Biosurvey News

The Newsletter of the Oklahoma Biological Survey
Summer 2010

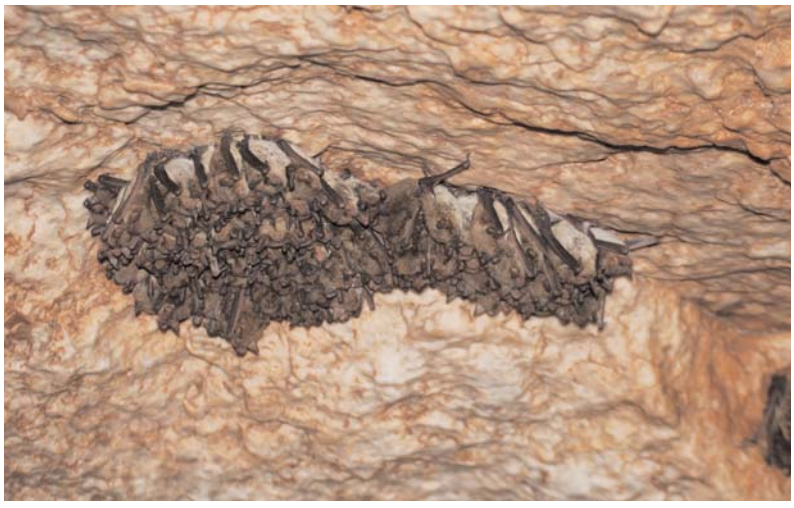
White Nose Syndrome Detected in Oklahoma

Discovered in 2006 in a cavern near Albany, N.Y., White Nose Syndrome (WNS) has been responsible for the mortality of over a million of America's hibernating bats. Spread by a newly described fungal pathogen known as *Geomyces destructans,* the external signs of the disease are a cotton-like white mass on the exposed tissues of the ears, wings and rostrum. While it possesses no direct threats to humans, 25 out of the 45 bat species in North America are at risk from this disease.

The contributions to local ecosystems by bats are well-documented and their loss would be dramatic. All North American species are insectivorous and eat up to their body mass in insects in a single evening. This translates to a small colony of 2,500 Little Brown Bats consuming 66 pounds of insects in one night. With the expansion of such insect-borne diseases as Dengue Fever and West Nile into the United States, the conservation of these bat populations is more important than ever.

Geomyces destructans is a psychrophilic, or cold-loving, organism that thrives at temperatures of 40 to 50 °F and in high humidity – conditions similar to bat hibernacula. It appears that infection causes more frequent bat arousals during hibernation, leading bats to prematurely deplete their fat reserves and resulting in mortality rates approaching 95 percent in some hibernacula. Bats are unique among small mammals in possessing low fecundity and high survival rates of their young, an evolutionary survival strategy that translates to slow recovery from epizootics (rapidly spreading animal diseases) and disturbance.

Since 2006, the presence of *G. destructans* has been confirmed in 13 states and three provinces in Canada and has spread more than 1,750 miles westward from its epicenter. The recent discovery of a *G. destructans*-positive bat in northwestern Oklahoma by graduate student Ryan Shipley is a cause for great concern for several reasons. This is the first documented case in the novel species *Myotis velifer*, which ranges through the southwestern United States and Mexico, and is a probable transmission route into new species and regions. Additionally, the infected hibernaculum is the largest aggregation of this species in Oklahoma, with a population of over 75,000 bats during some winters. Another concern is that this occurrence is 450 miles west of the nearest documented case in Missouri, illustrating the gaps in our knowledge of the transmission of this disease.



One of the bat species affected by WNS. Photo by Ryan Shipley.

continued on page 2

Inside this issue

New on the Web

New Survey outreach activity page

New page and teacher's guide for Prairie River poster

Updated page for the Bergey lab

Updated plant tracking list

www.biosurvey.ou.edu

Photos From the Field

A titmouse comments on field biology techniques. Photo by Claire Curry.

White Nose Syndrome (continued from page 1)

Recently, the U.S. Fish and Wildlife Service announced the closing of all caves and abandoned mines on public land in states including Colorado, Wyoming, South Dakota, Nebraska and Kansas. Even though the presence of *G. destructans* has yet to be found in these states, the risk over the next year is extremely likely based on previous transmission routes. Earlier cave closings from 2010 have already included all states east of the Mississippi River.

Current research on the disease ranges from identifying transmission routes and detecting the viability of the fungal spores in the environment to determining major histocompatibility complex variability within populations for resistance to WNS. Ryan Shipley and Dr. Jeff Kelly of the Oklahoma Biological Survey are currently working toward early detection of its presence in key hibernacula in Oklahoma and Texas and determining its effects on mortality rates.

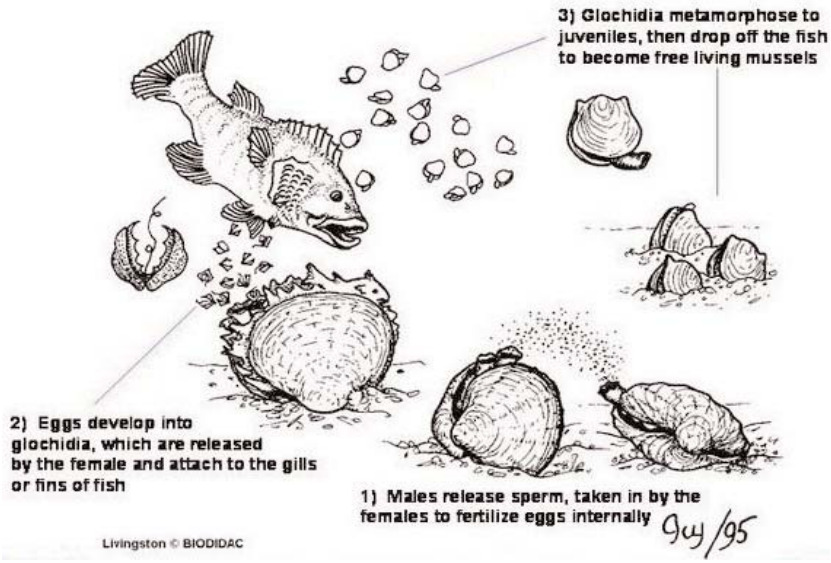
The effects that WNS will have on U.S. hibernating bat populations will be felt for quite some time. Under federal protection from the Endangered Species Act, we have witnessed the gradual population growth of two bat species, the Gray Bat (*Myotis grisescens*) and the Indiana Bat (*Myotis sodalis*), that were at the brink of extinction just 40 years ago. Hopefully, increased awareness of the ecological and economic contributions of bats will afford security for these newly affected species during their recovery. Even if WNS doesn't lead to the extinction of several species, as has been predicted, during this recovery period it will be critical to protect these species from loss of habitat and hibernacula.

Ryan Shipley is a graduate student in the Department of Zoology under the direction of Dr. Jeff Kelly

Graduate Student Research: My Attempt to Decipher the "Drift Phase," a Complex Part of Freshwater Mussel Life History

Freshwater mussels (Bivalvia: Unionidae) have a complex reproductive cycle. Male mussels release their sperm into the water column, which is subsequently picked up by the females through their incurrent siphons. After fertilization, the eggs develop into parasitic larvae called glochidia. Utilizing amazing strategies (luring, mimicking, etc.) to attract a suitable host fish to the otherwise sessile female mussel, glochidia have to be attached to the fish's gills or fins for successful metamorphosis into juvenile mussels. Besides serving as a food source, the host fish also is assumed to play an important role in the dispersal of otherwise relatively immobile mussels. After a species-specific time period, juvenile mussels drop off their host and sink toward the stream bottom. At the same time, the river current causes juveniles to drift downstream.

The mechanisms and processes that are important during the drift phase, as well as potential behavioral adaptations of juveniles, are largely unknown. Thus, my Ph.D. research asks the following questions: At what rate do juvenile mussels sink toward the bottom after dropping off their fish host? How far do they drift downstream during this sinking process? What effects do current and local flow patterns have on the drift phase and the subsequent spatial distribution of mussel aggregations (mussel beds)? How do the spatio-temporal movement patterns of the host fishes during mussel infestation influence the beginning of the drift phase?



The reproductive cycle of the mussel. Courtesy of http://animaldiversity.ummz.umich.edu.

Juvenile mussels are tiny (< 0.5 mm), making them hard to detect in stream sediments or drifting in the water column. Therefore, I am using several experimental approaches to decipher this complex and mostly unstudied part of unionid life history. In the laboratory, I am measuring the sinking and drift rates of actual juvenile mussels in a controlled setting. In several streams in southeastern Oklahoma, I am conducting experiments where I put fluorescent dye in the stream to simulate juvenile drift. I use aerial photography to record the spread of dye plumes, and to compare their spatial distribution within the channel with the distribution and locally varying densities of existing mussel beds. GIS (Geographic Information Systems) is an important tool in this process. In summer 2011, I will record the spatial locations of host fish individuals weekly, over the course of several weeks, to determine their movement patterns as well as areas of potential "starting locations" for juvenile drift.

My goal is to combine results from the above studies to create a model for juvenile mussel dispersal that considers such factors as river flow and fish movement. The model can be used to help determine and manage river flows to sustain endangered mussel populations in Oklahoma and other areas. For example, plans to divert water from streams in southeastern Oklahoma to metropolitan areas in Oklahoma and Texas for human consumption might greatly affect critical current and flow patterns during the summer months. Sustaining environmental (i.e., minimum flow) conditions that allow for successful reproduction of mussel populations during that time of the year is crucial for protecting these highly threatened animals from further extinction.

Pascal Irmscher is a doctoral student in the Zoology Department and Ecology and Evolutionary Biology Program at the University of Oklahoma under the direction of Dr. Caryn C. Vaughn

On the Importance of Natural History Publications

This year marks the fifth anniversary of the resurrection of the Oklahoma Biological Survey publication series, which was originally published from 1929-33. Journals such as this and other regional outlets such as *The Southwestern Naturalist*, *American Midland Naturalist* and *Proceedings of the Oklahoma Academy of Science* play a critical role in the dissemination of descriptive and observational studies of organismal biology. The role of these journals is more critical than in the past, because in many ways natural history seems to be a dying science. It doesn't get the respect it deserves from the scientific community, and in this time period of rapidly expanding journals there are actually fewer and fewer outlets for this type of work. This is unfortunate because as biologists it doesn't matter what type of question you are addressing – theoretical or empirical, molecular or organismal – you cannot appropriately address that question unless you understand the underlying natural history of your target organism(s).

As biologists, the foundations of our work are based on evolutionary theory. I think most would agree that Darwin's *On the Origin of Species* remains a, if not the, seminal work on evolutionary theory. Last year we celebrated the 200th anniversary of Darwin's birth and the 150th anniversary of the publication of *On the Origin of Species*. It's important to step back and remember that this book and Darwin's theory are based on his reflections upon a cumulative series of natural history observations.

For biologists in academic positions, there is tremendous pressure to publish in what are considered important "high impact" journals, and this is particularly true for pre-tenure faculty. This is great if your work is appropriate for that broad audience, but natural history observations, often considered inappropriate for these journals, frequently get back-burnered and end up never being published. My plea is, do both! Your big, high-impact papers are important, but so are your natural history observations. In fact, in many cases natural history observations may actually be read by a wider audience and are especially important for conservation and management, which is important to all of us.

Caryn Vaughn

Upland Forests of Oklahoma Database Now Online

In the summer of 1953, Elroy Rice and William T. Penfound embarked on a field project to quantify forest structure and composition. Over the next four years, they collected vegetation data from 61 of Oklahoma's 77 counties. The analysis and results of this undertaking were published in the journal *Ecology* in 1959 as "Upland Forests of Oklahoma." The Biological Survey has made these data available as a searchable online database.

Rice and Penfound's report includes analytical data, obtained in the summer months from 1953 through 1957, from 208 upland forest stands. They recorded the identification and distribution of all relatively undisturbed forest types and provided a quantitative description of each stand based on the woody species. No data were obtained on herbaceous plants because of the necessary variation in time of sampling and the unequal amount of grazing in the diverse stands. During the last two years of the investigation, data were secured on the death of trees caused by an extended drought (1952-1956).

The searchable online database is available for researchers, educators and citizens interested in the past and future of Oklahoma forests. It can be found at **www.biosurvey.ou.edu/rice_and_penfound/**.

Bruce Hoagland

Registration is now open for the Oklahoma Biological Survey's BioBlitz! 2010. The annual rapid inventory of Oklahoma's biodiversity will occur October 8-9 at Kaw Lake in north-central Oklahoma. To register for the event please visit the BioBlitz! web page at **www.biosurvey.ou.edu/bioblitz/BioBlitzregistration.html**

Survey Faculty Member Retires

Oklahoma Biological Survey and University of Oklahoma Department of Botany and Microbiology George Lynn Cross Research Professor John Skvarla retired this year after 45 years of university service. Dr. Skvarla is an internationally recognized scholar in the fields of palynology (the study of pollen) and ultrastructural approaches to comparative plant morphology. He has authored more than 160 publications in 36 different journals, including *Science* and *Nature*, and has received more than 20 years of continuous financial support from the National Science Foundation.

Dr. Skvarla was born in Passaic, New Jersey. He received his B.S. and M.S. degrees in geology from Upsala College and Miami University, respectively. He received his doctorate in botany from the University of Texas in Austin in 1965, soon after which he became the director of the Electron Microscopy Facility on the OU campus. In 1981 he was named a George Lynn Cross Research Professor, a title awarded to faculty who demonstrate outstanding leadership over a period of years.

Dr. John Skvarla. Photo courtesy of OU Department of Botany and Microbiology.

Skvarla's contributions to the field of palynology include the recognition and characterization of the developmental processes associated with the highly specilized pollen grain wall in the evening primrose family. His work helped elucidate an understanding of how the developmental stages of the pollen grain are crucial to making fundamental systematic determinations. Recently he has been studying the morphology of pollen grain walls in the sunflower family which, combined with molecular data, is helping to explain its evolution. He also is credited for devloping techniques that improved imaging of pollen with the scanning electron microscope.

In his retirement, Skvarla intends to continue his work with pollen wall morphology in the sunflower and the *Goodenia*, *Brunonia* and *Calycera* families, as well as studies on the pollen of Oklahoma plants.

Wayne Elisens and Gordon Uno

Biosurvey News
Summer 2010

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.

The Oklahoma Biological Survey is proud to be a unit in the College of Arts and Sciences at the University of Oklahoma.
The University of Oklahoma is an equal opportunity institution.

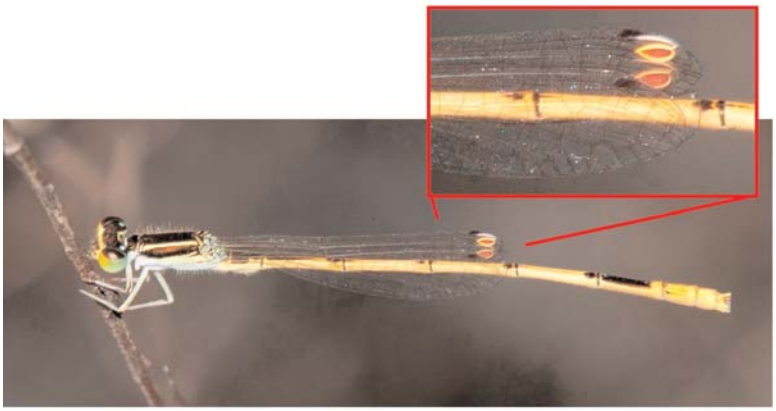
Prepared at a cost of $164.43.

"Life Along a Prairie River," the fourth poster in the Oklahoma Biological Survey's Biodiversity of Oklahoma poster series, is now available. For more information or to receive a FREE poster, please visit www.biosurvey.ou.edu/posters/OBSposters.html

Biodiversity: The Citrine Forktail (*Ischnura hastata*)

Down among the rushes, almost under one's feet, the dainty creatures flit from stem to stem, the red stigmas of the fore wings of the males twinkling among the shadows. Exquisite little creatures. – Needham and Heywood (1929)

"Exquisite little creatures" refers to the Citrine Forktail, *Ischnura hastata*, at a mere 20.5 mm for some males, the smallest damselfly in North America. The Citrine Forktail is found throughout Oklahoma as well as across much of the eastern United States (and north into Ontario, Canada), west to southern California, and south to northern South America. Despite its wide distribution, it is local, typically perching low in dense emergent vegetation at seeps, drainages and backwaters. You probably have walked by many, as they can be found in ditches near the Oklahoma Biological Survey's building on the OU campus.



The Citrine Forktail. The inset highlights the unique position of the pterostigma. Photo credit: © Greg W. Lasley

The Citrine Forktail is a member of the zygopteran family Coenagrionidae, known as pond damsels. Species in the genus *Ischnura* are known as "forktails" in the United States because of the forked projection off of the 10th abdominal segment of most males, but they are known as "blue tails" in Europe because males of most species have the abdomen tipped blue.

Males of the Citrine Forktail are remarkable among the suborder in being the only damselflies in the world with the pterostigmata (blood-filled thickened areas near the tip of the wing) separated from the costal vein (the marginal vein at the leading edge of the wing; see photo). This characteristic was once thought distinctive enough to warrant placing the species in a separate genus, *Anomalagrion*. As this name implies, the species was considered an anomaly in the genus *Agrion*, which once included all pond damsels. Yet despite this unique phenotype, recent genetic analyses have shown that the species fits neatly within genus *Ischnura*.

Female Citrine Forktails also are distinctive: although they are similar to other *Ischnura* species in being polymorphic — an andromorph (a female form which is similar to the male) and two gynomorphs are known — they are one of the few damsels for which a true bilateral gynandromorph, a mix of male and female traits, has been discovered.

So next time you are walking past a nearby ditch, be sure to look deep into the vegetation for these exquisite little creatures twinkling among the shadows. They are a piece of Oklahoma's biodiversity that should not be missed.

Brenda D. Smith-Patten and Michael A. Patten