Biosurvey News

The Newsletter of the Oklahoma Biological Survey
Winter 2010

Understanding Avian Migration Strategies

Avian migration is an astounding natural phenomenon. Each fall, millions of birds of hundreds of species depart their North American summer quarters and fly south hundreds or thousands of miles to spend the winter. For many of these birds, fewer individuals have returned to breed each year for most of the past 50 years. Such long-term population declines in migratory birds have been well documented by national programs like the Breeding Bird Survey. As a result, there is a lot of interest in the conservation of migratory birds. Developing effective conservation strategies for these birds, however, presents some unique challenges for biologists.

For non-migratory species, biologists usually collect data on the habitat that individuals use throughout their lives and then determine which individuals were the most successful (in terms of survival and reproduction). With these data, habitat management strategies can be developed to help conserve populations. For migrants that reproduce in Oklahoma, however, most of the year is spent in Mexico and Central and South America, and it is has been impossible to know where specific individuals go during the entire year. Recently it became possible to track large migrants (raptors and waterbirds) with Global Positioning and Satellite Tags, but these are still too large and heavy for migrant songbirds to carry.

A male Painted Bunting. Photo by Jeff Kelly.

To get the type of specific location data we need to understand the annual cycle of migrants and to manage songbird populations, we have developed a small (0.7g) geolocation tag that relies on the timing of sunrise and sunset to determine the location of a bird on a given day. While these tags are not as precise as radio telemetry or GPS tags, they can be used on many more small songbird species. We recently received funding from the National Science Foundation to test these geologgers on Painted Bunting populations in western Oklahoma. This two-year grant will help us verify that the geologgers work and help us understand the complex migration system of our most colorful songbird.

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Amy K. Buthod and Caryn C. Vaughn, editors

Biosurvey News is published twice each year and reports on activities, programs and news related to the Oklahoma Biological Survey. We welcome readers' comments and suggestions.

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Avian Migration Strategies (Continued from page 1)

The Painted Bunting (*Passerina ciris*) is one of the most colorful and unusual songbirds in North America. It is unusual in both its molt and migration strategy. Male and female Painted Buntings have different appearances, termed sexual dimorphism. The males are brilliantly colored with a mix of reds, blues and greens, whereas the females are a uniform green that blends in well with their grassy and shrubby habitats. In most dimorphic songbirds, males acquire their bright adult plumage during their first molt, which occurs in late summer or early fall near where they were raised. Painted Bunting males, however, wait until their second fall to grow their multicolored feathers. During their first season as adult birds, they look very similar to females. This process, termed "delayed plumage maturation," is quite rare in songbirds and may be important in understanding the migration strategies of this species.

Migration is energetically taxing and dangerous. A few studies indicate that mortality risk faced by a migrating songbird is 10 times greater during migration than during either the summer or winter. One reason that most birds in North America grow new feathers at the end of the breeding season and before fall migration is to increase the speed and efficiency of migration. Painted Buntings in the Southwest, however, take a different approach. They head south soon after they finish raising their young, but they don't fly all the way to their winter home. Instead, they stop over in western Mexico where the monsoons have started and the food is super-abundant and the number of predators (and parasites) is relatively few. It may be possible that this environment allows the Buntings to grow better feathers faster than they would be able to in the summer range.

While field observations suggest the Buntings molt in the thorn scrub of western Mexico, chemical signatures in the Buntings' feathers (stable isotope ratios) suggest that there may be more than one migration destination or at least two different migration strategies within the same Oklahoma breeding population. If this is the case, then these populations would be of great interest to biologists. It is typically impossible for two separate life history strategies to exist within one interbreeding population because one of the strategies is likely better than the other, or because offspring of parents with different strategies are less likely to survive and reproduce than either of their parents.

Our hope is that with the geolocation tags, we can quantify the connections between Oklahoma breeding locations, molting locations and winter locations. These data will help us understand if there is a single or multiple migration strategies in our population of Painted Buntings. This information will improve our understanding of how migration behaviors evolve and how we might manage habitats to increase the survival and reproductive success of migrants.

By Jeff Kelly

Graduate Student Research: Titmice and the Nature of Species: A Dynamic Avian Hybrid Zone in Oklahoma and Texas

Titmice are small woodland songbirds related to our common Carolina Chickadees and the famous, well-studied tits of Europe. I am studying hybridization between two species of titmouse. Black-crested (*Baeolophus atricristatus*) and Tufted Titmice (*Baeolophus bicolor*) hybridize in central Texas, north-central Texas, and southwestern Oklahoma. The hybrid zone (the area in which they interbreed) is 60 to 90 miles wide. The two species can be easily distinguished by their plumage. Black-crested Titmice have a black crest and pale forehead, while Tufted Titmice have a black forehead and gray crest. Hybrids' foreheads vary from light tan to dark chestnut, while their crests can be gray to sooty to jet black.

A hybrid titmouse. Photo by Claire Curry.

The two species diverged during the Pleistocene glaciations and were considered one species until recently, when ornithologists re-evaluated genetic evidence and song characteristics. They are an excellent study species because they are common and easy to observe; they sing frequently; and they will nest in nest boxes. The unique aspect of the titmouse hybrid zone is a difference in time since contact for the Texas and Oklahoma zones. The Texas hybrid zone is stable, but in southwestern Oklahoma the contact is likely more recent as a result of mesquite tree invasion.

The big question for hybrid zones is why the two species continue to interbreed in this comparatively narrow zone instead of merging into one population. This is important because it elucidates the nature and evolution of species. If they are two separate species, why are they interbreeding? However, if they are one species, then why do they only interbreed in this one narrow zone instead of gradually merging across a broad area? In addition to adding to our knowledge of basic evolutionary biology, this question of speciation is relevant to conservation. Speciation is a driver of biodiversity by evolution of new species. Understanding the causes of biodiversity can help us protect it.

There are several models about why hybrid zones exist (they exist pretty much everywhere, including in frogs, mammals, insects and other birds). Each model makes a different assumption about the evolutionary fitness of hybrids, which can be approximated by how many young that the birds produce. So, do one-parent species or hybrids produce more eggs? Of those eggs do they all hatch? How many of the young survive to leave the nest?

The goal of my Ph.D. project is to describe and compare variation in appearance, songs and genetics between titmice in the younger Oklahoma contact zone and the older Texas contact zone and within each parental species adjacent to the hybrid zone; determine why differences in song occur and if these reasons differ between the two contact zones; determine how mate choice is affected by song differences across hybrid zone; and test which hybrid zone model best describes the contact zones and if it differs between zones.

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Graduate Student Research
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Describing the variation, my first goal, provides me with background to explore the experimental (mate choice) and theoretical (hybrid zone models) aspects of my study. I'll capture and release titmice with individually identifiable color bands and take blood samples to look at genetic markers. I can then record songs from individual titmice and correlate their songs with their genotype. By putting up nest boxes and monitoring titmice nesting success, I can get an approximation of hybrid fitness and test the various models. Finally, with the songs I record and play back to the titmice, I can explore song recognition and mate choice in depth. Different species typically do not respond to one another's songs; Black-crested and Tufted Titmice are already known to have slightly different songs in central Texas. These song differences also could be due to the environment (different sounds transmit better through different environments, such as open versus dense forests). Determining the processes involved in mate choice, species recognition and fitness in this hybrid zone will provide an excellent test of hybrid zone models and add valuable information to our knowledge about the nature of species.

By Claire Curry

Claire Curry is a doctoral student in the Zoology Department at the University of Oklahoma under the direction of Dr. Michael Patten.

Sutton Avian Research Center Receives "Keep Oklahoma Beautiful" Award

The Sutton Avian Research Center received the "Keep Oklahoma Beautiful Team Builder Award" for 2009 from the Keep Oklahoma Beautiful Board of Directors at an annual awards dinner in Oklahoma City on November 17. The award went to the Center and their partners OG&E, Atlas Computers, and OneNet for the Eagle Nest Web Cam project. The Team Builders Award honors those organizations that have worked together to achieve a goal of creating a more sustainable and beautiful Oklahoma in a unique way.

The Eagle Nest Web Cam project site received over 4 million hits from 60 countries this past season. A detailed article on the project can be found in the fall 2009 issue of *Sooner Magazine* (www.oufoundation.org). The current nest platform was built by OG&E. Signals from the web cams go to Atlas Computers and then are picked up and shared around the world by OneNet.

NEW ON THE WEB

Updated rare plant tracking list

Information for Bioblitz! 2010

Meeting information, abstract submission form and online registration
for 2010 Southwestern Association of Naturalists meeting

www. biosurvey.ou.edu

Type Specimens Receive Special Treatment in the Bebb Herbarium

Of all the specimens housed worldwide in herbaria, "type specimens" represent arguably those most important to the scientific community. In the Bebb Herbarium, type specimens are deemed so significant that they are stored in their own herbarium cabinet, maintained individually in an outer red folder with a cardboard stiffener, and listed separately in an online database. But how do type specimens differ from other collections and why are they so important?

A typical type specimen. Photo by Wayne Elisens

The uniqueness and importance of type specimens relate to two major factors. First, type specimens stabilize scientific names by associating names (abstractions) with specimens from actual organisms. Plant names are less likely to be misapplied when there are representative specimens available for examination. The second and most practical reason for their importance is that type specimens are selected to typify the form and appearance of a species and to allow others to communicate species characteristics to anyone anywhere. Types (as they are commonly called) represent international standards for scientific names; they are invaluable to biologists because they make possible widespread use and communication of plant names.

There are 214 type specimens archived in the Robert Bebb Herbarium at OU. Most represent flowering plants from more than 40 families with greatest representation in the sunflower (Asteraceae), buckwheat (Polygonaceae), mustard (Brassicaceae), and legume (Fabaceae) families. Most types were collected in the USA from five states: Nevada, Oklahoma, Utah, California and Idaho. The geographic representation of the type specimens mirrors the strength of the Bebb Herbarium for Oklahoma plants and a secondary strength for plants from the western United States. Several notable botanists have their collections archived in the Bebb type cabinet, including some of F. J. Lindheimer's Texas collections from the 1840s and 1850s, G.W. Stevens' pioneering Oklahoma collections from 1904 to 1916, and A. W. Chapman's Florida collections made between 1840 and 1860.

Type specimens represent natural history collections possessing a unique combination of scientific, historical and practical significance. The Robert Bebb Herbarium makes a special effort to carefully maintain its types and to disseminate the information contained in those specimens to the broader scientific community.

By Wayne Elisens

Photos From the Field

Biosurvey News is pleased to announce a new feature. "Photos From the Field" will highlight interesting (and in this case, amusing) shots taken by Survey personnel during the course of our research activities. We hope you will enjoy these photos!

Humor in the Ouachita mountains of southeastern Oklahoma. Photo by Amy Buthod.

Biodiversity: The Pickerel Frog

The Pickerel frog, *Lithobates palustris*, is in the family Ranidae, a group referred to as "true frogs." It is one of Oklahoma's most beautiful and, at the same time, most secretive amphibians. It occurs from southeastern Canada to Georgia and west to Texas and Oklahoma. In Oklahoma, Pickerel frogs can be found only in the easternmost counties. The Pickerel frog's name apparently comes from its former use as bait by anglers fishing for pickerels, which are large, predatory fish.

Mating Pickerel frogs. Photo by Janalee Caldwell.

Male Pickerel frogs are about 2–2.5 inches in length; females are larger, reaching 3.5 inches (see photograph of mating pair). They can be easily distinguished from similar frogs, especially the more common Southern Leopard frog, by the large, dark brown, squarish spots on the back. The spots are highly variable; some individuals have equally spaced spots but others have spots fused either vertically or horizontally (see photograph). Each frog has a unique spotting pattern, a feature that is used by scientists to recognize individuals in studies of their demography and life history. The frogs are deep yellow at the base of the arms, in the groin, and on the lower part of the belly.

Variation in spotting patterns of Pickerel frogs. Photo by Janalee Caldwell.

Pickerel frogs can be abundant where they occur, but they spend most of the year below ground, making them difficult to observe or study. They come abroad only in late winter and early spring to breed. Exceptions are juveniles or young frogs that may be seen along small streams during the spring and summer, and large individuals, especially females, which may take refuge in caves. In an ongoing study of these frogs in Le Flore County, Oklahoma, the first individuals appeared in drift fence traps on February 27 and were common throughout March. Isolated individuals were found occasionally through April, but none was seen after that time until the following breeding season.

Pickerel frogs migrate to ponds, marshes or swampy areas to breed. As in most other frogs, males arrive at the breeding site first and call to attract females. The call of the Pickerel frog is a very low snore repeated at frequent intervals. Other frogs that breed at the same time as Pickerel frogs, including Spring Peepers (*Pseudacris crucifer*) and Cajun Chorus frogs (*Pseudacris fouquettei*), have much louder calls, making it difficult to hear Pickerel frogs. Paired male and female Pickerel frogs deposit round masses of eggs, which are attached to aquatic vegetation or fallen branches in the water. Each mass contains 1000 to 3000 eggs. Hatching occurs in 2 to 3 days, and tadpoles, which reach 2–2.5 inches in length, require about three months to grow and develop into small froglets.

Pickerel frogs are probably common in Oklahoma, but actual data are difficult to obtain because of the short breeding season and the secretive nature of these frogs during the remainder of the year. The greatest threat to the species is the loss of natural habitat as forested areas and breeding sites are converted to housing developments, and ponds and wetlands are drained.

By Janalee P. Caldwell

Janalee Caldwell is a professor of zoology at the University of Oklahoma and the curator of Herpetology (Amphibians) at the Sam Noble Oklahoma Museum of Natural History