24th Annual Meeting of the Tennessee Herpetological Society

Lichterman Nature Center

5992 Quince Road
Memphis, TN 38119

September 27-28, 2018

Front Cover and Name Tag Photo: American Alligator, Dr. Chris Murray, Tennessee Technological University

Artwork for T-shirts: American Alligator, Dr. Chris Murray, Tennessee Technological University

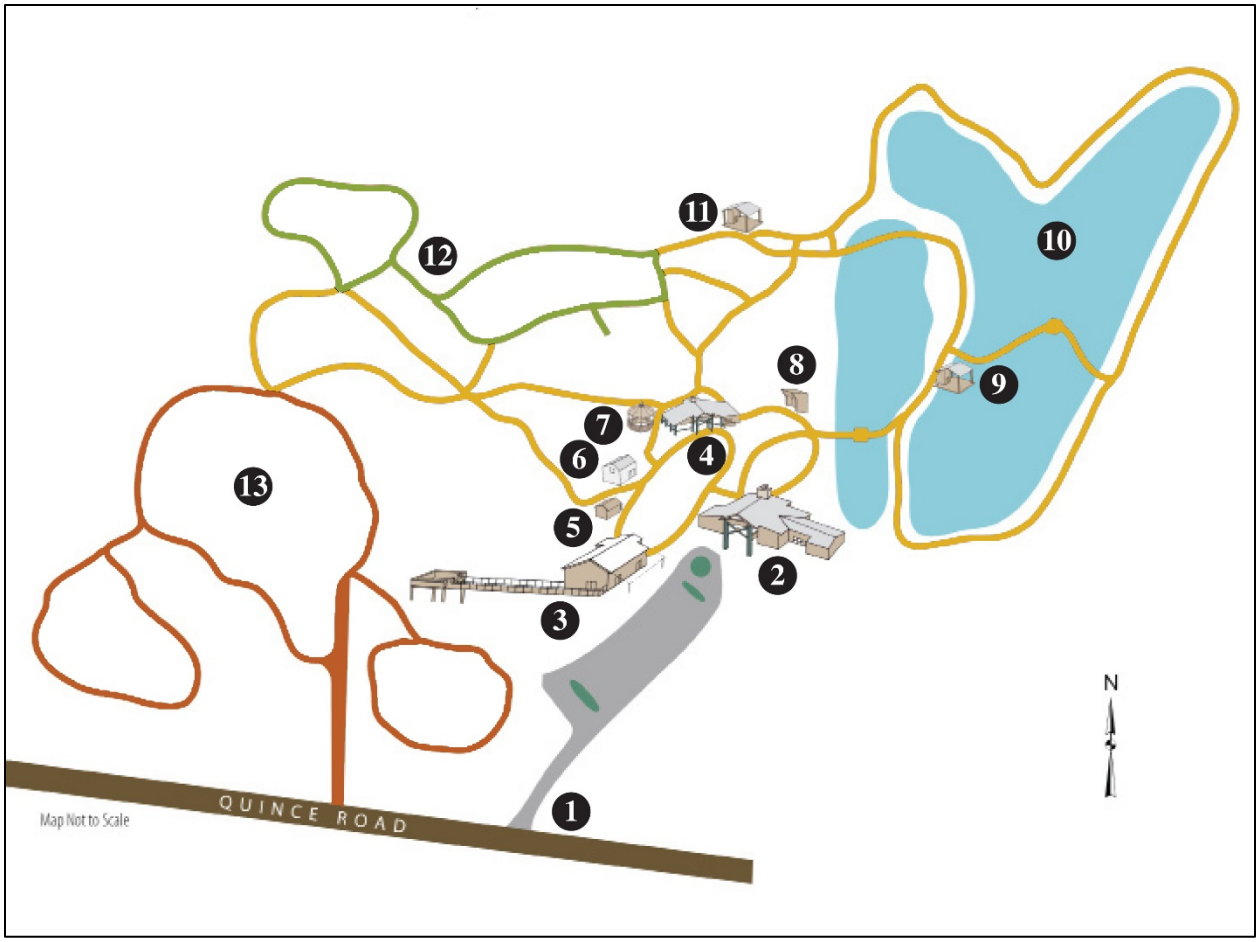
Lichterman Nature Center

Lichterman Nature Center is a 65-acre site with forest, meadows, and lakes. Prior to settlement, multiple Native American tribes hunted in the area. In the mid-1800s, the Mosby family established a 5,000 acre plantation in the area where the nature center is located. George Bennett purchased 1,099 acres from the Mosby family to raise racehorses in 1870. Mr. Bennett built a race track on the property and he produced 7 champions, including Able Frank, winner of the 1909 Kentucky Derby. On May 9, 1928, Clarence Saunders, founder of the world's first self-service grocery (Piggly Wiggly), bought 300 acres, including what is now the Lichterman Nature Center. He began construction of a very elaborate summer house and estate. Within 4 years he went broke and lost it all, in part due to the depression. In 1929, Bill Terry, a famous baseball player and manager of the New York Giants baseball team (winner of 3 pennant victories and a World Series championship in 1933) took ownership. While living on the estate, Mr. Terry converted much of the grounds back into a working farm, through elimination of the golf course, establishment of pastures, and erecting a large milking barn. He sold the property in 1944 to pursue other business interests.

The Lichterman family acquired in the property in 1944. They maintained much of the property as a working farm, continuing to raise dairy cattle, planting crops and creating an orchard. As the development of Memphis sprawled eastward, portions of the property were sold and developed, including the establishment of Ridgeway Elementary and Ridgeway High Schools. With the passing of Ira J. Lichterman, Lottie Lichterman donated a portion of the property, 12.4 acres, to the Memphis Park Commission as a memorial. Additional acres were donated in successive years and the Park Commission purchased the remainder of the land through a grant.

In 1983, with over $600,000 in capital improvements restoring trails and facilities, the Lichterman Nature Center officially opened. In 1994, a fire destroyed the historic 7,000 square foot log home that served as the interpretive visitor center. The current buildings opened in 2000, using the unfortunate fire as a means to develop a state-of-the-art environmental education facility. The native wildlife building features over 88 species of wildlife, including 24 amphibian and reptile species. Thousands of school children each year visit the nature center to view amphibian, snakes, lizards, and turtles. The Lichterman Nature Center seeks educate the public with truth overcoming fiction.

For more history regarding the Lichterman Nature Center, please visit: http://www.memphismuseums.org/lichterman-nature-center/about/the-story-of-lichterman-nature-center/.



1. Entrance
2. Loewenberg Visitor Center
3. Backyard Wildife Center
4. Davidson Special Events Pavilion
5. Plant Propagation Center
6. Greenhouse
7. Gazebo
8. Amphitheater
9. Lake Pavillion
10. Mertie's Lake
11. Meadow Pavillion
12. Meadow Loops
13. Forest Loops

A map of the Lichterman Nature Center can be downloaded at: http://www.memphismuseums.org/lichterman-nature-center/about/lichterman-nature-center-map/.

Thursday Afternoon, September 27, 2018

Lichterman Nature Center	
12:00	Registration
1:00	Opening Remarks
Student Session I	Chair - TBD
1:15	**Larval development in treated wastewater confers an advantage in the terrestrial environment** Emma Zeitler
1:30	**Embryo development and global change: how do reptile embryos respond to ecologically relevant thermal stress?** Joshua M. Hall
1:45	**Online Instruction of Herpetology for Gifted Students: An Overview** Allison Metler
2:00	**Secondary contact and ecological segregation in the two-lined salamander (*Eurycea bislineata*) species complex** Todd W. Pierson
2:15	**Investigating the proximate mechanisms of habitat constraints in two species of Plethodontid salamanders in the Southern Appalachian Mountains** Trevor Chapman
2:30	**Break**
Student Session II	Chair - TBD
3:00	**Habitat suitability models for and occurrence of Plethodon montanus at two Unaka Mountain sites** Tyler Wicks
3:15	**Detecting the Presence or Absence of the State Endangered Streamside Salamander (*Ambystoma barbouri*) in Middle Tennessee using Environmental DNA** Nicole Wetzel
3:30	**Update on the population status and movement ecology of West Tennessee Alligator Snapping Turtles (*Macrochelys temminckii*)** Saidee J. Hyder
3:45	**The structure of micro-communities within alligator nesting ecosystems: a comparative approach across ecological scales** Alejandro Grajal-Puche
4:00	**Break**

Thursday (cont.), September 28, 2017

Lichterman Nature Center	
4:15	THS Business Meeting and Annual Elections
5:30	Poster Presentations / Social
6:30	THS Banquet
7:30	THS Auction

Friday Morning, September 29, 2017

Lichterman Nature Center	
Student Session III	Chair - Stephen Nelson
8:30	**Host and Geographic Range of Snake Fungal Disease in Tennessee** Matthew Grisnik
8:45	**The snake fungal disease pathogen is predictive of the microbiome across spatial scales** Donald M. Walker
9:00	**A Survey of Serpent Biodiversity at a Thirty Year Post-Reclamation Mountaintop Removal Mining Site in Eastern Kentucky** Damien Laws
9:15	**City Snakes: the movement ecology of *Agkistrodon contortrix* in an urban forest.** Malle Carrasco-Harris
9:30	**Break**
10:00	**Detection and habitat modeling for the State Threatened Western Pygmy Rattlesnake (*Sistrurus miliarius streckeri*) in Tennessee.** Shawn Snyder
10:15	**A Description of Home Range and Temporal Aspects of Hibernation for the Eastern Box Turtle, *Terrapene carolina carolina* , in a Suburban Wetland Habitat in Middle Tennessee** Jessica M. West
This concludes the student presentations.	
Professional Session I	Chair - TBD
10:30	**Updates on the conservation status, life history, and demography of the Berry Cave Salamander (*Gyrinophilus gulolineatus*)** Matthew L. Niemiller
10:45	**Break**

Friday Morning (cont.), September 29, 2017

Presentation Awards will be issued prior to the start of this session	
11:00	**Pine Snakes, Pocket Gophers, and Politics** Steve Reichling
11:20	**Where have all the turtles gone, and why does it matter?** Josh Enen
11:40	**It's not easy being green…or is it?: update on the distribution and genetics of the Green Salamander (*Aneides aeneus*) in Tennessee** Matthew L. Niemiller
12:00	**10,001 Radiated Tortoises Confiscated, Now What?** Stephen Nelson
12:20	Meeting Wrap-up

THS Annual Field Trip	
Lichterman Nature Center	
1:30	**Details given during the meeting**

Tennessee Herpetological Society Business Meeting

Agenda Items

Thursday, September 27, 2018

- Reading of the 2017 Meeting Notes
- Treasurer's Report
- Committee Reports
    - Conservation Committee
    - Chad Lewis Memorial Grant Committee
    - Website
    - Publication/Newsletter (Society Journal)
- New Business
    - Website Recommendations
- Elections

Positions to be elected during the 2018 meeting:

- President
- Secretary
- West Tennessee Representative
- Sergeant at Arms

Current Tennessee Herpetological Society Board

President: Josh Campbell

Vice President: David Withers

Secretary: Stephanie Chance

Treasurer: Chris Ogle

West TN Representative: Lee Barton

Middle Tennessee Representative: Danny Bryan

East Tennessee Representative: Stephen Nelson

Sergeant at Arms: Scott Dykes

Abstracts – Student Presentations

Larval development in treated wastewater confers an advantage in the terrestrial environment

Emma Zeitler, Kristen Cecala, Deborah McGrath
735 University Avenue, Sewanee, TN 37383

Constructed wetlands are an important environmental technology because they can serve as a tertiary wastewater treatment among other functions, removing nutrients and pollutants that remain in the water after the primary and secondary treatments. It is hypothesized that tertiary treatment wetlands (TTWs) may function similar to natural wetlands in their ability to support plant and wildlife communities, but remaining pharmaceuticals have been demonstrated to cause developmental abnormalities in anurans using wastewater treatment wetlands. In a controlled experiment, we evaluated larval anuran development in water from secondary and tertiary treated wastewater versus rain-filled pond water. Tadpoles took 21% longer to metamorphose in pond water and grew to only 70% the size of tadpoles from secondary and tertiary treated wastewater. Survival was 2.2 times higher in wastewater relative to pond water. We also noted that size-corrected leg length was larger in tadpoles from wastewater but size-corrected head size was smaller than individuals from pond water. No malformations were noted in individuals from pond water but 5.5% of individuals from wastewater exhibited minor malformations. Overall, larval anurans developed faster to larger sizes in wastewater relative to pond water with tadpoles from TTWs more closely resembling those from secondarily treated wastewater relative to pond water. Increased growth in wastewater may confer higher long-term survival despite low rates of malformations suggesting that TTWs may serve as high quality habitat for anurans.

Embryo development and global change: how do reptile embryos respond to ecologically relevant thermal stress?

Joshua M. Hall and Daniel A Warner
Auburn University, 101 Rouse Life Sciences Building, Auburn, AL 36849

Two components of global change, climate change and urbanization, both contribute to increased ambient temperatures that may induce heat stress or mortality in animals. Each phenomenon independently results in both increased mean temperatures and increased maximum day-time temperatures; however, there is also the potential for these components to act synergistically: extreme temperatures due to the urban heat island effect are likely to be exacerbated as the earth's surface warms due to climate change. Many animals can respond to harmful temperatures behaviorally, by altering their periods of activity or shifting their habitat use. Such behavioral compensation, however, is unavailable to embryos of ectotherms which typically develop inside eggs in the ground and receive little or no parental care. Thus, this early life stage is expected to be more vulnerable to harmful temperatures caused by aspects of global change, and yet, the effects of

ecologically relevant thermal stress on these embryos has received little attention. We sought to understand the consequences of such extreme temperatures on embryological development by utilizing two species of lizard (*Anolis sagrei* and *Anolis cristatellus*) that commonly inhabit urban areas. We measured ground temperatures in an urban landscape where lizards nest and modeled daily thermal fluctuations that included brief periods of extremely high temperatures. We then subjected eggs of both species to various magnitudes and frequencies of these thermal fluctuations at multiple stages of embryo development. We report results of embryo survival and highlight the potential for extreme incubation temperatures to differentially impact species.

Online Instruction of Herpetology for Gifted Students: An Overview

Allison Metler
Southwest TN Community College, Scepter Dr., Bartlett, TN, 38135

Online instruction is a growing industry in education, providing opportunities for students to access courses remotely. However, herpetology instruction has a large focus on providing live animals for students to interact with, which cannot be done online. Some online resources for herpetology exist, but very few to none exist below the college level. Because of this, experimentation has been being implemented into creating an online herpetology course for interested students in the gifted elementary and middle school demographic, via the Athena's Advanced Academy online provider. The provider uses a combination of the "classroom" containing forums, website URLs, and embedded files and live classes using audio and PowerPoint slides or images. Webcams are not used. Via these available resources, an attempt was made to produce an 8-week class covering the basics of herpetology, with each week focusing on a different group of reptiles or amphibians, with the first week covering their basic characteristics. The weeks were as follows: Reptile and Amphibian Characteristics, Snakes, Lizards, Chelonians, Crocodilians, Frogs, Other Amphibians, and a final week focusing on student presentations on topics in herpetology that interested them. The live sessions included PowerPoint slides covering characteristics of the group that week focused on with opportunities for student discussion and questions as well as images and information about various particularly notable members of the group and overviews of conservation concerns to the featured group. Overall, students' reviews of the course, posted in a "What did you think?" forum at the end of the semester were positive and included mention that they were satisfied with the instruction and content of the course.

Secondary contact and ecological segregation in the two-lined salamander (*Eurycea bislineata*) species complex

Todd W. Pierson, Carlos D. Camp, and Benjamin Fitzpatrick
569 Dabney Hall, 1416 Circle Drive, University of Tennessee, Knoxville, Knoxville, TN 37996

Hybridization following secondary contact between previously independently evolving lineages has been influential in the evolutionary history of the two-lined salamander (*Eurycea bislineata*) species complex. However, little is known about gene flow between putative species at modern contact zones. Here, we examine the mechanisms regulating gene flow at a replicated contact zone between *Eurycea cirrigera* and *Eurycea* cf. *wilderae* in the foothills of the Appalachian Mountains. We generated RADcap data for 330 individuals and recovered no evidence for ongoing gene flow. Instead, we show a strong pattern of fine-scale segregation within an ecological mosaic, potentially driven by nest-site selection. This study highlights the complexities of reticulate evolutionary histories and the importance of examining reproductive isolation between putative species when delimiting species boundaries.

Investigating the proximate mechanisms of habitat constraints in two species of Plethodontid salamanders in the Southern Appalachian Mountains

Trevor Chapman, Tyler Wicks, Dr. Joseph Bidwell
East Tennessee State University, Department of Biological Sciences, PO Box 70703, Johnson City, TN, 37614

Research aimed at identifying sensitive habitats has revealed complex interactions between biotic and abiotic variables in montane salamander communities. This study examines the behavioral and physiological mechanisms that restrict the northern gray-cheeked salamander (*Plethodon montanus*) to high elevation habitats. Slimy salamanders (*Plethodon glutinosus*) serve as a potential competitor with *P. montanus* where their distributional boundaries overlap. This study is being conducted in two phases. The first phase will identify elevation limits and characterize the habitat microclimate for *P. montanus* and *P. glutinosus* using plot surveys at Rocky Fork State Park (Unicoi County, TN). The second phase will investigate the proximate mechanisms underlying the two species' distributions in the park. Behavioral preference will be determined by exposing salamanders to simultaneous temperature and humidity gradients in laboratory behavior arenas. Additional trials will combine biotic factors (i.e. territoriality, predation) with abiotic gradients to examine interactions. Finally, to characterize the stress response of salamanders in sub-optimal conditions, corticosterone will be quantified in field and laboratory studies using a new, non-invasive sampling technique. Preliminary results suggest that *P. montanus* dominates plots above 1,100 m while *P. glutinosus* is most abundant at lower elevations. Further, temperature during active periods is significantly different between plots dominated by *P. montanus* and *P. glutinosus*, but humidity has been consistent across all plots.

Habitat suitability models for and occurrence of *Plethodon montanus* at two Unaka Mountain sites

Tyler Wicks, Trevor Chapman, and Dr. Joseph Bidwell
East Tennessee State University, Department of Biological Sciences, PO Box 70703, Johnson City, TN, 37614

Species distribution modeling (SDM) has become an increasingly important tool in wildlife conservation and the ability of a model to produce an accurate representation of habitat suitability can be crucial. This study compares species distribution models generated for the northern gray-cheeked salamander (*Plethodon montanus*) with occurrence data from Rocky Fork State Park (Unicoi County, TN) and Roan Mountain State Park (Carter County, TN). The occurrence of individuals at the Rocky Fork site is consistent with the model prediction. However, at Roan Mountain State Park, a significant number of individuals were collected outside of the zone of suitable habitat indicated by the SDM. This suggests that the SDM for Roan Mountain requires further refinement or that a portion of the *P. montanus* population is occurring in sub-optimal habitat. In order to explore this further, fine-scale abiotic data will be collected from the Roan Mountain site and compared with the known habitat preferences for the salamander.

Detecting the Presence or Absence of the State Endangered Streamside Salamander (*Ambystoma barbouri*) in Middle Tennessee using Environmental DNA

Nicole Witzel and William B. Sutton
Tennessee State University, 3500 John A Merritt Blvd, Nashville, TN 37209

Amphibians represent the vertebrate taxa that has experienced the greatest perceived declines globally. Declines tend to occur in species with geographically-isolated and/or fragmented populations. This is specifically true for the state endangered Streamside Salamander (*Ambystoma barbouri*), an Ambystomatid salamander that occurs in Middle Tennessee. This salamander species emerges to breed in low-order, ephemeral streams during the winter and spring months. As these animals are cryptic and only surface-active for several months, they can be difficult to detect using traditional survey methods. Surveys that target environmental DNA (eDNA) in the form of DNA sloughed into their aquatic environment could provide an effective method for detecting the presence of this species. In April of 2018, water samples were collected at eighteen road-side sites randomly selected from a list of potentially suitable and previously unsampled streams provided by the Tennessee Department of Environment and Conservation. We filtered and extracted DNA from these water samples and used real-time PCR to amplify and detect *A. barbouri* DNA using a species-specific primer. Six out of eighteen sites tested positive for the presence of *A. barbouri* DNA. This study provides an efficient, replicable eDNA approach to identify *A. barbouri* populations in Middle Tennessee, particularly in streams where access is limited or many streams are being searched at one

time. This information will provide a method which can be used by wildlife agencies to further the knowledge and conservation of this species.

Update on the population status and movement ecology of West Tennessee Alligator Snapping Turtles (Macrochelys temminckii)

Saidee J. Hyder, Joshua R. Ennen, Dustin F. Garig, Rob L. Colvin, Jeremy S. Dennison, Andrew J. Feltmann, Madison A. Herrboldt, Caitlin M. Weible, Taylor R. Simmonds, and Jon M. Davenport
Southeast Missouri State University, Cape Girardeau, MO 63701

The Alligator Snapping Turtle (*Macrochelys temminckii*) is the largest freshwater turtle in the United States and is distributed within the Mississippi and Gulf Coast river drainages reaching as far north as Iowa. ASTs are apex predators in these drainages, but have experienced dramatic declines throughout their range due to overexploitation. Despite the type locality from West TN, very little distribution and demographic information is available from this part of their range. For conservation measures from years 1992 to 2005, Tennessee Wildlife Resources Agency (TWRA) released 444 ASTs into West and Middle Tennessee river drainages. Unfortunately, no data is available assessing the success of those introductions along with the current status of the AST. Previously, our initial work investigated the distribution and abundance of ASTs in four West TN drainages, the Wolf, Hatchie, Obion and Forked Deer Rivers. This year we surveyed all four rivers again in new areas to verify presence or absence of ASTs. These past three summers we surveyed 68 sites with baited hoop net arrays of various sizes. The various sizes allowed us to determine what age classes if any were present. During this sampling period, we did detect two new populations of ASTs. In addition, one of the known reintroduced populations is being monitored in order to understand habitat preferences and spatial use of ASTs. We hypothesized that the home range size will have increased since estimates taken from reintroduced hatchlings and that turtles will select warmer microhabitats with a high percentage of tree cover. Preliminary data shows that the mean home range size is 1.22+/- 0.38 hectares. The mean distance moved per day by a turtle is 2.17 +/- 0.62 meters with trends showing differences in microhabitat. Monitoring the habitat preferences and spatial use of this population will aid in future reintroductions and management protocols within West Tennessee. This study will also provide updated data for the IUCN in a state with currently little information available on ASTs.

The structure of micro-communities within alligator nesting ecosystems: a comparative approach across ecological scales

Alejandro Grajal-Puche, Christopher M. Murray, Donald M. Walker
Middle Tennessee State University, 1301 E Main St, Murfreesboro, TN 37132

Recent publications have highlighted the ecological significance of both the endo- and exogenous microbiome. Thus, the characterization of microbial assemblages, across focal scales, and elucidation of environmental drivers behind microbial communities can further scientific

understanding of pattern-driven ecological phenomena. Many questions remain regarding the formation and functional role of a host's microbiome, especially within understudied taxonomic classes, such as Reptilia. Crocodilians are keystone reptiles, which are crucial to the resiliency of the ecosystems they inhabit. Utilizing high-throughput DNA sequencing, I have categorized the microbiome of wild American alligator (*Alligator mississippiensis*) nests, the alligator eggshell surface, and surrounding nest habitat. In addition, I have identified which environmental variables influence the associated alligator-nest microbial assemblage and predicted the functional role of core microbial members. These results reflect a single sampling season and location, we will be expanding our sampling efforts across sample sites to determine spatiotemporal microbial variations. With these findings, I address ecological scaled-based questions and add to the scientific understanding of ecosystem community dynamics.

Host and Geographic Range of Snake Fungal Disease in Tennessee

Matthew Grisnik, Jacob E. Leys, Danny Bryan, Rebecca H. Hardman, Debra L. Miller, Vincent A. Cobb, Chris Ogle, Chris Simpson, Joshua R. Campbell, Rodger D. Applegate, Matthew C. Allender, Eric J. Nordberg, Alyssa A. Hoekstra, Donald M. Walker
Middle Tennessee State University, Toxicology and Disease Group, Biology Department, Murfreesboro, Tennessee 37132, USA

Snake fungal disease (SFD), caused by the fungus *Ophidiomyces ophiodiicola*, is proposed to negatively impact eastern North American snake populations, but its distribution is largely unknown. First identified in Tennessee in 2012, current information about the host and geographic distribution of *O. ophiodiicola* within Tennessee is lacking. The objectives of this study were to identify the spatial extent and the host range of *O. ophiodiicola* within Tennessee. Between 2015 and 2017, 160 snakes were sampled from 32 sites, across 25 counties. *Ophidiomyces ophiodiicola* was detected on 48 of the 160 snakes (30%) and in 15 of 28 counties sampled (54%). We report the first host records of *O. ophiodiicola* on the skin of *Diadophis punctatus* (Ring-necked Snake), *Storeria dekayi* (Dekay's Brownsnake), *Nerodia erythrogaster* (Plain-bellied Watersnake), *Pantherophis spiloides* (Gray Ratsnake), and *Thamnophis sauritus* (Eastern Ribbonsnake). In addition, *O. ophiodiicola* was reported on a species of greatest conservation need, the Eastern Hog-nosed snake (*Heterodon platirhinos*) in Tennessee. This is the first comprehensive account of SFD and *O. ophiodiicola* in Tennessee.

The snake fungal disease pathogen is predictive of the microbiome across spatial scales

Donald M. Walker[1], Jacob E. Leys, Matthew Grisnik, Alejandro Grajal-Puche, Christopher M. Murray, Matthew C. Allender
[1]*Middle Tennessee State University, Toxicology and Disease Group, Biology Department, PO Box 60, Murfreesboro, Tennessee 37132*

Understanding how biological patterns translate into functional processes across different scales is a central question in ecology. Within a spatial context, extent is used to describe the overall geographic area of a study, whereas, grain describes the overall unit of observation. This study aimed to characterize the cutaneous snake microbiome (grain) and to determine host-microbiome-pathogen effects across spatial extents within the Southern United States. The causative agent of snake fungal disease, *Ophidiomyces ophiodiicola*, is a fungal pathogen threatening North American snake populations. We hypothesized that the cutaneous microbiome of snakes differs from its surrounding environment, by host species, spatial scale, and in the presence of *O. ophiodiicola*. We collected cutaneous snake swabs, soil samples, and water filtration samples across six states in the Southern U.S. (broad extent), four Tennessee ecoregions (moderate extent), and at multiple sites within each ecoregion (fine extent). These samples were subsequently subjected to DNA extraction and quantitative PCR to determine the presence/absence of *O. ophiodiicola*. High-throughput sequencing was utilized to characterize the microbial communities in cutaneous snake samples, as well as terrestrial and aquatic environments. We concluded that the snake cutaneous microbiome is distinct from environmental microbial communities. Snake host species is predictive of the cutaneous microbiome at broad to fine spatial extents, whereas, geography is predictive at broad extents, but inconsistent at finer scales. Lastly, the presence of the fungal pathogen *O. ophiodiicola* is predictive of the microbiome at broad to fine spatial extents. Our results highlight the importance of scale regarding wildlife host-pathogen-microbiome interactions.

A Survey of Serpent Biodiversity at a Thirty Year Post-Reclamation Mountaintop Removal Mining Site in Eastern Kentucky

Damien Laws
Lincoln Memorial University, 470 Moores Chapel Rd., Bean Station, TN 37708

Because of their unique life histories, serpents are highly susceptible to the effects of abrupt environmental changes, such as the loss or alteration of habitat encountered during a large-scale disturbance event. One of the leading causes of habitat alteration in the Central Appalachian region is deforestation and habitat fragmentation from mining activities. Mountaintop removal mining (MTR) is a large-scale surface mining technique that removes entire floral and faunal communities, along with soil horizons located above the coal seams. After mining ceases, the land is typically reclaimed to grasslands and shrublands, primarily with invasive and exotic vegetation, resulting in novel ecosystems. This study is designed to investigate the effects of post-MTR reclamation efforts

on serpent biodiversity. Surveys of serpent species are being conducted at a reclaimed MTR mining site and at an unmined reference site in Bell County, Kentucky. The influence of several environmental variables affecting the occupancy and detectability of individual snake species are being investigated during this study. Upon the completion of data collection efforts, occupancy modeling will be performed in the USGS program PRESENCE. The results of this study can aid in developing future reclamation/restoration projects and help guide future research.

City Snakes: the movement ecology of *Agkistrodon contortrix* in an urban forest

Malle Carrasco-Harris, Judith Cole, Steve Reichling
University of Memphis, 3700 Walker Ave., Memphis, TN 38152

Urbanization and fragmentation associated with anthropogenic environments leads to changes in movement patterns and spatial use in a wide variety of taxa. Limited mobility organisms, such as snakes, may be constrained to native habitats within cities. This ongoing radio telemetry study examines the spatial ecology of the southern copperhead (*A. c. contortrix*) within Overton Park, a heavily used area bordered by roads in Memphis, Tennessee. Adult copperheads were implanted with radio transmitters and tracked periodically to collect location, behavior, and environmental information. Geographic data were analyzed using different spatial models to determine home range estimates and movement parameters. Home ranges and core areas in the Overton population are smaller than previously reported for this species and compared to a site 40 km north, Meeman Biological Station. Consequently, average daily movement is also less than rural copperheads. Contrary to previous studies, no differences in spatial patterns between the sexes were noted. Home range size was also not correlated with body condition indices.

Detection and habitat modeling for the State Threatened Western Pygmy Rattlesnake (*Sistrurus miliarius streckeri*) in Tennessee.

Shawn Snyder and William Sutton
Tennessee State University, 3500 John A Merritt Blvd, Nashville, TN 37209

Globally, reptile populations are declining at a rate quicker than most other vertebrates. The Western Pygmy Rattlesnake (*S. miliarius streckeri*) occurs in a narrow range in west-central Tennessee along the Tennessee River drainages and Western Highland Rim. Little is known about the spatial ecology or habitat requirements of this species in Tennessee where it is listed as State Threatened. Previous studies on this species have reinforced the rarity of this species in the state with as little as 30 confirmed occurrences coming in the last 30 years. Our primary research objectives are to evaluate the distribution of the Western Pygmy Rattlesnake in Tennessee by using a variety of field-based survey methods and species distribution modeling techniques. Our habitat suitability model suggests most of the suitable habitat for pygmy rattlesnakes in Tennessee occurs on the East side of the Tennessee River and is predominantly associated with riverine and stream systems.

A Description of Home Range and Temporal Aspects of Hibernation for the Eastern Box Turtle, *Terrapene carolina carolina*, in a Suburban Wetland Habitat in Middle Tennessee

Jessica M. West, Daniel R. Istvanko, and Matthew Klukowski
Middle Tennessee State University, Box 60, Murfreesboro, Tennessee, 37132

Eastern Box Turtles (*Terrapene carolina carolina*) are known for spending most of their lives within a defined home range, but there is variation depending upon the habitat. Our objectives were to use radio transmitters to estimate home range for Eastern Box Turtles (n = 6) in a suburban wetland habitat in Murfreesboro, Tennessee, USA. In addition, we monitored turtles (n = 5) during their winter hibernation period to characterize temporal aspects of hibernation, such as immergence, emergence, and duration of hibernation. The 95% fixed kernel (FK) home range for two female turtles and one male turtle averaged 1.50 ± 1.18 ha. The 50% FK core areas for the same three turtles were small and averaged 0.19 ± 0.15 ha. Similar to the trend of the FK estimates, the 95% minimum convex polygon (MCP) home range for four female and two male box turtles averaged 1.20 ± 1.58 ha. Turtles entered their hibernacula in November and emerged in April, spending an average of 149 days in hibernation. To our knowledge, this is the first study to quantify home ranges and describe temporal aspects of hibernation for Eastern Box Turtles in middle Tennessee as well as one of the few studies conducted in a suburban wetland habitat. With regional and habitat variation affecting Eastern Box Turtle home range size and timing of hibernation, this information can be used for monitoring box turtles and for proper habitat management for this declining species.

Abstracts – Professional Presentations

Updates on the conservation status, life history, and demography of the Berry Cave Salamander (*Gyrinophilus gulolineatus*)

Matthew L. Niemiller, Evin T. Carter, Nicholas S. Gladstone, Lindsey E. Hayter, and K. Denise Kendall Niemiller
Department of Biological Sciences, The University of Alabama in Huntsville, 301 Sparkman Drive, Huntsville, AL, 35899

Salamanders are among the few vertebrates that have successfully colonized and exploited subterranean habitats, having evolved adaptations allowing them to cope with perpetual darkness and limited energy resources. Our knowledge of the life history, demography, and conservation status of many subterranean salamanders, however, is poorly understood due to the limits and challenges of studying life in caves. The Berry Cave Salamander (*Gyrinophilus gulolineatus*) is a large, neotenic plethodontid salamander restricted to just 11 known localities in the Ridge and Valley of eastern Tennessee. Because of its restricted distribution, few documented occurrences, and presumably small population sizes, this cave-obligate salamander is a Candidate species for listing under the U.S. Endangered Species Act. To better understand the demography, life history, and conservation status of this threatened species, we conducted surveys of historical *G. gulolineatus*

sites as well as attempted to discover new populations in caves of eastern Tennessee. We also conducted mark-recapture studies of the two most significant populations (Meads Quarry Cave and Berry Cave), employed growth models to estimate growth rates, age at sexual maturity, and longevity, and an open population model to estimate population size, density, detectability, and survival rates. In addition, we compared life histories and demography of *G. gulolineatus* with related *Gyrinophilus* species (*G. palleucus* and *G. porphyriticus*) recently studied.

Pine Snakes, Pocket Gophers, and Politics

Steve Reichling
Memphis Zoo, 2000 Prentiss Place, Memphis TN 38112

The Louisiana pine snake, *Pituophis ruthveni*, is an endemic species of the decimated longleaf pine ecosystem west of the Mississippi River. Today it persists on four tiny parcels of marginally suitable habitat, and ongoing research reveals a continuing rapid decline in all of these last populations. Therefore, conserving these sites and relict populations, alone, will not be sufficient to recover the species. In recent decades, the USFS has implemented active burning regimens and longleaf pine replanting programs, which have been very successful in returning degraded sites to longleaf forest. A golden opportunity is now at hand to repatriate these restored landscapes using captive-bred specimens. A Species Survival Plan® was implemented to manage the zoo population that had been established in 1984. Since 2010, a modest release program of surplus snakes has been underway in cooperation with the USFWS, USFS, and Louisiana Dept. of Wildlife and Fisheries. However, the reproductive rate of the captive population has been unable to supply the number of animals necessary to establish a self-sustaining in situ population. Monitoring data shows that released snakes are surviving, growing, and maintaining fidelity to the carefully selected release site, but the number released after seven years of continual effort (96) is not believed large enough to overcome natural mortality and build sufficient population density to enable reproduction. To bring this effort to the level of meeting the goals of the project, bold action to strengthen the captive component has been implemented.

Where have all the turtles gone, and why does it matter?

Joshua R. Ennen[1], Jeffrey E. Lovich[2], Mickey Agha[3], and J. Whitfield Gibbons[4]
[1] Tennessee Aquarium Conservation Institute, 175 Baylor School Rd., Chattanooga, TN 37405; [2] U.S. Geological Survey, Southwest Biological Science Center, 2255 North Gemini Dr. MS-9394, Flagstaff, AZ 86001; [3] Department of Wildlife, Fish, and Conservation Biology, University of California, Davis, One Shields Ave., Davis, CA 95616; [4] University of Georgia, Savannah River Ecology Laboratory, Drawer E, Aiken South Carolina 29802

Turtle species are disappearing from the wild at unprecedented rates due to a variety of anthropogenic factors, including habitat destruction, overexploitation (e.g., food and pets), and potentially climate change. Because of these anthropogenic factors and others, over 61% of the 356 turtle species known to science are threatened by extinction or already extinct since the year 1500;

thus making turtles one of the most threatened vertebrate groups on the planet. Unfortunately, the environmental consequence of these dramatic global declines of turtles is largely unknown because turtles, especially freshwater turtles and tortoises, are underappreciated and underrepresented in ecological studies. Here, we review the role of turtles in the environment from an ecological perspective, and argue that the extinction crisis and global population declines of turtles might have significant impacts on ecosystem function. Turtle populations can contribute a significant portion of a community's overall biomasses, which is a measure of the amount of energy (available and stored) in a community. For example, pond sliders have the highest biomass (877 kg/-ha) reported for any animal and other turtles reach biomass estimates larger than iconic herbivore mammals on the African plains. Because of the incredibly high biomass achieved by many turtle populations, turtles play critical roles as consumers (top-down effects), seed dispersers and germinator enhancers, nutrient cyclers, agents of soil turnover, and keystone species.

It's not easy being green…or is it?: update on the distribution and genetics of the Green Salamander (*Aneides aeneus*) in Tennessee

Matthew L. Niemiller, Katherine Dooley, Rebecca Hardman, Daniel Istvanko, Debra Miller, K. Denise Kendall Niemiller, Chris Ogle, and Dustin Thames
Department of Biological Sciences, The University of Alabama in Huntsville, 301 Sparkman Drive, Huntsville, AL, 35899

The Green Salamander (*Aneides aeneus*) is the only species of the North American genus *Aneides* endemic to the eastern United States. They are cryptic and historically thought to be habitat specialists, and, therefore, can be difficult to detect and monitor. In Tennessee, Green Salamanders have primarily been found in association with forested, well-shaded sandstone rock outcrops with damp, deep crevices, but recent studies suggest that this species may use other habitats, such as limestone outcrops and arboreal habitats, more frequently than previously believed. Most populations have been found in the Cumberland Plateau, Cumberland Mountains, and Eastern Highland Rim, but disjunct populations are known from the Central Basin and Short Mountain in central Tennessee and the Appalachian Ridge and Valley, Bays Mountains, Clinch Mountain, and the Great Smoky Mountains in eastern Tennessee. However, the ecology, life history, and genetics of Tennessee populations are poorly understood. Consequently, there is a great need to assess the current distribution of the species in addition to sizes, persistence, health, and genetic relationships of existing populations. Here, we present preliminary results on the status of historical occurrences, updated distribution, habitat use, abundance, life history, and genetics of *A. aeneus* in Tennessee.

10,001 Radiated Tortoises Confiscated, Now What?

Stephen Nelson
Zoo Knoxville, Herpetology Department, 3500 Knoxville Zoo Drive, TN, 37914

Earlier this year, approximately 10,000 Radiated Tortoises (*Astrochelys radiata*) were confiscated in Tulear, Madagascar. Like all of the endemic chelonians to Madagascar, the Radiated Tortoise is listed as Critically Endangered by the International Union for Conservation of Nature (IUCN) Red List. This confiscation is the largest known confiscation of tortoises or freshwater turtles. In this presentation I will discuss the experience of going to Madagascar to help with the triage of the tortoises and what happens next.

Abstracts - Poster Presentations

Phylogeography of the Streamside salamanders as revealed by mtDNA

Joanna Bellan, Carla Hurt, John Niedzwiecki
Belmont University, 1900 Belmont Blvd. Nashville, TN 37206

In recent decades previously unknown populations of the streamside salamander, *Ambystoma barouri*, have been found in central Tennessee. Previous work on the mtDNA phylogeny of the only then known populations, showed TN salamanders to be both basal and monophyletic, with respect to *A. barbouri*, from other parts of their range. We have collected genetic samples from seven populations spread across the range of *A. barouri*, to test if this pattern still holds true. Mitochondrial Sequences, were amplifies by PCR from the d-loop and control region of the mitochondrial genome. Sequences where edited and aligned, and then combined with sequences from GenBank. Trees are being constructed, using parsimony and maximum likelihood methods, to determine the relationship of Tennessee's populations to the species at large. The pattern of relatedness could have potential impacts on the conservation strategy for this salamander in Tennessee, and across its rather restricted range.

The Cutaneous Microbiome of *Desmognathus fuscus*

Samantha Chu, Tori Hongo, John Niedzwiecki
Belmont University, 1900 Belmont Blvd. Nashville, TN 37206

The community of bacteria which occurs on amphibian's skin has been shown to be important in fending off potentially pathogenic microbes. Therefore understanding the normal or natural microbiome is important for conservation of amphibians in a time of global threat. Characterizing this community is challenging, especially for a fossorial and ectothermic organism like the salamander, *Desmognathus fuscus*. Determining which bacteria are in fact directly associated with the amphibian and not incidental from the environment is not trivial. Among Bacteria derived from

the skin, determining those which are broadly associated with the species or population, versus, something unique to one or a few individuals is also challenging. In this study we compare the microbiomes of six *Desmognathus fuscus* individuals from Beaman Park in Davidson County, Tennessee and attempted to characterize the microbiome. We used a standard rinsing technique, to obtain samples and also took samples of rinse water, and the environment where each animal was found. In particular we are comparing the communities of microbes found in the environment, from the rinse water, and from the skin. We are looking for general trends and particular microbes unique to each sample location. We are also attempting to compare the communities on each of the six samples to look for commonalities. When complete we hope to have a good understanding of the diversity of the microbiota of this population of *D. fuscus* and understand how much of the microbiome is shared between individuals and how much may be unique.

Impacts of Snake Fungal Disease in Tennessee; Variation in Physiology, Demography and Assemblage Structure as a Function of Inoculation

Cody D. Godwin, Dr. Chris Murray and Dr. Donald Walker
Tennessee Technological University/PhD student, William L Jones Drive, Cookeville, TN, 38505

Novel fungal pathogens threaten multiple taxa and represent a growing epidemic on already compromised wildlife. One of the most recent emerging fungal pathogens is Snake fungal Disease (SFD) caused by the fungus (Ophidiomyces ophiodiicola O.o). This virulent pathogen infects the tissue of snakes resulting in large sections of infected scales associated with crusting brown heterophilic granulomas. Severe infections of the face, facial pits, or respiratory system can compromise snakes health leading to death. The disease has been discovered in Tennessee and current distribution of the pathogen is unknown. Additionally, severe knowledge gaps about the snake's physiological response to the mycosis exist, and even larger ecological ramifications of the mycosis prevalence are understudied. My research aims to asses 1) the immunological response to SFD and test the hypothesis that snakes with SFD will exhibit a leukocyte profile indicative of both chronic stress and elevated immune function relative to non-infected snakes, 2) understand the physiological ramifications of SFD infection, diagnosed by shifts in testosterone and estrogen allocation (reproduction) and attenuated adrenal function (corticosterone), 3) test for behavioral febrile induction as a function of O. o inoculation and test the hypothesis that SFD infected individuals will bask at higher temperatures to combat the infection relative to healthy snakes, 4) understand how SFD prevalence influences demography with the hypothesis that infected populations experience altered population sizes, immigration, emigration and growth rates, and 5) understand assemblage-level effects and trophic disturbance of areas with variable SFD prevalence and test if the decline in snakes results in higher prey abundance and shift in prey communities.

The effect of nutrient growth media on microbial diversity cultured from *Desmognathus fuscus* skin

Tori Hongo, Samantha Chu, John Niedzwiecki
Belmont University, 1900 Belmont Blvd. Nashville, TN 37206

The Microbiota of amphibians has been implicated in the health of amphibian populations. A healthy and natural microbiota, may help fend off potentially pathogenic microbes, therefore understanding the normal or natural microbiome is important for conservation. Characterizing the microbiome of wildlife is challenging, the conditions in which samples are processed and cultured may affect the number and types of bacteria characterized from a particular organism. In this study we obtained samples for *Desmognathus fuscus*, from Beaman Park in Davidson County, Tennessee and attempted to characterize the microbiome. In particular we are comparing the characteristics of the microbiome, when cultured on three media types, to see if they are redundant, yield significantly different patterns, or if each contributes to a better picture of the microbiome. Preliminary results suggest different media selectively favor gram positive and gram negative bacteria, and that absolute number and diversity of bacteria may vary from each media type. When complete we hope to have a good understanding of the diversity of the microbiota of this population of *D. fuscus* and have an efficient technique to characterize the microbiota of additional populations or species.

Do relationships between temperature and behavior affect intra-species interactions?

Ansley Murphy, Kristen Cecala
735 University Avenue, Sewanee, TN 37383

Species may respond to climate change by shifting distributions, changing behavior, or reducing body size. Mismatches in the manner or rate in which organisms respond to change could disrupt well-established ecological and evolutionary patterns. Behaviors of terrestrial, lungless salamanders are known to be closely related to microhabitat conditions including temperature, which is expected to increase in the future. We evaluated exploratory behaviors that could affect rates of interactions among individuals. Specifically, we evaluated the effects of temperature on (1) latency to emerge and area moved, and (2) intraspecific interactions while accounting for potential differences in acclimation to different thermal regimes. While latency to explore a novel habitat did not vary between temperatures, distance and time explored were greater at warmer temperatures. With increased movement, individuals may encounter one another more frequently, and behavior trials indicated higher aggression between individuals at warmer temperatures. As individuals respond to warming temperatures by moving more on the surface and intensifying aggressive interactions, it appears that they are placing themselves at greater risk of injury. Plasticity in behaviors associated with temperature could prove to be adaptive or maladaptive with large-scale temporal shifts in thermal regimes.

The effect of snake fungal disease and shedding on epidermal microbiome community dynamics

Alexander Romer, Donald Walker
Middle Tennessee State University, Biology Department, Box 60, 1301 East Main Street, Murfreesboro, TN 37132

Snake fungal disease (SFD) caused by *Ophidiomyces ophiodiicola* (Oo), is an emerging infectious disease which is known to effect free-roaming snake populations in the Eastern United States, including Tennessee. A notable clinical sign presented by snakes infected with SFD is an increased rate of shedding, thus inspiring research into the effects of this disease on community turnover in the epidermal microbiome of the host. Research has demonstrated that microbial communities are subject to and altered by the process of disturbance. Furthermore, the effects of disturbance on microbial communities vary with respect to several factors including abiotic setting, disturbance regime, and community diversity. It has been shown that SFD is correlated with modifications to the structure of epidermal bacterial and fungal communities and that some bacteria from epidermal snake microbiomes can inhibit the growth of Oo. We will investigate the degree of microbiome transfer during shedding events in snakes to understand how pathogen-mediated disturbance effects microbiome structure and function. Captive-reared snakes experimentally inoculated with Oo will be maintained in mesocosms with an environmental pool of microbes. Snakes will be swabbed/tissue collected before, during, and after (< 24 hours) a shedding event. High throughput sequencing, metagenomics, and metatranscriptomics will be used to characterize alterations to microbiome community structure and function. Measuring taxonomic and functional turnover in snake microbiomes, using these methods, will elucidate how community dynamics in the microbiome may be altered by SFD and lead to a greater to greater clinical understanding of this pathogen.

2018 THS Annual Field Trip

This year’s field trip will be led by Lichterman’s own Mary Schmidt and THS member Paul Williams and explore the herpetofauna of the numerous trails and wetlands located on the property. The history of the nature center will also be discussed.

2018 Tennessee Herpetological Society Meeting Attendees
Lichterman Nature Center

Joshua Argo
Tennessee Valley Authority
jargo@tva.gov

Wayne Baker
Freed-Hardeman University
wayne.baker@students.fhu.edu

Logan Barber
Tennessee Valley Authority
clbarber@tva.gov

Lee Barton
Freed-Hardeman University
lbarton@fhu.edu

Joanna Bellan
Belmont University
Joanna.bellan@pop.belmont.edu

Joe Bidwell
East Tenessee State University
bidwell@etsu.edu

Danny Bryan
Cumberland University
dbryan@cumberland.edu

Brian Butterfield
Freed-Hardeman University
bbutterfield@fhu.edu

Josh Campbell
Tennessee Wildlife Resources Agency
josh.campbell@tn.gov

Malle Carrasco-Harris
University of Memphis
mfcrrsco@memphis.edu

Kristen Cecala
University of the South
kkcecala@sewanee.edu

Brandon Chance
TDOT
k.brandon.chance@tn.gov

Stephanie Chance
USFWS
chance.stephanie@gmail.com

Trevor Chapman
East Tennessee State University
chapmantl@goldmail.etsu.edu

Samantha Chu
Belmont University
samantha.chu@pop.belmont.edu

Rob Colvin
Tennessee Wildlife Resources Agency
rob.colvin@tn.gov

Jeremy Dennison
Tennessee Wildlife Resources Agency
jeremy.dennison@tn.gov

Scott Dykes
Tennessee Wildlife Resources Agency
scott.dykes@tn.gov

Sara Elliott

sara.elliott@tn.gov

Darrell England

Tennessee Wildlife Resources Agency
darrell.england@tn.gov

Josh Ennen
Tennessee Aquarium Conservation Inst.
jre@tnqua.org

Kevin Fouts
The University of the South
klfouts@sewanee.edu

Alejandro Grajal-Puche
Middle Tennessee State University
ag6x@mtmail.mtsu.edu

Joshua Hall
Auburn University
jmh0131@auburn.edu

Teal Hendrickson
Freed-Hardeman University

Aubree Hill
Tennessee Tech University
aubreehill@tntech.edu

Tori Hongo
Belmont University
tori.hongo@pop.belmont.edu

Laura Horton
Tennessee State University
lhorton7@my.tnstate.edu

Saidee Hyder
Southeast Missouri State University
Shyder1s@semo.edu

Daniel Istvanko
Tennessee Wildlife Resources Agency
Daniel.Istvanko@tn.gov

Tom Laughlin
East Tenessee State University
tomlaughlin@gmail.com

Damien Laws
Lincoln Memorial University
damien.laws@lmunet.edu

Andrew McCaskill
Freed-Hardeman University
andrew.mccaskill@students.fhu.edu

Alli Metler
Southwest TN Comm. College
Alli_draggy@comcast.net

Donna Metler
Mount Parnassus Academy
Dmmetler@comcast.net

Michael Metler
NCR
Dmmetler@comcast.net

Ansley Murphy
University of the South
murphae0@sewanee.edu

Chris Murray
Tennessee Technological University
cmmurray@tntech.edu

Stephen Nelson
Zoo Knoxville
snelson@zooknoxville.org

John Niedzwiecki
Belmont University
john.niedzwiecki@belmont.edu

Matthew Niemiller
The University of Alabama in Huntsville
matthew.niemiller@uah.edu

Bradley Nissen
Tennessee State University
Bnissen@my.tnstate.edu

Emilly Nolan
Tennessee State University
emillymnolan@gmail.com

Chris Ogle
Tennessee Wildlife Resources Agency
chris.s.ogle@tn.gov

Casey Parker
Tennessee Wildlife Resources Agency
casey.parker@tn.gov

Walt Peterson
Amateur Naturalist
Petersonwe316@ aol.com

Todd Pierson
University of Tennessee Knoxville
tpierso1@vols.utk.edu

Lisa Powers
Froghaven Farm
froghavenfarm@bellsouth.net

Steve Reichling
Memphis Zoo
sreichling@memphiszoo.org

Alexander Romer
Middle Tennessee State University
asr4x@mtmail.mtsu.edu

Avery Shappley
Freed-Hardeman University
avery.shappley@students.fhu.edu

Chris Simpson
Tennessee Wildlife Resources Agency
chris.Simpson@tn.gov

Shawn Snyder
Tennessee State University
ssnyder1@my.tnstate.edu

Jana Taylor
Freed Hardeman University
Jana.taylor@students.fhu.edu

Dustin Thames
Tennessee Wildlife Resources Agency
dustin.thames@tn.gov

Sarah Ulderich
Freed-Hardeman University
sarah.ulderich@students.fhu.edu

Aggy Vanderpool
Lincoln Memorial University
aggy.vanderpool@lmunet.edu

Donny Walker
Middle Tennessee State University
Donald.Walker@mtsu.edu

Jessica West
Tennessee Technological University
jmvannatta42@students.tntech.edu

Tyler Wicks
East Tennessee State University
wickstd@etsu.edu

Paul Williams
Lichterman nature center
poppabear1949@gmail.com

Nicole Witzel
Tennessee State University
nwitzel@my.tnstate.edu

Emma Zeitler
University of the South
zeitlef0@sewanee.edu

Notes