylococcus aureus* and other *Staphylococcus* species and the potential role the bacterium plays in the plumage ecology of birds.

P5 ^SEFFECT OF FEMALE BILL COLOR ON MALE PARENTAL CONTRIBUTION IN THE AMERICAN GOLDFINCH.

Harden **Wisebram**^{1*}, Troy G. Murphy², and Keith A. Tarvin¹; ¹Department of Biology, Oberlin College, Oberlin, OH 44074; ²Department of Biology, Queen's University, Kingston, Ontario K7L 3N6, Canada.

Bill color of female American Goldfinches (*Carduelis tristis*) changes from brown to orange during the breeding season and likely signals health. Male goldfinches normally provide most of the food to females and offspring through day 4 post-hatching. We hypothesize that males increase parental contribution when their mates have more colorful bills, as their offspring are more likely to be of higher quality. We tested this hypothesis by augmenting (painting orange) or diminishing (painting dull) female bill color during incubation. To index the relative contributions of males and females, we conducted nest watches during incubation and after hatching, during which observers recorded the time females spent on/off their nests and the number of times the young were fed by males and females. We found that orange females spent more time on their nests during early brooding ($p=0.068$), and that dull females fed nestlings more than orange females during the same period ($p=0.017$). Likewise, dull females fed nestlings more on day 11 post-hatching ($p=0.028$). These patterns suggest that male investment was greater at nests with orange females, allowing them to spend more time brooding and less time feeding nestlings. Additionally, increased male contribution to offspring late in the nestling stage may allow orange females to begin re-nesting before the first brood fledges. This study suggests that females may gain fitness benefits by investing in a costly ornament.

P26 ^SDEVELOPMENT OF A BIRD COMMUNITY INTEGRITY INDEX TO MONITOR SALT MARSH INTEGRITY AT NATIONAL WILDLIFE REFUGES.

Whitney **Wiest*** and W. Gregory Shriver, Department of Entomology and Wildlife Ecology, University of Delaware, Newark, DE 19717.

Coastal refuges in the National Wildlife Refuge System have been established to protect tidal marsh ecosystems across approximately 1,045,925 acres of salt marsh habitat in the lower 48 states. Minimal pristine salt marsh habitat remains and most marshes have experienced marsh management techniques such as grid-ditching or open water marsh management. Appropriate assessment and monitoring tools are necessary to provide refuge managers with the means to determine the overall habitat value of salt marshes in order to maintain or improve the integrity of the marsh. Birds are linked to the overall ecological integrity of their respective ecosystems and are relatively easy to monitor. We revised the index of marsh bird community integrity (IMBCI) created by DeLuca et al. (2004) to account for latitudinal variation between refuges and to incorporate species conservation status. During the summer of 2008, callback surveys were performed at 165 points across 7 National Wildlife Refuges (NWRs) from Maine to the southern tip of the Delmarva Peninsula. We detected 74 species, of those detected 23 were wetland obligates and 51 were wetland generalists. IMBCI scores will be used to compare management treatments of marsh units within and between refuges and may be used at NWRs to implement effective management strategies to monitor and improve salt marsh integrity.

AUTHOR INDEX

Presentation number (P = poster, S = symposium)

Abernathy, B.	P31	Curry, R.L.	24, 31, 45, P58
Ackerman, A.K.	P32	Dahlan, F.	P46
Almeter, A.L.	P52	Darling, N.	23
Alsford, C.	P16	Davidson, B.S.	P19
Ammer, F.K.	29, P3	Dawson, D.	18, S8
Anderson, J.T.	11, 36	Deatsman, R.	P37
Ardia, D.	P32, P33	Delaney, D.	P17
Askanas, H.	P20	DeLeon, E.	S8, S9, P56
Ausprey, I.	43	DeLeon, R.L.	10, P14
Avery, J.D.	15	Delgado, S.	2
Bashaw, B.	P39	Deppe, J.	S11
Beason, R.C.	S1, P47	Deutschlander, M.E.	P39, P40, P41, P42
Becker, D.	17	Diamond, A.	P20
Beckett, M.	P61	Dickinson, J.L.	41
Begier, M.J.	P47	Diehl, R.	P17
Beissinger, S.R.	2	Dorr, B.	36
Bennett, M.	P59	Dove, C.J.	P46
Beresin, G.A.	P6	Drynan, D.	40
Berg, K.S.	2	Ellis, A.B.	P36
Best, D.	P8, P9	Elphick, C.	44
Birch, D.L.	P28	Engelhard, A.	P21
Bonter, D.N.	30	Enstrom, D.	S4, S6, S10
Bowerman, W.	P8, P9, P10	Evans, W.R.	S2
Bradbury, J.W.	2	Fagan, W.	33
Braun, M.J.	33, P19	Farnsworth, A.	S5, S10
Brinker, D.F.	P62	Fatunmbi, D.I.	P16
Brittain, R.	P29	Figueroa, H.	S5
Brittingham, M.C.	14, 20	Finity, L.	P50
Brooks, E.W.	30	Fink, A.D.	P27
Brooks, R.	51	Fink, M.L.	P27
Broughton, D.	P33	Floyd, T.	S7
Brown, C.R.	P36	Forgues, K.	54
Brubaker, J.L.	25	Forsythe, S.J.	P25
Bulluck, L.	34	Fuentes, L.	P9
Burt, E.H.	P34, P35, P38	Funk, M.	P2
Calder, M.L.	P60	Gabrielson, R.	S3
Calderwood, L.	P18	Garvin, M.	P54, P55
Canterbury, R.	34	George, G.A.	9
Carman, Jr., E.	53	Getty, T.	26
Celis, A.	S11	Goodwin, S.E.	28
Chace, J.F.	P51	Gow, E.	46
Charif, R.A.	S5	Grove, L.	S8, S9, S10, P56
Clara, B.R.	45	Grubb, T.	P8
Cochran, W.W.	S6	Hager, S.B.	P57
Collins, M.D.	P27	Halverson, C.	50
Colpetzer, S.	P4	Hames, R.S.	8
Cooley, C.	36	Hamilton, M.	10, P14
Courter, J.	P22	Hanson, K.	36
Covino, K.M.	47, 48	Hatch, M.I.	6
Craft, C.	P29	Hill, J.	44
Cristol, D.A.	13		

Hilton, Jr., B.	53	Mennill, D.J.	1
Holberton, R.L.	48	Miller, E.A.	P54
Hopke, L.	P40	Miller, T.	51
Hoppe, T.	P49	Mills, A.	49
Horton, K.G.	P12	Mitchell, L.R.	P28
Ingelfinger, F.	P7	Moffat, L.A.	P51
Jack, J.	P44	Moody, K.	P7
Jackson, A.K.	13	Morley, V.J.	P54
Jacobs, J.D.	47	Morris, S.R.	10, 47, 48, 52, P12, P13, P14, P15, P16
Jadin, R.	P1	Mulvihill, R.	P53
Johnson, B.	P25	Murphy, T.G.	23, P5, P6
Johnson, G.P.	25	Nally, D.G.	P15
Johnson, L.S.	P25	Neuhäuser, M.	P25
Jones, R.	P39	Newcomb, B.W.	P27
Jones, T.	S9	Newell, F.L.	19
Kapetanakos, Y.	32	Nocera, J.	4. P48, P50
Katzner, T.	50, 51	O'Connell, T.J.	P11
Kearns, L.J.	42	Odom, K.J.	1
Keith, B.S.	P15, P16	Okawa, R.	2
Keith, R.S.	P15, P16	Olsen, B.J.	P30
Keller, G.S.	15	Owen, J.C.	P54, P55
Kennedy, E.D.	38, 39, P21	Pabian, S.E.	20
Kern, R.	P28	Palmer, M.	P37
Kingston, S.E.	33	Parise, A.M.	10, P14
Kirchman, J.	P45	Pater, L.	S6
Klandorf, H.	36	Peppe, L.	P59
Klapper, K.	P49	Piper, W.	P31
Klingensmith, A.	S10	Pitzrick, M.	S5
Konkoly, D.	P23	Poon, C.K.	P40
Kricher, J.	P18	Powers, M.	S10
Kyser, K.	46, P48	Purcell, K.	40
LaBarbera, K.	21	Raim, A.	S6
Lanzone, M.	50, 51, S7, P56	Ralston, J.	P45
LaPergola, J.B.	45	Ranson, C.A.	11
LaPointe, T.	P51	Ratcliffe, L.M.	4
Larkin, J.	34	Rehner, D.	P47
Lear, K.M.	P36	Reudink, M.	P48
Leberman, R.	P53	Revels, M.R.	P1
Leith, K.	P8, P10	Rico-G., A.	35
Levin, T.C.	P55	Riehl, C.	22
Llambias, P.	21	Riggi, R.	P41
Lohnes, R.G.	41	Rising, J.	P44
Lombardo, M.P.	P4	Ritchison, G.	P22, P59, P60, P61
Lovette, I.J.	21, 34	Rodewald, A.D.	19, 42, 43
Lowe, J.D.	8	Roe, A.	P8
MacCurdy, R.	S3	Rosenberg, K.	S10
Mackenzie, S.	49	Rosenthal, M.F.	23
Maecker, M.	P24	Rotenberg, J.A.	P52
Mager III, J.	3, P31	Roth, A.	34
Malcolm, J.	P43	Runnells, E.	P40, P2
Martinex Gómez, J.E.	45	Rutherford, E.M.	P27
Masters, B.S.	25, P25	Sakaluk, S.K.	P25
McChesney, H.M.	11	Sandercock, B.K.	41
McDonald, M.V.	37		
McElhone, P.	18		
McLeod, B.	P61		

Schara, Q.	P42	Thorpe, P.A.	P4
Schimmelman, A.	P29	Thurber, B.	49
Schrefflet, L.	P23	Trout-Haney, J.	P58
Sheehan, J.	9	Vallender, R.	34
Sheets, H.D.	10	van Els, P.	P11
Shriver, W.G.	28, P26, P28	VanWilgenburg, S.	34
Sikarskie, J.	P8, P9	Virgilio, M.	P42
Smith, L.A.	P35	Vitz, A.	S7, P53, P56
Smith, R.J.	6	Walcott, C.	3, P31
Smolinsky, J.	P17	Walters, L.A.	26
Somers, C.	P48	Ward, M.P.	S11
Soukup, S.S.	P25	Warner, S.	P30
Speicher, D.	P23	Wgenschimmel, C.-A	P43
Speicher, J.	P23	Whatton, J.F.	P24
Stephan, B.K.	10, P14	Whelan, R.J.	P55
Stokke, G.T.	14	White, D.	38, 39, P21
Stoleson, S.	7	Whitmore, M.M.	5
Stumpe, B.A.	P13	Whitmore, R.C.	5
Stutchbury, B.	46	Wierda, M.	P8
Suomala, R.	P49	Wiest, W.	P26
Swanson, D.L.	16	Williams, A.J.	P54
Szalkowski, H.A.	P30	Williams, S.	P38
Szewczak, J.M.	27	Wilson, A.	12
Tarvin, K.A.	23, P5, P6	Wilson, M.P.	P34
Taylor, P.	49	Winkler, D.	S3
Tcheng, D.	S4	Wisebram, H.	P5
Tegeler-Amones, A.	27	Wood, P.B.	9, 17, 18
Thelen, B.A.	P49	Woodman, N.	P24
Thomas, N.E.	16	Wright, S.E.	P47
Thompson, C.	40	Wright, S.G.	24
Thompson, C.F.	P25	Yeany II, D.	29, P3
Thompson, J.	P8	Yosef, R.	30