2018 Tennessee Bat Working Group Annual Meeting

University of Tennessee Arboretum
901 S. Illinois Ave., Oak Ridge, TN 37830

All Times Eastern
* Denotes Student Presenter

9:00-9:30	Business Meeting, Election of Officers
9:30-9:50	**Josh Campbell** – Tennessee White-nose Syndrome Update
9:50-10:20	Break
10:20-10:40	**Roger Vinson** – Living With Bats: Challenges, Exclusion, & Relocation
10:40-11:00	***Dustin Thames** – Diurnal Roost Selection of Male Tricolored Bats, *Perimyotis subflavus*, in Middle Tennessee
11:00-11:20	***Reilly Jackson** – Winter Activity of Four Species of Cavernicolous Bats in Tennessee
11:20-11:40	***Jessica West** – Range-wide Population Genetic Structure of Rafinesque's Big-eared Bats, *Corynorhinus rafinesquii*, and Southeastern Myotis, *Myotis austroriparius*
11:40-1:00	Lunch (on your own)
1:00-1:20	**Steve Samoray** – Aerial Tracking Results from Multiple Projects Across Tennessee
1:20-1:40	***Scott Hollis** – Validating an Aerial Bat Detection Technology: Acoustic Detection from Above
1:40-2:00	***Mallory Tate** – Investigating Roost Selection by Indiana Bat and Tri-colored Bat During Fall Swarming
2:00-2:30	Break
2:30-2:50	***Matt Grisnik** – The Probiotic Cutaneous Microbiome of Endangered Tennessee Bats

2:50-3:10 **Christy Walker** – Managing for Endangered Bats on Tribal Lands

3:10-3:30 **Cory Holliday** – Range-wide Gray Bat Landscape Use Model

3:30-4:00 Wrap-up and Awards

Tennessee Bat Working Group 2018 Annual Meeting

Abstracts (in order of presentations)

Underlined author is presenter. * denotes student presenter.

Tennessee White-nose Syndrome Update
Josh Campbell
Tennessee Wildlife Resources Agency, 5105 Edmondson Pike, Nashville, TN, 37211

No abstract available.

Living with Bats: Challenges, Exclusion, and Relocation
Roger Vinson

During the construction of a new home, a small bat colony was discovered roosting beneath torn "Tyvek Home Wrap", a paper-like vapor barrier typical of residential home construction. A fourchambered bat box (B-Box #1) was constructed and mounted approximately ten feet from the bats' roost area. Two weeks later, after dusk, the Tyvek was repaired and the following morning the colony occupied the bat box. The colony continued to roost in the box for the remainder of the season. During the winter months the bat box was moved to a pole approximately thirty feet north of the initial location. The following spring, bats returned to the new location and continued to return for several years thereafter, until the spring of 2012 when another larger (~4' x 4') bat box (B-Box #2) was installed on a wall of a nearby outbuilding. During July of 2013, this box was populated with >100 bats, one of which was identified as a Mexican Free Tail, prompting UT researchers to install an SM-2 acoustical monitor. In October 2013, another larger box (B-Box #3) was installed on a pole ~200 feet from the homeowner's residence and ~December 2013, BBox #2 was removed from the outbuilding. In February/March of 2014, the bats returned, however, instead of occupying B-Box #3 as hoped, they roosted behind the brick veneer of the homeowner's residence. In April 2014, Varmint Busters, a wildlife management company, implemented exclusion measures on the homeowner's residence resulting in the colony's relocation to B-Box #3, where they seemed to have returned every year since. Lessons learned include 1) Bat-proof your home prior to inviting/welcoming bats to your property, 2) Locate bat boxes well away from residences, 3) Inform visiting friends not to be surprised to see bats flying around your house during the evenings!

Diurnal roost selection of male tri-colored bats, *Perymyotis subflavus*, in middle Tennessee.

Dustin B. Thames[1,2]*, Josh R. Campbell[1], Mallory E. Tate[2], and Emma V. Willcox[2]
[1]*Tennessee Wildlife Resources Agency, 5105 Edmondson Pike, Nashville, TN, 37211, USA.*
[2]*Department of Forestry, Wildlife and Fisheries, University of Tennessee, 274 Ellington Plant Sciences, Knoxville, TN, 37996, USA.*

Tri-colored bats are declining across eastern North America, primarily from the impacts of white-nose syndrome. As regulators and lands managers begin creating and implementing conservation strategies for the species, more information is needed to determine if geographic variation exists in roost selection. The objectives of this research were to characterize the summer diurnal roosts of tri-colored bats and examine roost selection at the forest stand and landscape scale. This research is focused on male tri-colored bats due to an extremely low capture rate of females. In general, male tri-colored bats selected roosts in clumps of dead oak and hickory leaves of similar shape as has been reported in other areas. Stand level features were found to be less important to roost selection than landscape level features, likely due to the uniformity of forests in our study area. At the landscape scale, tri-colored bats selected roosts in large tracts of mature forest along the hibernacula-rich Cumberland Escarpment physiographic sub-region in close proximity to more open foraging areas on the Eastern Highland Rim. Additionally, tri-colored bats selected roosts further from streams, yet with a higher density of streams around the roost tree. Tri-colored bats may be utilizing streams as corridors for nightly commutes, but actually moving away from streams to roost.

Winter Activity of Four Species of Cavernicolous Bats in Tennessee

Reilly T. Jackson[1]*, Emma V. Willcox[1], Riley F. Bernard[2], John M. Zobel[1]
1 *Department of Forestry, Wildlife and Fisheries, University of Tennessee, Knoxville, USA;* ***2*** *Department of Ecosystem Science and Management, Pennsylvania State University, State College, USA*

Previous studies in Tennessee indicate mild winters and prey availability may drive bats to arouse from torpor and leave caves on warm nights throughout hibernation. Variation in activity patterns, as well as differences in white-nose syndrome (WNS) susceptibility in the region warranted further study. We used Passive Integrated Transponder (PIT) tags and associated data-logging detection systems to examine winter activity of cavernicolous bats in 3 Tennessee hibernacula. During hibernation seasons of 2016 – 2018, we deployed 1,271 PIT tags amongst 4 species, *Myotis grisescens, M. leibii, M. sodalis,* and *Perimyotis subflavus,* which were based on their range of susceptibility to WNS. *M. leibii* were more active during winter compared to all other species, with an average of 42.35% of tagged individuals active during hibernation (range = 6.06% - 72.7%; $p < .0001$). Of the 111 bats detected at least once during both winters, only 29.7% of individuals were detected more than once a night (n = 33/111), of which 69.6% were *M. leibii* (n = 23/33). The length of time between activity events (i.e., emerging from/returning to the cave) in one night ranged from 11.5 minutes to 399 minutes (6.65 hrs) in length, suggesting individuals are likely foraging and/or resting during these extended emergences. Our results highlight species specific differences in emergence behavior at sites impacted by WNS. Variations in winter activity likely play a significant role in differences in susceptibility to the disease, with *M. leibii* found to have low loads of *Pseudogymnoascus destructans*, despite their high rates of activity.

Range-wide Population Genetic Structure of Rafinesque's Big-eared Bats, *Corynorhinus rafinesquii*, and Southeastern Myotis, *Myotis austroriparius*

Jessica M. West* and Brian D. Carver.
Tennessee Technological University, Cookeville, TN 38505

Population genetic structure can provide pertinent and essential information for the conservation and management of rare species. *Corynorhinus rafinesquii*, or Rafinesque's Big-eared Bat, and *Myotis austroriparius*, or Southeastern Myotis, are two rare bat species with overlapping ranges across much of the southeastern United States. At the state level, both species are regarded as threatened, endangered, or of greatest conservation need across nearly all of their range. The overall objective of this study is to understand the population genetic structure of *C. rafinesquii* and *M. austroriparius* to determine population connectivity and determine if there is sufficient gene flow to maintain a high level of genetic diversity among populations. In 2016 and 2017, I collected tissue samples from both species across their range and extracted and sequenced mitochondrial DNA through Sanger sequencing and nuclear DNA through genotyping-by-sequencing (GBS). Thanks to the collaborative efforts of many researchers, I collected more than 800 tissue samples from 14 different states. Understanding the population genetic structure of these two rare species will provide much-needed information, such as gene flow and population connectivity, genetic diversity within and among populations, and needs for management of both species based on these population characteristics. Some populations may be disjunct and may need to be considered as separate evolutionarily significant units (ESUs) or management units (MUs), and it may be beneficial to create wildlife corridors to reconnect these populations for proper mixing of the gene pool, while lessening the impacts of genetic drift and the risk of a population bottleneck. Results from this study will be made available to improve long-term protection and management protocols for these two bat species.

Aerial Tracking Results from Multiple Projects Across Tennessee

Steve Samoray
Copperhead Consulting

No abstract available.

Validating an Aerial Bat Detection Technology: Acoustic Detection from Above

Dustin S. Hollis[1]*, Emma V. Willcox[1], David A. Buehler[1], John B. Wilkerson[2] and Eric R. Britzke[3]

1 *Department of Forestry, Wildlife and Fisheries, University of Tennessee, Knoxville, USA;* ***2*** *Department of Biosystems Engineering and Soil Science, University of Tennessee, Knoxville, USA;* ***3*** *Environmental Laboratory, U.S. Army Engineer Research and Development Center, Vicksburg, USA*

Throughout the United States, millions of acres of undeveloped land maintained by the Department of Defense for readiness, provides habitat for significant populations of endangered, threatened, and at-risk bat species. Natural resource managers charged with the stewardship of these lands and the monitoring of such species under the Endangered Species Act, Sikes Act, and National Environmental Policy Act, are unable to access large areas due to personnel hazards from the testing of certain weapons platforms and the potential for unexploded ordinance (UXO). Building off the fundamental ideas of the Autonomous Aerial Acoustic Recording System, an aerial bird monitoring technology developed and field-tested under the U.S. Army Corps of Engineers Environmental Laboratory (Dr. Richard Fischer) and the University of Tennessee (Dr. David A. Buehler, Dr. Stacy Worley, and Dr. John B. Wilkerson), we have developed an Aerial Bat Detection Technology (ABDT) to supplement ground-based ultrasonic acoustic sampling in accessible areas, as well as providing access to previously inaccessible areas within these DOD installations. The ABDT has been designed to acoustically detect bats along transects at virtually any altitude above the ground and improve our understanding of bat ecology, demographics, and occupancy across various ecosystems. The ABDT is comprised of a remote-controlled weather balloon and payload that incorporates an ultrasonic microphone array and redesigned data logger, engineered at the University of Tennessee. We will present the results of the initial validation testing from this microphone array and incorporated data logger.

Investigating Roost Selection by Indiana Bat and Tri-colored Bat During Fall Swarming

Mallory E. Tate[1]*, Emma V. Willcox[1], Riley F. Bernard[2] and Bill H. Stiver[3]

1 *Department of Forestry, Wildlife and Fisheries, University of Tennessee, Knoxville, USA;* ***2*** *Department of Ecosystem Science and Management, Pennsylvania State University, State College, USA;* ***3*** *Great Smoky Mountains National Park, National Park Service, Gatlinburg, USA*

The Indiana bat and tri-colored bat are two of seven bat species known to be affected by the devastating fungal disease white-nose syndrome (WNS). Since the introduction of this disease, populations of both species have seen dramatic declines. In an effort to improve management and conservation efforts, research has been conducted to further understand ecology and behavior of these species during summer and winter, two critical periods in the life-history of bats. However, the ecology and behavior of the Indiana bat and tri-colored bat during fall swarming have not been fully investigated. Fall is also an extremely critical period for bats because of the energetics associated with reproduction and entering hibernation. During fall swarming there is heightened activity in and around hibernacula, as bats attempt to both mate and build energy reserves to survive winter hibernation. Entering hibernation with substantial energy reserves has become especially important if individuals infected with WNS are to survive winter. Therefore, any effective conservation and management strategy must include provisions to identify, study, and manage fall pre-hibernation bat populations and associated habitat, including diurnal roost sites. During fall (August – October) 2017 and 2018, we captured bats at hibernacula and used radio telemetry to track 17 Indiana bats and 11 tri-colored bats to their diurnal roosts. We will present the initial results of our study examining diurnal roost selection by these species during fall swarming.

The Probiotic Cutaneous Microbiome of Endangered Tennessee Bats

Matthew Grisnik[1]*, Olivia Bowers[2], Ben Jones[2], Andrew Moore[2], John Munafo[3], Daniel Istvanko[4], Joshua Campbell[4], Chris Simpson[4], Dustin Thames[4], Cory Holliday[5], Donald M. Walker[1]

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Since its introduction in 2006 into the USA, *Pseudogymnoascus destructans* (*Pd*), the fungal agent of white-nose syndrome (WNS), has rapidly spread killing millions of bats. WNS has negatively impacted populations of three federally listed bat species and has been predicted to have the ability to cause extinctions in the near future. Treatment options for bats infected with *Pd* include anti-fungal chemicals, volatile compounds, and naturally occurring antifungal probiotic bacteria that may be members of the cutaneous microbiome. Studies of the cutaneous microbiome have revealed that specific bacterial strains play dominant roles in the microbiome community, when minor fluctuations occur in abundance of these 'core' microbes, it can alter immune function. The main objectives of this research were 1) to characterize the bat, cave soil, and roost microbiome using high-throughput DNA sequencing, 2) determine if the cutaneous microbiome is altered in the presence of a pathogen, and 3) to identify potential probiotic antifungal bacterial strains with activity against *Pd* that are found naturally on both the bat and in within the cave ecosystem. To date we have sampled the microbiome of 83 tri-colored bats and corresponding roost (n=41) and soil samples (n=37), from 20 *Pd* positive caves and compared bacterial communities using high-throughput DNA sequencing. Results indicate that there is a significant difference between tri-colored bats with *Pd*, and those without it (p=0.03). In addition, we have identified 33 unique bacterial isolates from the skin of bats that have antifungal activity against *Pd*, 22 of which have been found to be members of the bat, roost, and cave soil microbial community. Comparisons between *Pd* positive and *Pd* negative bats show that there is a significant difference in the presence of probiotics within the bat microbiome, with significantly more *Pd* negative bats having probiotic bacteria within their microbiome (p=0.02).

Managing for Endangered Bats on Tribal Lands

Christy Walker
Eastern Band of Cherokee Indians

The Eastern Band of the Cherokee Indians (EBCI) is a sovereign nation with the right to manage their own land. A continued goal for the EBCI Natural Resources Program (EBCI NRP) is to protect native species and the ecosystems on which they depend. Section 7(a)(1) of the Endangered Species Act was intended to "insure that federal agencies act out programs for the conservation of endangered species." However, Section 7(a)(1) unintentionally puts a disproportionate burden on individual tribal citizens. Protecting endangered species while supporting the interests of enrolled members presents a unique challenge to the tribe and federal government. Secretarial Order 3206 provided promise that the Bureau of Indian Affairs and the U.S. Fish & Wildlife Service would work with tribes to ease this burden, but this promise has not always been fulfilled. The burdens enrolled members face is evident with the protection measures for Indiana and Northern long-eared bats during summer months. Eighty-five percent of EBCI lands are forested and ubiquitous bat habitat, thus putting an economic strain on individuals to follow protocols regarding clearing trees for small house sites. In 2018 the EBCI NRP received funding to develop agreements with the USFWS to protect federally listed bat species while addressing the needs of tribal citizens.

Range-wide Landscape Use Model for Gray Bats

Cory Holliday
The Nature Conservancy, 210 25th Ave N. Nashville, TN 37203

No abstract available.