

Gale Monson Research Grants
Abstracts of reports from recipients

2011

Breeding Biology of Red-faced Warblers in the Santa Catalina Mountains

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Red-faced warblers have a relatively restricted breeding range in the United States, but unusually high densities of breeding Red-faced Warblers occur in the Santa Catalina Mountains of southeastern Arizona. We have studied Red-faced Warblers breeding from 1800 meters to 2800 meters on Mount Lemmon since 2002, encompassing the entire elevational extent of the species' breeding range. Very little is known about the breeding biology of this species, and we have learned much about their breeding behavior. One of the most intriguing observations that we've made is that birds at the top of the mountain typically lay fewer eggs than birds at lower elevations. Our research suggests that differences in nest predators may explain why high-elevation birds lay fewer eggs. We were also surprised to see that nestlings grew more rapidly at high elevation. Understanding the differences in breeding biology and behaviors among warblers at different elevations will help aid efforts to predict the effects of climate change on montane birds in the southwestern United States.

Migratory and Wintering Strategies of Yellow-eyed Juncos in Southeastern Arizona

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Yellow-eyed juncos (*Junco phaeonotus*) make facultative short-distance migrations along elevational gradients in the Sky Island mountain ranges of southeastern Arizona. From 2011-2012 we color-banded 850 juncos on their breeding grounds at five sites spanning the elevational extent of the species' breeding range in the Santa Catalina Mountains. We surveyed each site for banded juncos every two weeks September-February and found evidence for female-biased migration. We found individuals moving between sites as early as the first week of September. Most movements away from breeding areas are assumed to be downslope, but we found evidence of some individuals temporarily moving upslope at the end of summer. The presence of persistent open ground was related to flock formation at some sites. Flocking behavior may represent an alternative strategy to migration and may explain uphill movements. All Juncos temporarily vacated breeding areas following extreme snow events. All major hypotheses proposed to explain partial migration predict the observed differences in migratory tendency among sex classes. We tested explicit predictions of each hypothesis in order to gain insight into the relative importance of each mechanism that could explain why some juncos migrate downslope and why others do not. Nests of resident individuals succeeded 59% of the time while those of migrants succeeded at a rate of 44%. Residents initiated nests an average of 2.5 days earlier than migrants, but nestling growth rate was not related to migratory

status. Residents and migrants did not differ in response to simulated territorial incursions intended to measure interspecific aggression.

2012

The Distribution and Extent of Heavy Metal Accumulation in Song Sparrows of the Upper Santa Cruz River Watershed

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Riparian ecosystems in arid environments provide critical habitat for breeding, migratory, and wintering birds, yet are often at risk of contamination with heavy metals. Birds and other animals living in contaminated areas are susceptible to adverse health effects as a result of long-term exposure and bioaccumulation of heavy metals. Our study took place as part of a collaborative effort to quantify the level of contaminants in the upper Santa Cruz River watershed. We chose to examine five study sites and a reference site that reflect different potential sources of contamination. We investigated the extent of heavy metal accumulation in blood and feathers of Song Sparrows (*Melospiza melodia*) over two breeding seasons. Birds at our five study sites typically had higher metal concentrations than birds at our reference site, though most metals were below background concentrations determined from previous studies. Copper, mercury, nickel, and selenium in Song Sparrows did exceed background levels. Song Sparrows generally showed lower heavy metal concentrations compared to Killdeer (*Charadrius vociferus*) collected along the Santa Cruz River in 1998, however concentrations tended to be higher for Song Sparrows compared to Abert's Towhees (*Melospiza aberti*) and Yellow-breasted Chats (*Icteria virens*) sampled in 2008 and 2009. Continued monitoring of heavy metal concentrations in birds in the upper Santa Cruz watershed is recommended, as well as future studies examining how heavy metal contamination affects avian health and productivity.

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Seasonality, Habitat, and Diet of Gray Vireos at Kofa NWR in Southwestern Arizona

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The winter distribution of Gray Vireo (*Vireo vicinior*) closely matches the distribution of small trees in the genus *Bursera*, particularly elephant tree (*B. microphylla*), that produce calorie-rich fruits. Thus, it is surprising that Gray Vireos have been reported by Gale Monson and others during the winter at Kofa National Wildlife Refuge (Kofa) in southwestern Arizona where no *Bursera* occur. Additionally, recent observations suggest that Kofa is an important early (e.g., late February and early March) migration stopover for north-bound vireos. To examine vireo occurrence and diet at Kofa, we conducted seven surveys from December 2012 to May 2013 at three canyons and two valley xeroriparian washes. We detected a surprisingly high number of vireos in December, including eight at Alamo Wash. Subsequently, a dramatic drop in vireo detections coincided with a hard freeze, followed by a gradual increase in detections in late March and April. We observed vireos eating caterpillars and possibly spiders. We did not observe vireos eating fruit, though mistletoe and wolfberry fruits were plentiful. We conclude Gray Vireos may be more widespread than previously thought during the autumn and winter where arthropod prey is available and *B. microphylla* is absent until the first hard freeze occurs,

after when vireos are likely to move to where *B. microphylla* fruit is available. Our results suggest that a winter-time monitoring strategy for the vireo and its habitat would need to consider the plasticity of the vireo's winter distribution, diet, and habitat use.

2013

Winter Distribution and Plumage Characteristics of Sagebrush and Bell's Sparrows in Arizona

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The American Ornithologists' Union recently split the former Sage Sparrow (*Artemisiospiza belli*) into two taxa, Sagebrush Sparrow (*A. nevadensis*) and Bell's Sparrow (*A. belli*). Sagebrush Sparrow and the interior subspecies of Bell's Sparrow (*A.b. canescens*) have similar plumage characteristics and call notes, and these similarities render separation of the two taxa problematic in the field. Both Sagebrush and Bell's Sparrow winter in Arizona, and their respective wintering distributions in the state are not well understood. In February 2014 we captured 85 *Artemisiospiza* sparrows at five sites representing five distinct vegetation assemblages across southern and western Arizona.

We used plumage and morphological characteristics described in previous work to identify 74 individuals in the hand; one bird was left unidentified due to ambiguity in its plumage characteristics and in its intermediate wing size. To test our field identifications, we sampled blood from these 75 individuals to establish sex and genetic identification. Our field identifications were consistent with lab classification for 68 of 74 (92%) of our samples. We are further sequencing the gene for the remaining 6 samples, as the restriction fragment length polymorphism (RFLP) approach used by previous authors does not differentiate the species 100%. Our field identification success rate is thus preliminary and is a minimum. Preliminary results (considering only the 68 individuals with matching classifications) reveal that mixing between the two species was rare. At four sites only one species was present. At Robbins Butte (Maricopa Co.), 26 of 30 captures were identified as Bell's Sparrow (87%). This segregation was unexpected and suggests the two species hold divergent habitat preferences on their wintering grounds in Arizona. We photographed all captures from multiple views, and we will also discuss key identification points that may be used to separate these species in the field.

A Survey of Spring Migration at Lake Havasu with an Emphasis on Waterbirds

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The development of reservoirs along the Colorado River has changed the ecology of the region and offered habitat for many species of aquatic birds where none existed historically. Aquatic bird surveys were done to look at use of the location as a stopover site and to gain an understanding of what species may now use the area regularly in migration. I conducted surveys at the north end of Lake Havasu between mid-March and mid-May 2014. The main focus was on aquatic bird migration, although landbirds were also counted. An attempt was made to use sound recording equipment to detect nocturnal migration. This was done to see how effective this type of survey method would be, with negative results. A total of 41,292 individuals representing 59

species of landbirds and a total of 42,519 individuals representing 57 species of waterbirds were detected, excluding likely resident and breeding species, but including some likely wintering birds. Several aquatic species formerly considered rare were found regularly during the survey period and in recent years or were found in higher numbers than previously recorded, such as Common Loon, Eared Grebe, Red-necked Phalarope, and Bonaparte's and Franklin's gulls. This information can be used to judge future changes in aquatic bird use of reservoirs along the Colorado River.

Monitoring Diurnal Raptor Migration at a High-Elevation Site in the Central Highlands of Arizona: A Pilot Study during Fall 2013 and Spring 2014

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Monitoring raptor migration at strategic locations has been in practice for several decades at numerous sites across North America. Most migrant raptor species are difficult to monitor during the breeding season and migration counts can provide data to help track population changes. Sites in western United States are typically located on north-south trending mountain ridges that create orographic wind currents that provide energy-saving lift for migrant birds. During the fall of 2013 and the spring of 2014, I made observations of migrant raptors from the Sierra Prieta Overlook in the Bradshaw Mountains west of Prescott, Arizona. The most common species observed during fall include Turkey Vulture (35% of flight), Cooper's Hawk (22%), Sharp-shinned Hawk (15%), Red-tailed Hawk (10%), and American Kestrel (9%). During spring, the most commonly seen species were Cooper's Hawk (24%), Swainson's Hawk (21%), Turkey Vulture (21%), and Sharp-shinned Hawk (11%). The majority of birds observed passed the site on days when the wind direction had a westerly component.

2014

Gray Hawk Expansion on the San Pedro River: Density Dependence, Habitat, and Diet

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The Gray Hawk population along the San Pedro River has been expanding since it was first documented in the late 1970s. Gray Hawks first settled the northern areas of the San Pedro National Riparian Conservation Area (SPRNCA), where mesquite flanks the cottonwood gallery. But within the last two decades they have begun nesting in the southern, grassy end of the SPRNCA, and in the sycamore, juniper, and Madrean oak forests of the Huachuca Mountains. What might this population expansion indicate? The Fretwell-Lucas model of habitat selection states that preferred areas are settled first, and "overflow" individuals are consigned to lower quality habitats where productivity is lower. But are grassland and oak forest marginal habitat for these raptors? I am comparing Gray Hawk productivity and diet of pairs in these newly settled areas to those in historically occupied ones to determine how these raptors use different types of habitat and whether the Fretwell-Lucas model of population growth applies. Preliminary results suggest that overall productivity has not declined as the population has expanded. Though the percentage of nests that succeed is lower in newly settled areas, successful pairs produce more chicks in grassland and oak territories than those in historically occupied mesquite ones. These observations are from the 2015 breeding season only, and further research will determine whether these patterns hold over time. More data are needed to support a robust conclusion.

2015

Gray Hawk Expansion in the San Pedro River Valley: Habitat, Diet, and Density Dependence

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Models of ideal despotic distribution predict that populations of territorial animals will exhibit density dependent growth because newly arriving individuals will be relegated to inferior habitat where productivity is lower. Interference can also be a mechanism for density dependence if individuals devote more energy to territorial defense—and less to reproduction—as an area becomes more crowded. I examined these hypotheses in an expanding population of Gray Hawks (*Buteo plagiatus*) in southeast Arizona. As Gray Hawk numbers increased, pairs began to settle at higher elevations and in places with different foraging habitat. In the most recently occupied environments, pairs likely foraged in grasslands or oak woodland as opposed to mesquite bosques. I assessed vegetation and productivity in new and historical territories to determine if fecundity is declining with population growth and whether habitat heterogeneity might contribute to this pattern. I also analyzed nestling diet to assess how foraging habitat might affect the quantity and composition of prey that Gray Hawks feed their chicks. Preliminary results suggest that productivity is not lower in more recently occupied environments, though incubating females may be more vulnerable to predation in these areas. Mammals appear to comprise a greater portion of Gray Hawk diet in areas with grassland foraging habitat, while lizard prey appears to dominate in areas surrounded by mesquite.

The Evolution of Hummingbird Coloration and Courtship

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**Presenter*

Birds display an incredible diversity of exaggerated traits used for communication. The sensory drive hypothesis states that selection will favor signaling traits that can be effectively transmitted through the environment and can interact with each other to improve transmission efficacy. We are studying how the evolutionary interactions between colorful ornaments and display behaviors led to the diversity in these traits across bee hummingbirds. We have filmed male courtship displays and plucked feathers from several species for color measurements. We then used these data to recreate each species' courtship displays, and we photographed each species' plucked feathers as we moved them through the recreated display to measure perceived male coloration. We then compared each species' plumage patch, display behavior, and perceived coloration. Our results indicate a strong negative relationship between patch size and display width. Additionally, we found that display shape is related to changes in male coloration as he displays across species. Our results demonstrate the importance of signal interactions and behavioral displays when evaluating color/trait diversity and coevolution.

2017

Conservation of Western Burrowing Owls in an Urban/Suburban Desert Landscape.

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Burrowing Owl (*Athene cunicularia hypugaea*) is a species of conservation concern in Arizona. In Lake Havasu City, AZ, owls occupy nontraditional habitats—desert washes (arroyos) in developed locations. We began studying habitat characteristics and productivity of local Burrowing Owls in February of 2014. Over the past 5 breeding seasons, we monitored 112 nests. Nest success ranged from a low of 44% in 2014 to a high of 75% in 2015 with an average of 70% over all 5 years. The mean number of fledglings per nest to date is 2.9 (range 1-8). Nineteen nests were abandoned for unknown reasons and 16 experienced a mortality of 1 or more adults and chicks (predation and suspected secondary poisoning). Four breeding pairs were relocated to Phoenix from our population in 2017 due to wash stabilization projects. Results from regression models suggest that nest sites experiencing a mortality were less likely to produce fledglings but those with larger burrow diameters were more likely to have a larger number of offspring. This season, to address movement and juvenile dispersal, we began capturing and banding urban owls using walk-in traps at nests. We captured 29 individual owls from 16 nest locations and 6 females, 1 male and 22 juveniles were banded. We will be recording information on resighted birds over the next 2 months and I discuss these results as well as challenges of capturing urban birds during my presentation. In the future, we will continue to work to provide baseline data on this unique population.

2018

Western Yellow-Billed Cuckoos in the Sky Islands of Southeastern Arizona: A Watershed Perspective. *Beauregard, N. D., nickbeauregard@gmail.com; PO Box 1842 Flagstaff, AZ 86002*
In recent years, Yellow-billed Cuckoos (*Coccyzus americanus*) have been observed in many upland ephemeral drainages in the mountains and foothills of southeastern Arizona, though little data exists on their breeding status in these atypical habitats. If most of these cuckoos are breeding, this newly discovered population could have important implications for species recovery. Leveraging enormous citizen science contributions and multiorganizational collaboration, we evaluated cuckoo breeding status and distribution in a subset of the Sky Islands mountain ranges, sampling over 80 drainages along elevational and habitat gradients. Over 2 field seasons, breeding was documented in most drainages where cuckoos were detected and in most habitat types sampled. However, cuckoos did vacate some sites after stopovers, particularly in highest elevation and sparsely vegetated field sites. These results indicate that the Sky Islands contain important breeding and migratory habitat much different than that of typical cottonwood-willow riparian woodlands and that conservation measures for Yellow-billed Cuckoos should take place on a watershed scale. Preliminary analyses of biogeographic patterns of cuckoo occupancy will be presented, with an emphasis on the Santa Cruz River watershed. An assessment of citizen scientist contributions will also be discussed, highlighting the importance of volunteerism and collaboration in conservation research.

Bark Thickness is Related to Hairy Woodpecker Excavation of Prey in Northern Arizona Ponderosa Pine Forests. *Hammond, R. L., rlh267@nau.edu and Theimer, T.C., Biological Sciences Department Northern Arizona University 617 S. Beaver St. Flagstaff, AZ 86011*

Woodpeckers are important forest species, creating habitat for a diversity of animals by excavating nest cavities and aiding in the control of the forest pests on which they feed. Better understanding the ecology of umbrella and keystone species, such as woodpeckers, in threatened environments is needed as Global Environmental Change and human population growth exacerbate the current forest loss rate of 0.6% per year. In the Coconino National Forest in northern Arizona, Hairy Woodpeckers excavate for food in live and healthy ponderosa pines (*Pinus ponderosa*) ~27 times more per available tree area in forests growing on young and coarse cinder soils than in forest growing on older and finer soils. Using data collected at 3 sites on coarse and 3 on fine soils, we investigated 2 hypotheses to explain why birds use coarse soil sites more than fine soil sites: I) there are fewer large-diameter trees available, thus increasing the use of each available tree, II) tree characteristics that potentially affect woodpeckers and their wood-boring prey differ between the two forest soil types. Hypothesis I was not supported, with no relationship existing between tree use and available tree-area per bird (n=6 sites, $\beta = -16.9, p = 0.16$). Hypothesis II was supported. Phloem and bark thickness were both significantly smaller (~3mm, n=110; phloem t107-2.57, p=0.01; bark t104-1.94, p=0.05, respectively) in used trees vs. unused trees, with bark thickness being strongly correlated with use at unstressed sites (r=0.71, p<0.001).

2020

Adapting to City Life: Physiology and Behavior of Urban and Desert House Finch.

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Urban environments generally have reduced biodiversity, but some species thrive and reach higher abundances in urban environments compared to nonurban environments. Urban populations often differ from their nonurban counterparts behaviorally and physiologically, but few studies focus on multiple traits in the same individuals. To address this issue, I am investigating the effects of urbanization across multiple physiological and behavioral traits in the House Finch (*Haemorrhous mexicanus*), a widespread and locally abundant native songbird. I am measuring multiple indicators of oxidative stress as well as exploratory behavior in individual, wild birds sampled in urban and Sonoran Desert environments. The goal of this project is to identify behavioral and physiological differences between urban and desert populations, and to determine whether associations between oxidative stress and behavior are consistent across contexts. I captured over 160 House Finches between 2020 and 2022 during both breeding and nonbreeding seasons, from a total of four locations across the Phoenix valley. I will present my final behavioral analysis and partial oxidative stress analysis based on blood samples I collected. I predict that compared to nonurban finches, urban birds will display more exploratory behavior and higher oxidative damage in their blood.

Birds as Hosts for The Agents of Tick-Borne Relapsing Fever in Arizona. Motyka, P. J. pjm232@nau.edu, 2607 N. Nelson Drive, Flagstaff, AZ 86001

Wild birds have great potential to contribute to the transmission, maintenance, and spread of infectious diseases. I investigated how wild birds might contribute to the ecology of tick-borne relapsing fever (TBRF) in northern Arizona. TBRF infects humans and wildlife, and occurs when bacterial spirochetes, *Borrelia hermsii*, infect a host after being transmitted by

an *Ornithodoros* tick. Rodents are the primary vertebrate hosts for TBRF, but whether birds interact with the ticks, or the spirochetes remain untested. I collected blood samples from mist-netted wild birds and tested them for *Borrelia hermsii*. I also collected material from nest sites in search of ticks. Molecular tests and blood smears determined that zero birds were captured with active TBRF infections, and zero ticks were found infesting nest material.

These results suggest that the role of birds in the ecology of TBRF is minimal, but research into other vector-borne diseases like Lyme disease and West Nile Virus show that relationships are not always straightforward. Future climate change is predicted to shift the range of TBRF, and many questions about the relationships between birds and TBRF still remain.