29th Annual Meeting of the Southeastern Bat Diversity Network

&

34th Annual Colloquium on the Conservation of Mammals in the Southeastern United States

Meeting program

14 – 16 February 2024

Sonesta Resort, Hilton Head Island

South Carolina

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MEETING SCHEDULE OVERVIEW

Wednesday, February 14

2:00pm – 4:00pm	Pinckney National Wildlife Refuge Field Trip*
3:00pm – 6:30pm	Registration, Exhibitor Setup
3:00pm – 5:00pm	SBDN Executive Committee Meeting
4:00pm – 6:00pm	Mammal Trivia
5:00pm – 6:00pm	State Representative Meeting (Invitation Only)
5:30pm – 10:30pm	Netting at Palmetto Bluff*
6:00pm – 8:00pm	Welcome Social*

Thursday, February 15

7:00am – 8:00 am	Breakfast (provided), Exhibitor Setup
7:00am – 6:00 pm	Registration
7:00am – 7:00pm	Mammal Trivia
8:00am – 12:00pm	Working Group Meetings, Workshops
12:00pm – 1:00pm	Lunch (provided)
1:15pm – 3:30pm	Plenary Session
4:00pm – 5:00pm	SBDN Business Meeting
5:30pm – 7:00pm	Banquet Dinner (provided)
7:00pm – 10:00pm	Poster Session, Social, Silent Auction

Friday, February 16

7:00am – 8:00 am	Breakfast (provided)
7:00am – 11:00am	Registration
8:00am – 12:00pm	Oral Presentations (Student)
12:00pm – 1:30pm	Lunch (provided)
1:30pm – 3:30pm	Oral Presentations (Professional)
3:30pm – 4:15pm	Awards, Announcements, Closing Remarks

*Pre-registration required

EVENT LOCATIONS

Registration ---------- Hallway (♦)

Exhibitors ---------- Salons D, E

Field Trips ---------- Follow Emailed Instructions

Mammal Trivia ---------- Salon BC

SBDN Executive Committee/State Rep Meeting ---------- Salon A

Welcome Social ---------- Beach Pavilion*

Breakfast ---------- Salon FGH

Working Groups, Workshops ---------- Salons D, E

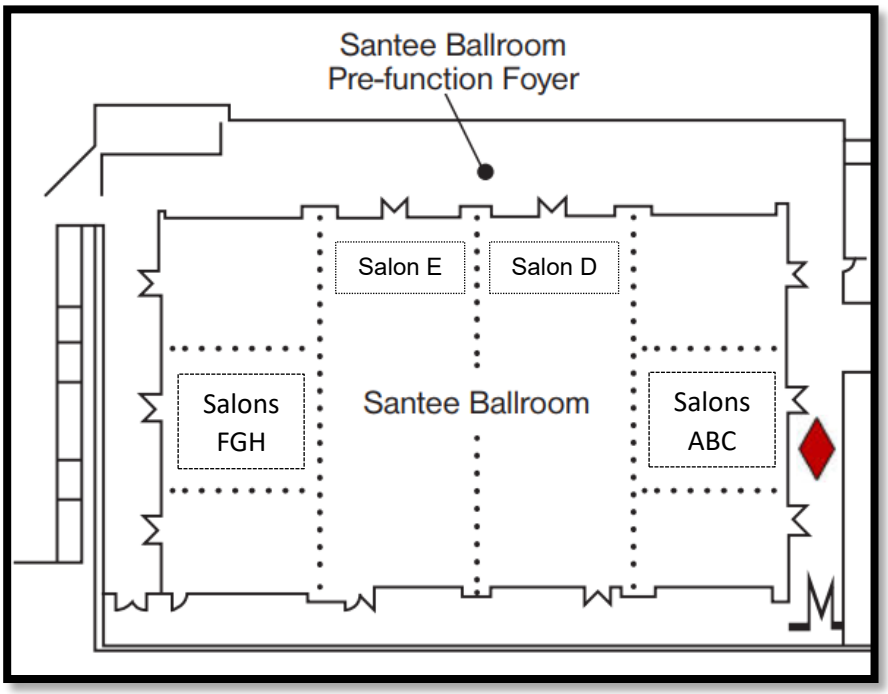
Lunch ---------- Salon FGH

Plenary Session ---------- Salon DE

Breaks ---------- Pre-function Foyer

Poster Session, Banquet & Social ---------- Beach Pavilion*

Oral Presentations ---------- Salons D, E



*Salon DE in case of inclement weather

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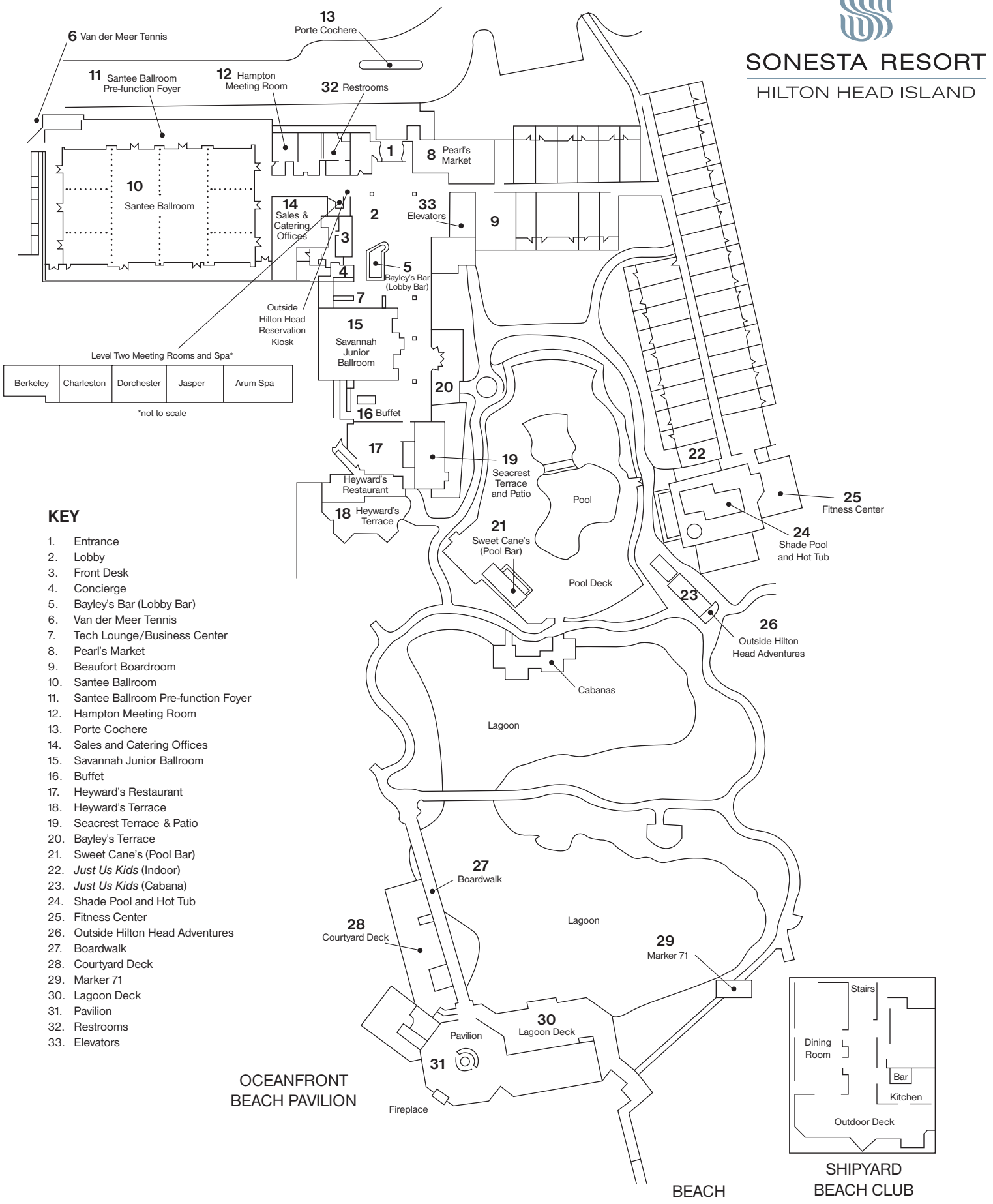

KEY

1. Entrance
2. Lobby
3. Front Desk
4. Concierge
5. Bayley's Bar (Lobby Bar)
6. Van der Meer Tennis
7. Tech Lounge/Business Center
8. Pearl's Market
9. Beaufort Boardroom
10. Santee Ballroom
11. Santee Ballroom Pre-function Foyer
12. Hampton Meeting Room
13. Porte Cochere
14. Sales and Catering Offices
15. Savannah Junior Ballroom
16. Buffet
17. Heyward's Restaurant
18. Heyward's Terrace
19. Seacrest Terrace & Patio
20. Bayley's Terrace
21. Sweet Cane's (Pool Bar)
22. *Just Us Kids* (Indoor)
23. *Just Us Kids* (Cabana)
24. Shade Pool and Hot Tub
25. Fitness Center
26. Outside Hilton Head Adventures
27. Boardwalk
28. Courtyard Deck
29. Marker 71
30. Lagoon Deck
31. Pavilion
32. Restrooms
33. Elevators


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- T/E Species Surveys
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MEETING INFORMATION

REGISTRATION TABLE

The registration desk will be staffed throughout the meeting. Volunteers can assist with registration, selling t-shirts, accepting silent auction donations, and answering questions.

MEETING PROGRAM

In efforts to reduce meeting costs and use of resources, the meeting program will be provided in digital format only. Contact Megan Wallrichs for program corrections.

PRESENTATIONS

Posters: Posters can be mounted in the Beach Pavilion on February 15 from 5:00-6:00pm. Easels will have a number corresponding to the presenter's assigned poster number. The poster session will be February 15 from 7:00pm – 10:00pm in the Beach Pavilion (Salon DE in case of inclement weather). Presenters are encouraged to stand by their posters from 7:00pm – 9:00pm

Oral Presentations: All who are delivering oral presentations should deliver their presentations to the registration table when they register or no later than 5:00pm on February 15. Presentations on Friday, February 16 will be delivered in Salons D and E. Each presentation will be 15 minutes, of which presenters are encouraged to allow 2 – 3 minutes for questions.

JUDGE INFORMATION

Please pick up judging packets at the registration desk which includes the judge's forms and instructions. See Nikki Castleberry for any questions or concerns. Please turn in judging forms as soon as possible so that scores can be tabulated after you finish judging each talk. Poster forms should be turned in at the end of the poster session. If you need additional time, please see Nikki. There will be a box at the registration table to turn in finished forms.

REFRESHMENTS & MEALS

A Welcome Social (pre-registration required) will be held Wednesday, February 14 at the Beach Pavilion (Salon DE in case of inclement weather) from 6:00pm – 8:00pm. A cash bar will be available.

Breakfasts and lunches will be provided on Thursday and Friday in Salon FGH. Breaks will be held in the Pre-function Foyer.

A dinner banquet will be held Thursday, February 15 from 5:30pm – 7:00pm in Salon FGH. Immediately following will be the poster session, social, and silent auction in the Beach Pavilion (Salon DE in case of inclement weather) until 10:00pm. A cash bar will be available.

Silent Auction

A silent auction will occur Thursday, February 15 from 7:00pm – 10:00pm at the Beach Pavilion during the social and poster session. Items can be donated at the registration desk. Last call for bids will be at 9:30pm. Forms of payment include cash, credit card, and check. Proceeds from the auction will fund the SBDN Student Travel Award Program.

Mammal Trivia Challenge

Back by popular demand! The 4th annual Mammal Trivia Challenge will include trivia questions, museum oddities and other interesting museum finds. The challenge requires 2-person teams. All teams of two are welcome to participate, but professional-student pairs will be eligible to win prizes and other pairs (pro-pro or student-student) will be eligible for honorable mentions. Students and professionals looking to find a partner for the Challenge are encouraged to leave their contact information at the registration desk. Contact Lindsey Troutman with any questions.

The Mammal Trivia Challenge will be held in Salon BC and will be open during meeting hours (see schedule overview). The Challenge will end at 12:00pm on Friday, February 16. Turn in completed answer sheets at the Registration Table by 12:30pm. Winners will be announced during the award ceremony on Friday afternoon.

Working Groups

Eastern Spotted Skunk Cooperative Study Group – The goals of the eastern spotted skunk cooperative study group are to promote the conservation of the eastern spotted skunk across their distribution through (1) enhancing communication about the species, (2) identifying management and resource priorities, and (3) facilitating collaborative planning, funding, outreach, monitoring, and research opportunities. The working group will meet in Salon D on February 15 from 10:00am – 12:00pm

NABat Southeastern Hub Working Group and Bats in Transportation Structures – The Southeast (SE) Bat Hub was created in summer 2022 to coordinate NABat survey projects in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina,

South Carolina, and Tennessee. This joint working group will meet on February 15 from 8:00am – 10:00am in Salon D.

Regional Wildlife Science Collaborative for Offshore Wind **Working Session: Bat Research and Monitoring Offshore –** With the rapid expansion of offshore wind development along the U.S. Atlantic Coast expected over the next decade, concerns are growing about potential impacts to bats. At present, we know relatively little about bat ecology offshore, collision risks associated with offshore turbines, - or even the most effective ways to deploy equipment and monitor bat activity in the marine environment. This working session will begin with a brief presentation outlining the work of the Regional Wildlife Science Collaborative for Offshore Wind (RWSC) Bird & Bat Subcommittee to develop regional research recommendations for bats offshore. We will also present draft guidance for stationary acoustic monitoring of bats on offshore wind facility infrastructure, developed by RWSC's Offshore Bat Working Group. The majority of this session will focus on small-group discussions to provide feedback on research priorities, draft monitoring guidance, potential coastal/offshore mist netting locations, and opportunities for collaboration along the Southeast coast. All those with interest or experience in acoustic monitoring or coastal/offshore research are encouraged and welcomed to participate! This working group will meet February 15 from 10:00am – 12:00pm in Salon E.

WORKSHOPS

Wildlife Acoustics: A Closer Look at the Song Meter Mini Bat 2 – Please join Wildlife Acoustics to learn about the new Song Meter Mini Bat 2 and how it compares to our first generation of Song Meter Mini Bats. Wildlife Acoustics is excited to showcase this new product at our workshop. This is a great training opportunity for researchers just starting or already involved in using acoustics to monitor bats. The workshop will cover the details of the recorders and a deep dive into the Configurator app. Please download the Song Meter Configurator app from Google Play or the Apple App Store to a phone or tablet you are bringing**.** You'll have two opportunities to join this workshop. Please meet in Salon E from 8:00am – 9:00am **OR** 9:00am – 10:00am on February 15.

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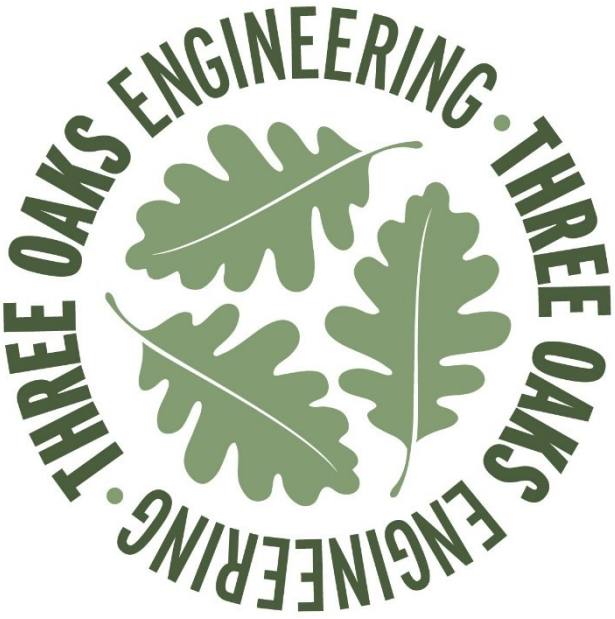

KEYNOTE SPEAKER ABSTRACTS

WAYNE MCFEE – MARINE MAMMAL CONSERVATION

National Oceanic and Atmospheric Administration, Charleston, SC 29412

Marine mammal conservation in South Carolina has taken many forms over the last three decades. The NOAA Charleston Laboratory was originally located in the National Marine Fisheries Service until 2000 when the lab changed line offices to NOAA's National Ocean Service as one of the National Centers for Coastal Ocean Science labs (NCCOS). Most of the 1990s was dedicated to the recovery and necropsy of stranded marine mammals for life history and contaminant studies. Since 2000, the marine mammal research has taken a One Health approach using marine mammals as sentinels of ecosystem and human health. This presentation will briefly detail past research as well as current research approaches to aid the NOAA One Health initiative.

MICHAEL WHITBY – ACCESSING RISK OF OFFSHORE WIND ENERGY TO BATS

Bat Conservation International, Austin, TX 78746

As the United States moves to meet ambitious offshore wind energy goals, the possible impact to bat populations is increasingly become a concern. Despite not being a 'marine mammal' there are significant records of bats in the offshore environment. This activity and the documented mortality of bats at onshore wind turbines raises concerns about the risk offshore wind energy poses to bat populations. Sampling in the offshore environment is often limited to the availability of existing structures (e.g., platforms and buoys). In autumn 2023 BCI, EPRI, USGS, and Stantec partnered with Saildrone to test the use of uncrewed surface vessels to sample bat activity near Southeast Farallon Island. We recorded 1,375 files during the mission. Sonobat filtering determined that 544 (39.6%) were

noise and 831 files included bat echolocation calls. SonoBat identified 15 big brown bats, 111 hoary bats, 48 silver-haired bats, and 164 Mexican free-tailed bats (total = 338 bats). Bats were recorded across most of the sampling area and across the entire sampling period. There was a slight increase in activity recorded near dawn, however one night (Sept 20) recorded an abundance of calls at this time and likely had an outsized effect on the distribution. I will discuss these results and the larger sampling effort in the Pacific as a model to how risk of offshore wind energy in the Atlantic can be assessed.

HAN LI – BATS AND COASTAL URBANIZATION

Department of Biology, University of Nebraska Omaha, Omaha, NE 68106

North Carolina is one of the fastest-growing states in the United States, experiencing a surge in population migration. This demographic shift has led to rapid urbanization throughout the state. In the coastal plain region, urbanization often occurs in the form of residential development projects along the coastline near nature-based recreational areas. Increasing population also results in the conversion of natural habitats into agricultural lands in the inner coastal plain to meet the rising demand for food. The coastal plain is also home to thirteen species of bats, including the endangered northern long-eared bats. The acceleration of urbanization and associated land-use changes poses potential threats to these coastal bats. In this presentation, I will highlight several studies on bats and urbanization, utilizing data collected from acoustic monitoring conducted in the coastal plain between 2012 and 2022. The monitoring efforts include year-round recordings, NABat stationary point surveys, and NABat mobile transect surveys. At the species level, modeling results indicate that urbanization has a negative effect on certain bat species, such as the northern long-eared and tri-colored bats, with reduced occupancy probabilities near housing developments. At the community level, urbanization alters bat community compositions and diel activity patterns. Examining overall bat activity for quantifying pest control ecosystem services reveals lower bat activity in urban areas compared to non-urban areas, despite the range expansion of urban-adapted species. This suggests a potential loss of ecosystem services. In contrast, in areas where land-cover and land-use changes have been minimal over the last decade, bat populations have remained relatively stable. Therefore, I argue that while the economic benefits of a growing population are undeniable, cautionary measures are needed to minimize the adverse effects of urbanization on critical bat habitats.

Detailed Meeting Schedule

Wednesday, February 14

Time	Activity	Location
2:00pm – 4:00pm	Field Trip: Guided Tour of Pinckney National Wildlife Refuge (pre-registration required)	Follow emailed instructions
3:00pm – 6:30pm	Registration	Hallway
4:00pm – 6:00pm	Mammal Trivia	Salon BC
3:00pm – 6:30pm	Exhibitor setup	Salon D, E
3:00pm – 5:00pm	SBDN Executive Committee Meeting	Salon A
5:00pm – 6:00 pm	State Representative Meeting (invitation only)	Salon A
5:30pm – 10:30pm	Field Trip: Netting at Palmetto Bluff (pre-registration required)	Follow emailed instructions
6:00pm – 8:00pm	Welcome Social (pre-registration required)	Beach Pavilion

Thursday, February 15

Time	Activity	Location
7:00am – 8:00am	Breakfast	Salon FGH
7:00am – 8:00am	Exhibitor Setup	Salons D, E
7:00am – 6:00pm	Registration	Hallway
7:00am – 7:00pm	Mammal Trivia	Salon BC

Thursday, February 15

Working Group Meetings & Workshops

Time	Working Group	Location
8:00am – 10:00am	NABat Working Group + Bats in Transportation Structures	Salon D
8:00am – 9:00am	Wildlife Acoustics: A Closer Look at the Song Meter Mini Bat 2	Salon E
9:00am – 10:00am	Wildlife Acoustics: A Closer Look at the Song Meter Mini Bat 2 (repeat)	Salon E
10:00am – 12:00pm	Eastern Spotted Skunk Cooperative Study Group	Salon D
10:00am – 12:00pm	RWSC Working Session: Bat Research and Monitoring Offshore	Salon E

12:00PM – 1:00PM Lunch provided in Salon FGH

Plenary Session

Salon DE
Moderator: Scott Bergeson

Time	Title, Speaker
1:15pm – 1:35pm	Marine Mammal Conservation, *Wayne McFee*
1:35pm – 1:55pm	Accessing Risk of Offshore Wind Energy to Bats, *Michael Whitby*
1:55pm – 2:15pm	Bats and Coastal Urbanization, *Han Li*

Thursday, February 15

2:20pm – 3:30pm	USFWS Update on Endangered & Threatened Bats and Coastal Bat Biology Panel Discussion *Pete Pattavina (USFWS), Mark Ford (Virginia Tech), Gary Jordan (USFWS), Susan Loeb (USFS), and Steven Castleberry (University of Georgia)*

Afternoon Activities

Time	Activity	Location
3:45pm – 4:00pm	Afternoon break	Pre-function Foyer
4:00pm – 5:00pm	SBDN Business Meeting	Salon DE
5:30pm – 7:00pm	Dinner Banquet (provided)	Salon FGH
7:00pm – 10:00pm	Poster Session, Silent Auction, Social	Beach Pavilion

Friday, February 16

Time	Activity	Location
7:00am – 8:00am	Breakfast (provided)	Salon FGH
7:00am – 11:00am	Registration	Hallway
7:00am – 12:00pm	Mammal Trivia	Salon BC

Friday, February 16

Morning Session - Student Oral Presentations

Salon DE
Moderator: Piper Roby

Time	Title, ***Presenter***
8:00am	Alopecia Syndrome in Gray Bats *Ashleigh Cable*
8:15am	Tracking Gray Bat (*Myotis grisescens*) Movement Using MOTUS Towers in Southwest Virginia and Northeast Tennessee *Hila Taylor*
8:30am	Comparing the Effectiveness of Enclosed Camera Trap Systems Used to Survey Long-tailed Weasels (*Neogale frenata*) *Carsten White*
8:45am	Bat Activity Across Urban Forest Plantings in the Metropolitan Area of Lexington, Kentucky *Grayson Collier*
9:00am	A Comparison of Estimates of Foraging Space Use of a Little Brown Bat Maternity Colony Using an Azimuthal Telemetry Model and Traditional Bi-Angulation and Triangulation *Amber Litterer*
9:15am	Relative Activity and Occupancy of Little Brown Bats (*Myotis lucifugus*) Along the Chesapeake and Ohio Canal *Megan Moran*
9:30am	Talus Habitat and Abundance Modeling of Eastern Small-Footed Bats at Shenandoah National Park *Nicholas Kalen*
9:45am	Exploratory Ecology of Reintroduced Elk *Braiden Quinlan*

BREAK
10:00am – 10:30am

FRIDAY, FEBRUARY 16

Salon DE
Moderator: Jimmy Gore

10:30am	Camera Trapping Methods to Target Small and Cryptic Predator Species *Jenna Myers*
10:45am	Roost Tree and Stand Conditions of the Endangered Northern Long-Eared Bat (*Myotis septentrionalis*) in the Mid-Atlantic with a Comparison Between Marine Corps Base Quantico, VA, Prince William Forest, VA, and Rock Creek Park, D.C. *Samuel Freeze*
11:00am	Occupancy and Relative Abundance Estimates of the Endangered Northern Long-Eared Bat (*Myotis septentrionalis*) on the Monongahela National Forest *Jesse De La Cruz*
	End of Student Presentations
11:15am	Relating Morphological Structure to Ecological Niche: Investigating Four Species of Vespertilionidae *Scott Bergeson*
11:30am	Pyrodiverse Forests Support Bat and Insect Diversity *Andrew Eldelman*
11:45am	Operation Desert Bat: Examining Distribution and Environmental Impacts on Bat Populations in the Colorado Plateau Region *Michael St. Germain*

12:00PM – 1:30PM LUNCH PROVIDED IN SALON FGH

FRIDAY, FEBRUARY 16

AFTERNOON SESSION – CONCURRENT ORAL PRESENTATIONS

	Salon D *Moderator: Megan Wallrichs*	Salon E *Moderator: Jennifer Kindel*
Time	**Title, *Presenter***	**Title, *Presenter***
1:30pm	Thirty-two New Records for the Northern Long-Eared Bat (*Myotis septentrionalis*) in Mississippi *Alison McCartney*	30 Years of Bat Houses: Lessons Learned *John Chenger*
2:00pm	Culverts Provide Alternate Roosting Habitat for Cave Bats in North Florida *Lisa Smith*	Indiana Bat Acoustic Survey in Mt. Juliet Tennessee *JD Wilhide*
2:15pm	Estimating Population Status and Trends of Hibernating Bats from the North American Bat Monitoring Program Using a Bayesian Hierarchical Volatility Function *Teresa Bohner*	An Overview of the First Georgia Bat Programmatic Agreement to Provide a Statewide Consultation Process and New Conservation Strategies for Bats and Habitats Impacted by Transportation Structures *Trina Morris*
2:30pm	Importance of Manual Vetting Acoustic Bat Call Files: A Case Study for Northern Long-Eared Bats *Piper Roby*	"Bats in Bridges": Implementation and Results of a Statewide Database on Bat Use of Transportation Structures in Georgia *Maggie Hunt*
2:45pm	Update on the Use of Acoustic Lures to Increase Capture Success of Indiana Bats *Steve Samoray*	Endangered Carolina Northern Flying Squirrel (*Glaucomys sabrinus coloratus*) Resource Selection in High Elevation Red Spruce (*Picea rubens*) Forests *Katie Gorman*

FRIDAY, FEBRUARY 16

3:00pm	Building an Understanding of *Perimyotis subflavus* Hibernations and White-Nose Syndrome in Non-Traditional Hibernacula *Nate Fuller*	Investigating the Species Status of Sherman's Short-Tailed Shrew (*Blarina shermani*): Preliminary Insights *Verity Mathis*
3:15pm	Water-Works: Bat Community Response to Everglades Restoration *Elizabeth Braun de Torrez*	Evaluating Bat Response to Human-Altered Landscape in a Midwestern River Corridor *Tim Carter*
3:30pm	Award Ceremony, Announcements, Closing Remarks	

--Meeting Adjourned--

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POSTER PRESENTATION SCHEDULE

Poster #	Title, Author
S01	Assessment of Population Genetic Structure and State Isotopes (δ^2H) of Southeastern U.S. Tricolored Bats (*P. subflavus*) *Laura Henderson*
S02	Analysis of Guano Among Bat Species from Two Regions Shows Influence of Geography and Diet on the Guano Bacterial Community *Kerrigan Larkin*
S03	Tracking Fecal Contamination of Local Watersheds: Optimization of Mammal Markers *Lauryn Carrington*
S04	On the Front: Tracking White-Nose Syndrome and Bat Distributions on the Southern Colorado Plateau *E.M. Johnston*
S05	Changes in the Nightly Activity of Northern Long-Eared Bat (*Myotis septentrionalis*) Due to Increased Urban Light Intensity in Rock Creek Park, Washington D.C. *Christopher Blume*
S06	Preliminary Analyses of Bat Diversity Responses to Streamside Management Zones Across a Landscape *Roxanne Pourshoushtari*
S07	Advancing Knowledge to Inform Bat Marking Practices *Ashleigh Cable*
P08	Do you see what I see? Documenting Virginia Big-Eared Bats (*Corynorhinus townsendii virginianus*) in Maryland *Dana Limpert*
P09	Long-Term Monitoring of Small Mammals in Urban Greenspace *Lisa Gatens*
P10	Bat Communities in the Upper Coastal Plan of the Southeastern U.S. Private, Working Forests *Angela Larsen-Gray*

S# = Student Poster
P# = Professional Poster

ABSTRACTS

ORAL PRESENTATIONS

WATER-WORKS: BAT COMMUNITY RESPONSE TO EVERGLADES RESTORATION

E.C. Braun de Torrez, L.P. Nicholson, H.K. Ober
Florida Fish and Wildlife Research Institute, Gainesville, FL 32601 (ECB and LPN);
Oregon State University, Corvallis, OR 97331 (HKO)

Over half of wetlands worldwide are degraded or destroyed. Recognition of their ecological importance has led to increased restoration efforts, but little is known about the impacts on wildlife, and in particular, bats. South Florida has experienced extensive development in areas now slated for hydrologic restoration as part of the Comprehensive Everglades Restoration Plan (CERP), the largest hydrologic restoration project in the United States. We investigated the effects of hydrological restoration in the Florida Everglades on bat diversity, community structure and two endangered species (Florida bonneted bats, *Eumops floridanus,* and tricolored bats, *Perimyotis subflavus*). We conducted acoustic surveys at 194 points across a restoration gradient (unrestored, partially restored, restored, and reference) in 2020 and 2021 and characterized roosting habitat for *E. floridanus*. We found significantly higher species diversity, evenness and higher activity of *E. floridanus* and *P. subflavus* in the reference and restored zones. Predictors of activity varied by species but both *E. floridanus* and *P. subflavus* showed positive responses to several characteristics associated with hydrological restoration (e.g., hydroperiod, water depth, freshwater forested wetlands), suggesting that restoration efforts within the Everglades ecosystem may benefit these species. Similarly, all discovered roosts for *E. floridanus* were located in pristine reference sites in freshwater forested wetlands. Insights from this study inform immediate management decisions and contribute to our understanding of how bats are influenced by hydrologic restoration.

ALOPECIA SYNDROME IN GRAY BATS

Ashleigh B. Cable*[1], Megan Kinsella[2], Richard W. Gerhold[2], Elizabeth Hamrick[3], Robert Stinson[3], Chris Ogle[4], Cory Holliday[5], Dustin Thames[6], Emma V. Willcox[1]
School of Natural Resources, University of Tennessee, Knoxville, TN (ABC, EVW);
College of Veterinary Medicine, University of Tennessee, Knoxville, TN (MK, RWG);
Tennessee Valley Authority, Knoxville, TN (EH, RS);
Tennessee Wildlife Resource Agency, Region 4, 3030 Wildlife Way, Morristown, TN (CO);
The Nature Conservancy, Tennessee Chapter, Granville, TN (CH);
Tennessee Wildlife Resource Agency, Region 2, Nashville, TN (DT)

We observed multiple gray bats (*Myotis grisescens*) in 2022 with large patches of fur loss on the dorsal surface of their body. Alopecia syndrome can be a sign of poor health or stress and has numerous possible causes including disease, ectoparasites, and reproduction. In 2023, we designed

an experiment to compare prevalence of alopecia in gray bats across various reproductive stages, characterize the severity of alopecia lesions, and determine the ectoparasites and microbiota present on the regions of fur loss. We harp-trapped 4 summer gray bat roosts 2–3 times between 11 April–30 August 2023 and collected skin swabs and scrapes from each bat with alopecia. We determined the severity of the alopecia lesions on a scale 0–7 by summing the degree of redness (0–2), skin condition (0–1), and percentage of fur loss (0–4). We cultured the skin swabs for fungal and bacterial growth and examined skin scrapes under a microscope to determine the presence of subcutaneous mites. We found no evidence that subcutaneous mites cause the fur loss. We determined that energetically costly processes are related to higher prevalence of alopecia in bats. Prevalence is highest for female bats that are or recently were reproductively active, reaching an average of 6% ± 6 SD (0–15% range) of captured females exhibiting fur loss during the pup rearing period. Alopecia is most prevalent in male bats following spring migration (1% ± 2 SD; 0–4% range). Lactating/post-lactating females had more severe cases than males and were often associated with possible opportunistic infections indicated by redness, irregular skin condition, and the presence of skin microbiota. Conservation strategies aimed at reducing stress during energetically costly periods (e.g., post-migration and during lactation) are likely beneficial to gray bats.

30 YEARS OF BAT HOUSES: LESSONS LEARNED

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In the late 1980's bats were overtaking some homeowner's attic spaces, compounding the problems bat conservation was already dealing with in the overly sensationalized scare media. Small and sometimes large neighborhood bat colonies were drawing more attention, and even if a homeowner or pest control company managed to conduct a successful bat exclusion, sometimes the now "homeless" bats caused trouble for neighbors in the community, moving the problem elsewhere. The idea for a "bat house" was not new, and the PA Game Commission wanted to use them as a tool for homeowners to keep bats around, if desired. At that time, bat houses did not work reliably, a problem which was solved with diligent testing, observations, and some luck. Today's most successful little brown bat populations are in artificial roosts located close to winter hibernacula, highlighting the importance of both resources. Throughout the Southeast, bats utilize culverts, garages, bridges, and other structures which bat houses can be used as a tool for when bat and human conflicts inevitably arise. We will review bat houses and the turning point of the modern design, the strategy behind placement, maintenance considerations, and overheating. We will look at bat house fails, unintended consequences, unexpected data from post-WNS, and other lessons learned that all contribute to our bat house recommendations today.

BAT ACTIVITY ACROSS URBAN FOREST PLANTINGS IN THE METROPOLITAN AREA OF LEXINGTON, KENTUCKY

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Urbanization is widespread and predicted to continue in coming decades. Despite reforestation being recognized as a crucial conservation focus to combat the negative ecological effects of urbanization, the benefits of planted urban forests for North American bat species remains uncertain. To better understand the importance of reforested habitats for bats, we assessed: 1) fine-scale differences in bat activity at urban forests plantings (edge versus interior), 2) patterns in bat activity across a chronosequence of forest plantings (dating from 1999 to present), and 3) the likely importance of planting size (spanning ca. 0.5-7.5 ha) for bat use at Reforest the Bluegrass (RTB) sites in the Inner Bluegrass region of Fayette County, Kentucky. Bat activity was assessed using acoustic surveys across 10 RTB sites, resulting in 420 detector nights across 60 detector locations from May to August of 2023. We found bat activity and species richness were greater at the edges of forest plantings rather than in the interior of forest plantings (total activity and four phonic groups). Additionally, a negative correlation was observed between bat activity and years since planting for most phonic groups (except for big brown bats and silver-haired bats). Conversely, bat activity was positively correlated with the size of forest planting for most phonic groups (except hoary bats). Furthermore, bat activity was positively correlated with tree height, DBH, and canopy closure across plantings, and species richness was positively correlated with all habitat attributes except basal area. Ongoing efforts will result in GLMMs describing the impacts of park characteristics and habitat attributes on bat activity and species richness. With continued threats from urbanization, bats may become increasingly dependent upon reforested areas. Our preliminary results suggest replanting with greater edge, as well as greater tree heights, DBH, and canopy closure will see greater overall use by bats.

BUILDING AN UNDERSTANDING OF *PERIMYOTIS SUBFLAVUS* HIBERNATION AND WHITE-NOSE SYNDROME IN NON-TRADITIONAL HIBERNACULA

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While *Perimyotis subflavus* are severely impacted by white-nose syndrome (WNS) throughout their range, there are populations in east Texas using non-traditional hibernacula (highway culverts) that evade the disease even though *Pseudogymnoascus destructans* (*Pd*) has been observed in their hibernacula. The mechanism in which these populations can persist with no disease pathology has yet to be understood. We aim to better understand hibernation behaviors that may allow WNS resistance or evasion. The objectives of this study are 1) to summarize the potential for *Pd* growth among sites and determine the impact of microclimate variables on the potential, 2) study torpor use and mid-winter movements of hibernating bats, and 3) to predict the potential for *Pd* growth over winter given microclimate variability. Initial analyses determined the impact of the amount of time spent within the fungal growth range of *Pd* and its impact on WNS status in these hibernacula. We then predicted *Pd* growth rate over hibernation for each site and assessed the impact of site characteristics on growth rate. We will also present methodology and preliminary analyses of

temperature-sensitive telemetry. We hope to use this information to inform management and potential interventions for WNS at this critical population of an at-risk species.

OCCUPANCY AND RELATIVE ABUNDANCE ESTIMATES FOR THE ENDANGERED NORTHERN LONG-EARED BAT (*Myotis septentrionalis*) ON THE MONONGAHELA NATIONAL FOREST

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Following the onset of white-nose syndrome (WNS), the endangered northern long-eared bat (*Myotis septentrionalis*) has experienced extreme population declines across the High Appalachian Plateau of West Virginia. Forest management actions that may impact the species are of particular concern to land management agencies and their partners. However, scarcity of the once-common species hampers collection of contemporary capture data and roost tree locations, hindering population monitoring and management. To assist land managers in avoiding take of northern long-eared bats, and to promote conservation of likely occupied sites, we designed and deployed a forest-wide acoustic survey effort on the Monongahela National Forest during the summers of 2022 and 2023. To assess occupancy, detectability, and relative abundance of the species, we fit Bayesian stacked-static multi-season occupancy models, i.e., MacKenzie and Royle-Nichols models, to acoustic data from *n* = 119 sites sampled for 3 (± 1.4 [SD]) weeks. We found that northern long-eared bat occupancy was highest in large core (>200 ha) areas of dry oak-pine forests. Importantly, our results suggest that site-level northern long-eared bat occupancy was moderately high (ψ = 0.70 [CI 0.51–0.87]). We similarly observed that northern long-eared bat relative abundance was highest in association with dry-oak pine forest. However, we observed no relation with relative abundance and large core (>200 ha) forests. Unlike occupancy, relative abundance (mean weekly echolocation passes) was low (1.65 [CI 0.82–3.09]) and suggests that occupancy is likely driven by very few animals. Furthermore, based on recent research, these relative abundance estimates may suggest the absence of maternity colony activity on the Monongahela National Forest. We observed no significant driver of detectability. Despite persistence across much of the Monongahela National Forest, northern long-eared bat relative abundance appeared very low, potentially indicating non-reproductive populations and raising concerns about future regional extirpation.

RELATING MORPHOLOGICAL STRUCTURE TO ECOLOGICAL NICHE: INVESTIGATING FOUR SPECIES OF VESPERTILIONIDAE

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To better understand the foraging behaviors and habits of Midwestern bat species, we conducted research focusing on the skull ecomorphology of four Vespertilionid species; *Lasiurus cinereus, Lasiurus borealis, Eptesicus fuscus,* and *Lasionycteris noctivagans.* These species represent two clades of Vespertilionidae (Lasiurini *and* Eptesicini*)* as well as different body sizes (Large bodied bats, Small bodied bats*).* The goal of this project was to gain insights on how these sympatric species may

be able to exploit different foraging niches due to varying morphologies. We collected ~30 mandibles and craniums for each species, captured high-resolution photographs in multiple views and then employed a landmark-based approach to compare morphologies. I found that the four species were all significantly different from one another in size measurements of 14 out of the 24 characteristics ($p < 0.001$). Tukey's post-hoc tests showed some species overlap in the other 10 characteristics (ex: Canine-Canine width; *Lasiurus cinereus* (0.73 ± 0.04), *Lasiurus borealis* (0.52 ± 0.03), *Eptesicus fuscus* (0.61 ± 0.02), *Lasionycteris noctivagans* (0.51 ± 0.02). When scaling for size differences I observed Lasiurini bats with shorter and wider rostrums, higher braincases and overall shorter skulls. These characteristics demonstrate adaptations for robust and durable craniums, indicating the ability to consume larger and harder prey. When considering body size and shape variation *Lasiurus cinereus* should consume the largest prey, and *Lasiurus borealis* may serve as a habitat generalist. *Eptesicus fuscus* should be able to consume hard bodied prey such as a beetle, despite a narrow and long skull due to its high coronoid processes, wide zygomatic arches, and robust canines. *Lasionycteris noctivagans,* however, may be most limited to small and soft bodied prey. These four bat species may partition dietary resources based on slight differences in skull morphology.

PYRODIVERSE FORESTS SUPPORT BAT AND INSECT DIVERSITY

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Prescribed fire is widely used throughout the southeastern U.S. to manage forest lands. Compositional and structural changes in forest habitat caused by prescribed fire can influence the bat community and their insect prey. Our research objectives were to evaluate bat and insect community responses to low-severity fire management used to restore and maintain pine-dominated southeastern forests in the southern Appalachians of Alabama. We assessed bat foraging activity and insect abundance and dry weight in response to fire interval (i.e., time between fires) and fire recency (i.e., time since last fire), two significant components of fire regimes that impact forest vegetation structure. We deployed acoustic monitors and UV light traps in late spring through the summer of 2019 and 2021 across 2 fire intervals (1–3 years and >3–8 years) and 3 fire recency groups (last burned <1 year, 1–<2 year, and 2–<3 year). For each site, we sorted identified bat calls into 3 phonic groups (Low, Mid, and *Myotis*) and identified insects to order and measured dry weight. Canopy structure was similar across fire regimes, but midstory density increased with longer intervals and time since last burn, and understory cover increased with time since last burn. The effect of fire regime varied across bat phonic groups. Low and Mid phonic bat groups had greater activity in sites burned >2 years previously with greater understory and midstory cover. *Myotis* activity increased at sites in the longer burn interval with greater midstory clutter. Insect abundance and dry weight were not affected by either fire interval or recency, suggesting insects quickly recolonize recently burned areas. Our results support that variations in low-severity prescribed fire regimes used to restore southeastern pine forests can benefit bat and insect communities by creating a pyrodiverse landscape supporting a mosaic of habitat conditions.

ROOST TREE AND STAND CONDITIONS OF THE ENDANGERED NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) IN THE MID-ATLANTIC WITH A COMPARISON BETWEEN MARINE CORPS BASE QUANTICO, VA, PRINCE WILLIAM FOREST PARK, VA, AND ROCK CREEK PARK, D.C.

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The now federally-endangered northern long-eared bat (*Myotis septentrionalis*) has disappeared throughout much of the eastern United States from the impacts of White-nose Syndrome. However, residual populations have been observed in the lower Potomac River Basin of the District of Columbia metro area in contrast to more interior and upland portions of the surrounding mid-Atlantic. Intensive mist netting was conducted within Rock Creek Park (ROCR), located in a heavily developed landscape, from 2016 to 2018 and within Marine Corps Base Quantico and Prince William Forest Park (MCBQ/PRWI), located adjacent to each other in a more suburban area from 2017 to 2023. These efforts documented successful reproduction and maternity colonies, or groups of roosts that females use, along with male roosts. We examined roost tree and habitat metrics for ROCR and MCBQ/PRWI. Suppressed *Acer rubrum* in later decay stages were used in greater abundance than expected at MCBQ/PRWI, whereas taller trees were used at ROCR and selection was equitable between *Acer rubrum*, *Fagus grandifolia*, *Liriodendron tulipifera* and oaks *Quercus* spp. Tree species and forest structure overlap with other day-roost studies in the Northeast, central Appalachians and Ohio Valley varied widely. At present, both ROCR and MCBQ/PRWI provide ample day-roost habitat for this species. Differences between the two study areas may be an artifact of MCBQ/PRWI being an early mature forest whereas much of ROCR is approach late mature to old-growth. Also, captures in MCBQ/PRWI were male-biased where in ROCR captures were female-biased.

ENDANGERED CAROLINA NORTHERN FLYING SQUIRREL (*Glaucomys sabrinus coloratus*) RESOURCE SELECTION IN HIGH ELEVATION RED SPRUCE (*Picea rubens*) FORESTS

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The Carolina northern flying squirrel (*Glaucomys sabrinus coloratus*) inhabits high elevation red spruce (*Picea rubens*) forests in the southern Appalachians. Naturally fragmented by post-glacial climate change and vegetation shift as well as exploitative logging at the turn of the twentieth century, additional red spruce range contraction is projected under most future climate scenarios. Habitat loss will have cascading effects on high elevation wildlife in the region, such as the northern flying squirrel,

creating additional barriers to genetic exchange, increased resource competition, and possible local to regional extirpation. In order to develop conservation strategies, managers need a better understanding of Carolina northern flying squirrel habitat relationships. To date, attempts to do this have been conducted at coarse scales with a variety of imperfect data. Using a new, high-resolution (1m) aerial imagery coverage of red spruce, we created a northern flying squirrel resource selection function using two decades of den and foraging locations to better describe habitat associations and to provide data to parameterize future climate change projections. Consistent with previous work, we found that predicted habitat quality was associated with red spruce cover. Adding to previous work, we observed that increased forest canopy height, proximity to open habitat, and landform index also were significant factors for the squirrel's current distribution. Presently, we are exploring the nuances of these relationships on different "sky-islands" in the southern Appalachians and creating composite models that will be optimal for managers to make conservation decisions at both the individual massif and overall regional scale.

"BATS IN BRIDGES": IMPLEMENTATION AND RESULTS OF A STATEWIDE DATABASE ON BAT USE OF TRANSPORTATION STRUCTURES IN GEORGIA

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Bats have been known to utilize bridges across the United States for many decades (see "Bats in American Bridges," by Keeley & Tuttle, 1999), but occurrence has not been thoroughly documented until more recently. In the past decade, both on-the-job inspections by transportation departments and targeted research on transportation structures by wildlife conservation agencies have demonstrated that culverts and bridges serve as suitable roosting habitat for bat populations. Georgia's DNR, USFWS Field Office, and DOT have established a standardized survey methodology for detecting bat presence at transportation structures, in order to effectively implement avoidance and minimization measures for transportation projects. The results from these inspections (2015 - YTD) performed statewide by Georgia DNR and partners indicate a 20% detection rate for bat use of transportation structures in Georgia. Almost 2,800 surveys have been completed within the state, with approximately 2,220 structures surveyed. The most commonly observed species include the big brown bat (*Eptesicus fuscus*), the southeastern myotis (*Myotis austroriparius*), the tricolored bat (*Perimyotis subflavus*), and the Mexican free-tailed (*Tadarida brasiliensis*) bat. Tricolored bat is the main species observed roosting in transportation structures during the winter, while the main species observed during the summer is southeastern myotis. Challenges of maintaining a living database on these surveys have included data variability due to incorporation of legacy data and numerous contributors, and the associated quality control; however, the insights provided by this data have proved invaluable for agency coordination and management decisions.

TALUS HABITAT AND ABUNDANCE MODELING OF EASTERN SMALL-FOOTED BATS AT SHENANDOAH NATIONAL PARK

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Most natural history aspects of the eastern small-footed bat (*Myotis leibii*) remain relatively poorly understood in the central Appalachians. Traditional survey methods hibernacula counts and summer mist-netting have failed to provide robust population estimates due to their unique habits. Visual searches of their preferred day-roost habitat, talus slopes, have proven effective but have thus far been limited in scope. We conducted visual searches of talus slopes in Shenandoah National Park, Virginia and explored methods for modeling potential habitat and abundance using remotely sensed data. We observed 152 eastern small-footed bats in 19 of 24 talus slopes searched and maternity colonies in 12. We derived topographic landscape variables slope, aspect, elevation, topographic position index, and vector ruggedness measure from digital elevation models and used these along with high resolution (1 m) imagery to classify available talus habitat from sampled training data. Variables talus slope area, forest type, slope, elevation, topographic position index, and vector ruggedness measure were significant in predicting bat abundance in the top generalized linear model. Aspect was not significant in predicting bat abundance, however, it was the only significant predictor for presence of maternity colonies (p = 0.007) that were predominately located in south and southwestern aspects. Results suggest synthesis of visual searches, abundance modeling, and talus slope classification may be useful for quantifying eastern small-footed bat populations and better understanding their distribution on a broader landscape scale in the central Appalachians.

A COMPARISON OF ESTIMATES OF FORAGING SPACE USE OF A LITTLE BROWN BAT MATERNITY COLONY USING AN AZIMUTHAL TELEMETRY MODEL AND TRADITIONAL BI-ANGULATION AND TRIANGULATION

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Insectivorous bats can be difficult subjects for movement studies because of their small size and high vagility. Traditional foraging studies of *Myotis* spp. have used fixed station telemetry and associated multi-azimuthal observations to create location estimates of individuals. To understand how different calculations of animal locations affect estimates and size of space use, we compared location estimates and associated movement models calculated from traditional methods using Lenth's maximum likelihood estimator (MLE) to those calculated using a Markov chain Monte Carlo algorithm (MCMC). During the summer of 2022, we radio-tagged 29 little brown bats (*Myotis lucifugus*) from a maternity colony along the Potomac River in Maryland and collected bearings of individuals using fixed station telemetry from sunset until bats returned to the maternity roost. We used the R package *henry-dang/radiotrack* to determine location estimates using Lenth's MLE. We compared these to location estimates obtained from the R package *razimuth* that used a MCMC Azimuthal Telemetry Model (ATM) to estimate locations with error from both single and multi-azimuthal observations. We

calculated movement models for each individual and fit them to an auto-correlated kernel density estimation (AKDE) of space use using the R package *ctmm*. We compared the ATM and traditional 95% and 50% isopleths of individual bats. For all bats, we found that number of locations increased as *razimuth* was able to incorporate single azimuth observations. We also found that ATM AKDEs were more conservative in size than the traditional methodology due to outlier locations being censored from the final movement model. This methodology can be incorporated into previous and future studies of insectivorous bats to increase the number of locations and accuracy of space use and foraging habitat selection.

INVESTIGATING THE SPECIES STATUS OF SHERMAN'S SHORT-TAILED SHREW (*BLARINA SHERMANI*): PRELIMINARY INSIGHTS

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Sherman's short-tailed shrew (*Blarina shermani*) was described as a distinct species in 2006, elevated from *B. carolinensis shermani* based on eight cranial characters, overall larger size, and slightly darker color compared to the other two *B. carolinensis* subspecies in Florida (*B. c. carolinensis* and *B. c. peninsulae*, which is recognized by some authorities as a distinct species *B. peninsulae*). No individuals have been caught from the type locality since 1955. Trapping efforts started in 2013 by the Florida Wildlife Commission to locate Sherman's short-tailed shrew yielded only 3 *Blarina* individuals about 31 km SE of the type locality, which were genotyped as *B. carolinensis* using cytochrome b data. We extracted DNA from 10 historical museum specimens collected from Lee County (including the type locality) that were designated as *B. shermani* and amplified fragments of the cytochrome b gene. Bayesian phylogenetic analyses of these historical data along with modern samples revealed that *B. shermani* may not be genetically distinct from nearby *B. c. peninsulae* and thus may not need be recognized as a distinct species. However, there were noted genetic distances between *B. c. carolinensis* and *B. c. peninsulae* as well as western subspecies *B. c. minima*. We plan to continue investigating the genetic relationships among the *Blarina* groups in Florida using more comprehensive genetic data in the future.

THIRTY-TWO NEW RECORDS FOR THE NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) IN MISSISSIPPI

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Prior to August 2023, a total of three occurrence records for the northern long-eared bat (*Myotis septentrionalis*) had been documented in Mississippi. These records included individuals observed in an abandoned chalk mine in Tishomingo County in 1937, 1939, 1979, (Mississippi Museum of Natural Science 2007) and 2004 (McCartney and McCartney 2004). The second and third occurrence records for this species were obtained through mist net surveys with two individuals captured in Sharkey County in 1999 and 2000 (Wilf 2002) and one individual captured in Wilkinson County in 2017 (Cross

2021). During the Mississippi Bat Working Group Third Annual Bridge Blitz in August 2023, eight northern long-eared bats were observed using two different culverts less than one mile from one another in Warren County (Morris 2023). These are the first county records for this species in Warren County and the first culvert roosts documented for this species in Mississippi. One-hundred thirteen culverts and 33 bridges were surveyed in seven counties from August – October 2023 to find additional roosts for this species, as part of the Mississippi Bats and Bridges Initiative. Twenty-nine culverts and three bridges were found to be occupied by the northern long-eared bat (representing a 26% and 9% occupancy rate respectively out of the total number of culverts/bridges surveyed) in six counties. A total of 76 northern long-eared bats were documented in 29 culverts and three bridges, with 18 of the culverts containing one individual each and one bridge containing 17 individuals. Twelve genetic samples were collected with nine confirmed as northern long-eared bats and three not yet processed. Twenty-nine of the new sites have been surveyed before with no northern long-eared bats previously observed (22 are surveyed every winter, 7 have been surveyed once during the summer and 3 have never been surveyed before).

EVALUATING BAT RESPONSE TO HUMAN-ALTERED LANDSCAPE IN A MIDWESTERN RIVER CORRIDOR

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Bats continue to face numerous conservation challenges across the United States including wind energy development, the spread of white-nose syndrome, and habitat loss. Human alterations to natural environments can impact the presence of bats. Our goal is to examine bat use across a gradient of habitats altered by humans. During the 21-22 summer seasons, we used acoustic detectors to survey a variety of sites to examine bat response to human-altered habitats along the White River corridor in Delaware County, IN. To ensure sampling occurred across a range of habitat types, we created an apriori model categorizing 1-km sections of habitat into five habitat groups based on habitat structure and human influence. Within each category, we randomly selected for six sample sites, totaling 30 sites along the river corridor. Habitat and environmental covariates were measured using artificial light measurements, field observation data, and ArcGIS Pro. Calls were analyzed using Kaleidoscope and BCID software along with manual identification based on species rarity and call structure attributes. We used a Dail-Madsen N-mixture model with a negative binomial distribution to estimate call abundance and detection probabilities to evaluate the effects of habitat structure on bat use. The dominant species in the study area were overwhelmingly big brown bats, followed by the Myotis sp. group, eastern red bats, evening bats, silver-haired bats, and tricolored bats. Due to low sample size, hoary bats were ineligible for analysis. Species exhibited a wide variety of responses to urban variables, particularly artificial light. Every species model, whether a forest-obligate or a generalist species, predicted that higher levels of riverbank canopy percentage yield an increased abundance of bats. Our aim is to gain a better understanding of species-specific habitat requirements for struggling bat populations and aid future management decisions regarding habitat protection and the effects of land development on bats.

RELATIVE ACTIVITY AND OCCUPANCY OF LITTLE BROWN BATS (*Myotis lucifugus*) ALONG THE CHESAPEAKE AND OHIO CANAL

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The little brown bat (*Myotis lucifugus* [MYLU]) is a species of concern due to dramatic declines following the introduction and spread of white-nose syndrome (WNS), a disease caused by the fungus *Pseudogymnoascus destructans* (*Pd*). However, modest population increases have been recorded in the Northeast, and anecdotal evidence suggests the same for the mid-Atlantic region. If populations are truly increasing, it is possible that activity patterns and occupancy on the landscape would reflect a positive change. We created occupancy and relative activity models from bat acoustic data collected on the National Park Service's Chesapeake and Ohio Canal National Historical Park (C&O) along the Potomac River in southern Maryland from 2016-2022. Additionally, because the park runs from Washington D.C to Cumberland, Maryland, spanning 3 physiographic provinces and a diverse urban to rural gradient, it represented a good opportunity to assess a wide suite of habitat variables, and other predictors of detection, such as weather and seasonality, which could be used to inform conservation and management across this landscape. Over this 7-year period, none of our habitat variables had an influence on MYLU occupancy in this region, although seasonality and amount of precipitation were strong predictors of detection. Detection probability also increased with year. This is supported by our relative activity models, which showed an upward trend of bat activity over years, suggesting that similar to the Northeast, MYLU populations might be increasing in this region.

AN OVERVIEW OF THE FIRST GEORGIA BAT PROGRAMMATIC AGREEMENT TO PROVIDE A STATEWIDE CONSULTATION PROCESS AND NEW CONSERVATION STRATEGIES FOR BATS AND HABITATS IMPACTED BY TRANSPORTATION PROJECTS

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The recent proposal to list the tricolored bat (*Perimyotis subflavus*) as endangered by the USFWS has extended the federal bat range from a limited area of several counties in north Georgia to the entire state. This expansion means that the Georgia Department of Transportation (GDOT) will have increased federal consultation requirements and a greater potential to impact bat habitat within project rights-of-way (ROWs) if the species is listed. In addition, all bats in Georgia protected by the State and impacts to transportation structures with known roosts must be considered when conducting maintenance and demolition projects. To reduce costs and project delays, multiple partners developed a programmatic agreement for most transportation project types in Georgia. The intent of this collaborative document is to implement a streamlined, statewide consultation for protected bat species (federal and state), resulting in better conservation outcomes. The agreement highlights multiple strategies to protect bats on transportation structures and in ROWs. One unique

strategy was developed to offset the inevitable loss of suitable forested habitat in ROWs. Through an associated state interagency agreement, GDOT will provide monetary support to the Georgia Department of Natural Resources (GA DNR) to be used for bat conservation efforts. Funding amounts will be calculated annually, based on the amount and timing of suitable federally listed bat habitat lost. This funding agreement allows GA DNR to address conservation and recovery of listed bat species with strategies including but not limited to land acquisition, land management, and research.

CAMERA TRAPPING METHODS TO TARGET SMALL AND CRYPTIC PREDATOR SPECIES

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In the Southeast, small, cryptic predators, such as the long-tailed weasel (*Neogale frenata*) and eastern spotted skunk (*Spilogale putorius*), are of conservation concern, potentially because of increased competition with more abundant predators, habitat loss, and disease. Camera traps are commonly used to monitor carnivores, but difficulties in detecting cryptic species limit our understanding of possible declines and range shifts. Refining standard camera trapping methods to target rarely documented species could increase detections and allow for better population and trend estimates. Therefore, we compared a camera trapping protocol designed to monitor the entire mesopredator community to a method targeting cryptic, and potentially rare, predators. We conducted scent detection dog surveys for long-tailed weasels and used the results to inform placement of 17 cameras, which were deployed from March to December 2023 on a wildlife management area in northern Georgia. We compared detections of cryptic species at these cameras to detections from 120 camera traps deployed throughout the year as a part of a general mesopredator community monitoring project. General survey cameras detected long-tailed weasels at 12 (0.01%) and eastern spotted skunks at 8 (0.007%) of 1,140 camera sites. Cameras informed by scent dog surveys detected long-tailed weasels at 14 (82%) and eastern spotted skunks at 5 (29%) of 17 camera sites. We detected American mink (*Neogale vison*) at 2 (12%) of the targeted locations but did not detect mink with the general sampling method. Cameras targeting cryptic species based on scent detection dog surveys resulted in higher detection rates and more reoccurring detections. Increased detection rates resulting from this method will provide valuable information necessary to assess population statuses and determine the current distributions of rarely documented predators.

EXPLORATORY ECOLOGY OF REINTRODUCED ELK

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Reintroductions of extirpated species are an important tool in wildlife conservation. Understanding how reintroduced populations acclimate to novel environments can lend insight into social learning and is needed to assess reintroduction success and to maximize efficacy of subsequent efforts. From 2012 – 2014, the Virginia Department of Wildlife Resources implemented a soft-release of elk (*Cervus canadensis*) translocated from eastern Kentucky to southwestern Virginia. We investigated home range establishment and post-release movements, by evaluating weekly movement and space use patterns of reintroduced elk (n = 60) for ≥ two years post-release. Following soft releases each year, we found elk released in 2012 took longer to establish home ranges compared to those released in 2013 and 2014. Elk exhibited variation in weekly movement and space use that often correlated with the onset of different biological seasons (e.g., gestation, parturition, and mating season), likely driven by energetic requirements and possibly compounded by seasonal changes in forage quality and/or abundance. We found adult elk dispersed farther following release than both yearlings and calves. Release site fidelity increased, and home ranges were often smaller in subsequent years possibly as a result of individuals joining established social groups which were already familiar with the landscape. Our findings suggest the selection of a release site, the number of released cohorts, and the composition of sex and age classes for released individuals are important considerations for successful reintroductions.

IMPORTANCE OF MANUALLY VETTING ACOUSTIC BAT CALL FILES: A CASE STUDY FOR NORTHERN LONG-EARED BATS

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Definitively identifying bats based on their acoustic calls is difficult and sometimes impossible. This is particularly true for *Myotis* species that can make similar calls to one another which could lead to false positive detections of federally listed bat species as defined by the Endangered Species Act in areas where these species are not known to occur. This is problematic for conducting species presence or probable absence surveys using acoustic detection, particularly when manual vetting of calls is not conducted, which is an option but not a requirement by current United States Fish and Wildlife Service (USFWS) guidelines. We conducted simultaneous mist-net and acoustic surveys for bats in areas of Edgecombe and Johnston counties in eastern North Carolina where there are capture records of a common *Myotis* species, the southeastern myotis (*Myotis austroriparius*), but not for the federally endangered northern long-eared bat (*Myotis septentrionalis*). We caught southeastern myotis at six of the 12 sites surveyed. Although automated acoustics software produced

a Maximum Likelihood Estimation (MLE) value for probable presence of northern long-eared bats at three of the 12 sites surveyed, we did not catch any individuals or confirm the species acoustically through manual vetting. If we had used automated software alone without manual vetting, we would have incorrectly presumed presence of an endangered species at 25% of our sites. Therefore, manual vetting is highly recommended for northern long-eared bat acoustic surveys where southeastern myotis co-occur.

UPDATE ON THE USE OF ACOUSTIC LURES TO INCREASE CAPTURE SUCCESS OF INDIANA BATS

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In the summer of 2012, Copperhead Environmental Consulting, Inc. began conducting field experiments to determine the feasibility and effectiveness of using acoustic lures to increase capture success of the endangered Indiana bat (*Myotis sodalis*). These experiments continued for the next three years, using a variety of techniques and types of acoustic lures as well as targeting additional bat species. Results showed that acoustic lures can generally increase capture rates for bats, dramatically for some species, but did not show a significant increase in Indiana bat captures. In 2023 we took new approach, using synthesized bat calls created by Dr. David Hill and a different type of lure, the Autobat MK2. Using four MK2 lures we tested six synthesized call sequences against a control (silence) at harp traps set outside of traditional bat flyways (e.g., roads, creeks, water sources). We also used thermal cameras (Teledyne FLIR Scion) at each harp trap location to record bat activity and behavior throughout the survey period. A total of 31 bats of five species were captured during the study including 23 Indiana bats. Additionally, 438 bat behavioral responses were recorded on the thermal cameras with an average interaction time of 07.97 seconds. All call sequences outperformed the control and we found bats responded significantly more often to synthesized Indiana bat social calls. Our latest study adds to the growing evidence supporting the use of acoustic lures to increase bat capture success and reinforces the utility of these devices in a post white-nose syndrome world.

CULVERTS PROVIDE ALTERNATE ROOSTING HABITAT FOR CAVE BATS IN NORTH FLORIDA

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Culverts under roads can provide important habitat for bats that typically roost in caves. To better manage bats in structures, it is necessary to understand regional variation in culvert use. We

surveyed 211 culverts 1-3 times during the winter torpor period in 2018 and 2019 and in summer in 2018 in north Florida. To determine temporal variation in use during winter, we surveyed 34 culverts repeatedly from November 2019–April 2020. For each culvert, we recorded values for 19 characteristics related to conditions inside the culvert, outside the entrances, and the surrounding landscape. We used logistic regression to determine the influence of environmental and physical variables on the probability of encountering bats and generalized linear regression models to evaluate the influence on counts of bats. Southeastern myotis (*Myotis austroriparius*) was the most common species observed in culverts in both seasons. Southeastern myotis were more likely to be present when culvert entrances were farther from the road edge, in culverts with multiple structures, weep holes present, and in rural areas and were more abundant in longer concrete culverts with multiple consecutive tunnels. During winter, southeastern myotis were present in >50% of culverts and peaked in abundance in mid-November. Wintering tricolored bats (*Perimyotis subflavus*) occurred in ~15% of culvert, while in summer, only two bats were detected at a single site. Tricolored bats were more likely to be encountered when culvert entrances were farther from paved roads. Tricolored bats were first observed roosting in culverts in mid-November and increased in abundance until late January. Our study highlights the use of culverts as alternative roosting sites for southeastern myotis and tricolored bats in Florida and provides insights into culvert features and seasonal variation in culvert use that may be useful to develop conservation guidelines.

OPERATION DESERT BAT: EXAMINING DISTRIBUTION AND ENVIRONEMNTAL IMPACTS ON BAT POPULATIONS IN THE COLORADO PLATEAU REGION

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Bat communities in the Southwest have the highest species diversity in the United States. Recent cross-continent expansion of white-nose syndrome (WNS) has increased the urgency to obtain basic ecological data in order to predict and evaluate the potential impacts of this disease on the bat communities regionally. This is critical on the Colorado Plateau where relatively little survey work historically has occurred. Our study represents the first, long-term comprehensive year-round assessment of bat populations across this vast geographic region. Since its inception in 2018, our work has expanded to 9 national parks and the Navajo nation. To assess species distribution, we are collecting year-round acoustic data from 120 sites combined with 22 independent mist netting locations to obtain morphometric data and swab individuals for the presence of WNS. We modeled temporal variations using Generalized Additive Models (GAMs) and effects of environmental factors on bat activity with Generalized Linear Mixed Models (GLMMs). We created spatial distribution models based on the top GLMM model for each species using ArcGIS and Program R. To date we have identified 19 species acoustically, captured 15 species and modeled the seasonal distribution of several across portions of the study area. This long duration study and vast geographic scope will identify bat distributions, provide valuable insight into the effects of temporal, environmental, and landscape factors influencing these spatial extents, and aide in monitoring WNS in the region.

TRACKING GRAY BAT (*Myotis grisescens*) MOVEMENT USING MOTUS TOWERS IN SOUTHWEST VIRGINIA AND NORTHEAST TENNESSE

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The gray bat (*Myotis grisescens*) is a cave-obligate species occurring in the mid-South that is strongly associated with riparian habitats. The species has been listed as federally endangered since 1976 after a sharp decline in population size due to human disturbance at hibernation and maternity caves. However, because of cave protection and restoration efforts, and now perhaps due to an ecological niche vacancy created by the decline of other species affected by White-Nose Syndrome, gray bat populations appear to be growing and expanding their distribution. In southwest Virginia, gray bats are largely restricted to summer bachelor caves in the Upper Tennessee River Basin, however there is a known maternity colony in the city of Bristol on the border of Tennessee that has been occupied for the past 30 years. To determine where this colony's primary foraging grounds are and to better define seasonal movement patterns between the two states, in cooperation with the Tennessee Valley Authority, we installed Motus wildlife tracking stations downstream at three reservoir dam visitor centers and along a series of reservoirs, and 4 upstream in the Beaver Creek (1) and Holston River (3) systems. We also maintained an 8th receiving unit at the maternity colony which was our main gray bat capture site. We radio-tagged 107 gray bats between May and October of 2023 and got reliable detections for 43 of those tagged bats. All of our towers detected gray bats throughout the monitoring period. These data are being used to assist with development of regional gray bat resource selection, i.e., impoundments or free-flowing riverine habitats, and to test the influence of within-night timing and weather on gray bat activity.

COMPARING THE EFFECTIVENESS OF ENCLOSED CAMERA TRAP SYSTEMS USED TO SURVEY LONG-TAILED WEASELS (*NEOGALE FRENATA*)

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In ecosystems across the United States, *N. frenata* plays an integral role as a mesopredator and top-down regulator of small mammal populations. However, factors including habitat loss and overharvesting have led to declining populations. This has made the elusive mammal rarer in the landscape and more difficult to survey. In recent years, enclosed camera trap systems, modified to target smaller wildlife, have shown promise in generating detections of *N. frenata* and related species. However, because these methods are new, research to evaluate their effectiveness is required. Our objective was to evaluate three enclosed camera trapping systems, the AHDriFT system (camera traps in overturned buckets with a drift fence), Mostela (camera traps in overturned buckets with a PVC pipe entrance), and MoHDriFT system (a combination of the previous two systems) in their respective abilities to detect *N. frenata*. All three systems were deployed in three sites in Northeast

Indiana, USA from February-November 2023 for 176 trap nights. Traps were active for four weeks without bait followed by four weeks with canned sardines placed in the traps. This survey format was repeated three times throughout the year. We detected three unique observations of *N. frenata* from the same site (P = 0.06), all occurring in the AHDriFT system when bait was not present. AHDriFT and MoHDriFT systems performed equally well in overall prey species visitation (AHDriFT 1,035 visits and MoHDriFT 2,121 visits; P = 0.46), while the Mostela was significantly less than the other two (299 visits; P < 0.01). The results from our project indicate that the AHDriFT system may improve the detectability of *N. frenata* by factors not associated with prey visitation. Instead, the design of the AHDriFT system (e.g., wider entrance) may make it more likely to be visited by *N. frenata* due to a lesser perceived threat.

ESTIMATING POPULATION STATUS AND TRENDS OF HIBERNATING BATS FROM THE NORTH AMERICAN BAT MONITORING PROGRAM USING A BAYESIAN HIERARCHICAL VOLATILITY FUNCTION

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The North American Bat Monitoring Program (NABat) is a collaborative endeavor seeking to address critical gaps in our understanding of bat abundance and population trajectories. We present the program's inaugural Status and Trend results for bats surveyed with winter colony counts. NABat has counts for 14 species, of which sufficient numbers of counts allow status and trend determination for 12 species, including several imperiled species (Indiana Bat, Northern Long-eared Bat, Gray Bat) and key species under review for listing under the Endangered Species Act (Tricolored Bat and Little Brown Bat). We will describe the analytical approach being used (hierarchical Bayesian model with growth rate volatility function). This approach accommodates rapid population changes like sudden declines, which allows for proper description of population rates of change in the face of mortality from white-nose syndrome and other acute stressors. We will present regional and species-wide results of current population trajectories based on count data from 1990 to 2023.

INDIANA BAT ACOUSTIC SURVEY IN MT. JULIET TENNESSEE

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With White Nose Syndrome having reduced many bat populations, it has become even more important to fill information gaps regarding numbers and species of bats on the landscape and what types of habitats are being utilized. This is particularly important in developing urban environments. We conducted an acoustic survey in Wilson County, Tennessee in the Mt. Juliet area. This survey was conducted under a Tennessee Imperiled Bat Conservation Fund and US Fish and Wildlife Services grant to confirm areas of Indiana bat (*Myotis sodalis*) detection and help identify potential

conservation and recovery focus areas for Indiana bats and other associated species. Our survey was conducted from 1 May through 5 August 2023. Thirty-six sites were sampled for five consecutive nights each for a total of 180 detector nights. Indiana bats were detected at nine (9) sites. Other species detected included northern long-eared bats (*Myotis septentrionalis*) at seven (7) sites, little brown bat (*Myotis lucifugus*) at 30 sites, and tri-colored bats (*Perimyotis subflavus*) at 31 sites. These results will help to fill some of the information gaps on Indiana bats and other bats species that use habitats in and around urban areas and assist in conservation and recovery efforts for bat populations in Middle Tennessee.

POSTERS

OFFSHORE BATS IN THE MID-ATLANTIC: SEASONAL AND CIRCADIAN ACTIVITY PATTERNS AND BEHAVIORAL CLASSIFICATION

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The accelerated development of offshore wind energy production and its potential impact on bats and birds is highlighting a major knowledge gap about bat presence and behavior – how much are bats present in the offshore environment and what do they do there? Using our unique Acoustic and Thermographic Offshore Monitoring system (ATOM™), deployed on two Coastal Virginia Offshore Wind (CVOW) pilot turbines located 23 nautical miles (42 km) offshore Virgina, we have monitored and characterized bat presence offshore throughout the year and around-the-clock, through thermal imagery, HD video, and acoustics. The first two years of this three-year project have been analyzed, and the results so far are intriguing: three species have been identified in our data, all migratory tree-roosting bats: hoary bat, Eastern red/Seminole bat, and silver haired bat. Bats show a very strong seasonal pattern with the vast majority of detections occurring during the fall (late August to early November) and are probably associated with fall migration. Interestingly, we recorded significant activity during daylight hours, and that was correct for all species. We have recorded significant foraging activity, both aerial hawking and gleaning off the tower. In many instances bats were present while turbine blades were moving, and while we documented macro-avoidance behavior and a few air-displacements we never documented a collision. Our results highlight the need for increased monitoring efforts offshore, using innovative and complementary methods to better understand bats presence, behavior, and their drivers in the offshore environment, especially in light of the expected increase in offshore wind facilities in coming years.

REMOVABLE BAT BOXES: FLORIDA BONNETED BAT POPULATION MONITORING MADE EASY

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The endangered Florida bonneted bat (*Eumops floridanus*) is endemic to Florida and one of the rarest mammals in North America. At the time of listing (2013), we knew little about their ecology, which inhibits conservation efforts. In 2014, we initiated a long-term mark-recapture study using passive integrative transponders (PIT tags) to investigate their population demographics, roosting behavior, social structure, and breeding biology. Since the first bat box installations in Babcock Webb Wildlife Management Area in 2007, the site has grown to encompass one of their largest known populations. Initially, triannual capture events involved capturing bats at roosts with mist nets at emergence. In 2022, we completely transitioned to a novel removable bat box design that allows researchers to lower each house to the ground to process the entire colony during daylight hours. This design has revolutionized our ability to collect demographic variables safely and efficiently, especially for collecting data on non-volant pups that were previously unattainable. Over the course of the study, the number of bats captured has shown an increasing trend from 50 bats in April 2014 to

147 bats in September 2023 with a maximum of 181 bats occurring in September 2022. Unlike most bats in the U.S., this species reproduces throughout much of the year and roosts in small colonies with a harem-based social structure. Weekly spotlight counts of flightless pups suggest that pups could be present any month of the year but vary seasonally with a primary peak in May and secondary peak in September. Several females were suspected to be pregnant twice per year, suggesting seasonal bimodal polyestry, though this was uncommonly observed. This robust long-term dataset allows us to answer many fundamental questions about the biology of Florida bonneted bats and serves as a model for monitoring other species roosting in bat boxes.

CHANGES IN THE NIGHTLY ACTIVITY OF NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) DUE TO INCREASED URBAN LIGHT INTENSITY IN ROCK CREEK PARK, WASHINGTON DC

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Due to the effects of White nose syndrome, the federally northern long-eared bat's (*Myotis septentrionalis*) population has declined drastically throughout the East, particularly in the interior Northeast and mid-Atlantic. In Washington D.C., of maternity colony presence was documented through 2018 at National Park Service's Rock Creek Park (ROCR) Viability and persistence metrics are unknown, but regardless, this extant population contends with challenges that come with living in a heavily urbanized landscape. In addition to limited interior forest habitat, one potential stressor might be high levels of artificial light sources that may impact foraging and movement behaviors. During summer, ROCR hosts events with large influxes of visitors and added artificial light. To assess impacts of added light to northern long-eared bat presence and activity, during the summer of 2023, we deployed 38 acoustic detectors in a grid pattern for 48 nights to track bat activity. We also deployed light meters to collect nightly ambient light data at each of the 38 acoustic monitoring sites before, during and after a particular multi-night event. Our work suggests that ROCR 1) has northern long-eared bat activity levels indicative of continued maternity colony presence; 2) the location of maternity activity in the park has shifted since 2018; and 3) artificial light may have spatial and temporal impacts to northern long-eared activity patterns in open- and near-open area conditions.

ADVANCING KNOWLEDGE TO INFORM BAT MARKING PRACTICES

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In 2021, representatives from the USA, Canada, and Mexico formed a working group to advance knowledge of global bat marking practices. We hosted sessions at regional, national, and international bat meetings, conducted surveys to gather expert insights, and are conducting a systematic literature review on utility of/effects of marking bats globally. In discussion sessions with experts, we identified 13 broad reasons why bats are marked, including monitoring bat health, habitat use, movement, and populations. We identified 14 types of marks—bands, PIT tags, and transmitters were the most universally employed. Participants at regional USA meetings noted a lack of published studies on recovery/injury rates. In a poll, 80% of Northeast Bat Working Group respondents said their agency issues bands and 12% indicated they collect data on injury from marks. Southeastern Bat Diversity Network discussion participants stressed the need for a centralized database to store marking data and information on injury and recovery rates. In both 2022 and 2023, White-nose Syndrome Conference attendees discussed a need for standardized records (e.g., datasheets), reporting of marking information (e.g., banding codes and injury scores), and collaboration among agencies. The 2022 International Bat Research Conference Session raised unique ideas, like the need for training videos and resources on how to apply marks, a call for more studies on determining appropriate marking sizes, and the urgency for understanding sublethal impacts of marking bats. These discussions have guided our group's immediate goals: 1) develop guidance regarding best practices for marking bats applicable to a broad audience, 2) identify knowledge gaps and encourage studies to address these gaps, and 3) develop or identify a centralized system for hosting bat marking data to facilitate gathering and analyzing data on mark recovery, injury, species-specific observations, or other sublethal effects. We continue to seek ideas for future work and expert insight.

TRACKING FECAL CONTAMINATION OF LOCAL WATERSHEDS: OPTIMIZATION OF MAMMAL MARKERS

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Contamination of local waterways from the fecal bacteria of terrestrial mammals can impact ecosystems but is of particular concern for human health reasons through the recreation in contaminated waters or consumption of contaminated seafood. Traditional methods to quantify contamination (e.g., fecal coliform, E. coli, or Enterococcus) can identify contaminated waters, but cannot identify the source of the contamination. Here, we present data from the optimization of previously developed mammal primers for microbial source tracking using qPCR. Current working markers include human, horse, dog, and deer, in addition to non-mammal bird markers. Local fecal sources from the above animals, and others, were collected and total DNA within the samples was extracted. These known fecal DNA samples were used as both positive and negative controls to examine the sensitivity of each marker to local sources of fecal bacteria pollution. The use of these fully optimized markers will help determine the sources of fecal contamination within the May River and Port Royal Sound watersheds (Town of Bluffton) and the Edisto River watershed (SC Sea Grant). The results of this work will help drive watershed management practices and may have other uses for wildlife biology through the identification of mammal populations surrounding waterways.

A LITTLE BROWN BAT TALE

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In 1999, a maternity colony of Little Brown Bats was excluded from the attic of a home in Merrimac, WI. The colony moved into a bat box mounted on an adjacent garage the following summer. More bat boxes were added over time. The homeowner began conducting emergence counts of the colony around 2009, and the Wisconsin Department of Natural Resources (WDNR) banded bats and used thermal cameras to provide additional monitoring. Bat deaths were observed periodically. Necropsies revealed that 14 juvenile bats died in 2015 from starvation, and in 2021, four adults died from trauma. White-nose syndrome arrived in Wisconsin in 2014, and the colony dropped from as many as 350 bats to fewer than 50 bats post-WNS. The colony has increased since then, with 93 bats in 2023 (data from WDNR). In 2022, due to the impending sale of the house, the landowner and WDNR developed a conservation easement to protect the colony. The easement protects one wall of the garage where the bat boxes are mounted and 30 feet of adjacent lawn. It allows the WDNR to continue monitoring the bats and replace bat houses (if needed) for 20 years. It specifies what should be done if the owner wants to build a new garage or install additional lights. A detailed conservation plan includes instructions for guano removal, invasive weed control, garage maintenance, etc. Since Little Brown Bats congregate in large colonies to reproduce, providing safe roosting habitat is one of the best ways to protect the species. Novel ways to protect roosting habitat, such as an easement on the wall of a building, should not be overlooked.

LONG-TERM MONITORING OF SMALL MAMMALS IN A RESTORED URBAN GREENSPACE

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Restoring abandoned agricultural and multi-use lands back to native grasslands and woodlands are priorities to preserve greenspaces for humans and biodiversity in urban environments. In 2004, a 15.5ha tract was transformed into native tallgrass prairie, bottomland forest and arboretum, and wetlands for outdoor education and recreation, becoming Prairie Ridge Ecostation. The biological value and use of this space by native wildlife requires monitoring. In the summer of 2011, we began a long-term mark-recapture project to monitor small mammal populations of Prairie Ridge. We established three permanent grids of 50 traps each in three distinct field types: bottomland, fescue, and switchgrass with trapping occurring seasonally. Initially high capture rates were common in all seasons with greater than 50% trap success in fall 2012. Species captured were *Sigmodon hispidus* (n=2848), *Peromyscus leucopus* (n=342), *Reithrodontomys humulis* (n=33), *Mus musculus* (n=23), and *Microtus pinetorum* (n=4). Results suggest temperature and precipitation extremes play a role in population fluctuation, and invasive blackberry encroachment in one of the study plots further impacts small mammal populations. Recent large-scale commercial development near the western and northern borders of Prairie Ridge have isolated the preserve and likely limits new migrants from other natural habitat patches. Changing climates and urban expansion are important in small mammal population dynamics. Invasive species removal can bolster wildlife populations in the face of other external threats.

ASSESSMENT OF POPULATION GENETIC STRUCTURE AND STABLE ISOTOPES (δ^2H) OF SOUTHEASTERN U.S. TRICOLORED BATS (*P. SUBFLAVUS*)

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Tricolored bats (*Perimyotis subflavus*) are critically threatened by white-nose syndrome (WNS) at the population scale, and Southeastern U.S. *P. subflavus* bats in the Cumberland Plateau and Appalachian Mountain regions have seen considerable population declines. Assessing population genetic structure is fundamental to determining a population's genetic diversity and provides insight into properly addressing and managing pervasive wildlife threats. However, much remains unknown about *P. subflavus* populations (i.e., distribution, size) in the Coastal Plain where nontraditional (transportation) structures, mines, tree roosts, and caves are occupied by the species. *P. subflavus* seasonal habitat/roosting preferences are also not fully ascertained, particularly in structures such as culverts. This study aimed to describe the relatedness between Coastal Plain and Appalachian Mountains populations, and how hibernating and/or roosting *P. subflavus* populations in transportation structures potentially exhibit genetic connectivity. Morphological measurements and hair and oral swab samples of bats were collected per each site. Field samples were kept at 0°C in silica gel desiccant until transferal to Kennesaw State University where they were held at -80°C. A QIAGEN DNeasy kit was used for DNA isolation. Six microsatellite markers were evaluated, indicating high gene flow (panmixia) and no substructure among sites. The bimodal distribution of alleles may be

attributed to recent population bottlenecking or admixture. Stable hydrogen isotope (δ^2H) analysis will also be addressed. Previous δ^2H studies have revealed yearly latitudinal and sex-biased migration patterns in *P. subflavus*, which may hold additional implications for the spread of WNS. Our analysis will provide initial spatial reference to disease transmission through migration by determining the geographic origins of hibernating bats. Future studies will investigate mitochondrial DNA (D-loop) haplotypes of *P. subflavus* via non-coding HV1 region sequencing for more conclusive estimates of genetic diversity, gene flow, and population structure.

ON THE FRONT: TRACKING WHITE-NOSE SYNDROME AND BAT DISTRIBUTIONS ON THE SOUTHERN COLORADO PATEAU

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In the United States, the southwestern bat communities boast the highest species diversity. With the recent cross-continent spread of white-nose syndrome (WNS), the need to collect baseline ecological data from bats on the southern Colorado Plateau is especially urgent to evaluate bat response and potential impacts. Our long-term, year-round study encompasses the extent of the Navajo Nation, which has little to no historical data on regional bat communities. With the emergence of wildlife diseases, there is an increased need for research on Native and Tribal lands. The Navajo Nation encompasses around 17 million hectares of land; however, there is a lack of hibernaculum on the southern Colorado Plateau, making surveying for WNS more difficult. Within this project, we implemented mist netting to capture and swab individuals for presence of WNS. Sites were chosen based on habitat characteristics and accessibility. During 23 nights of effort at 22 sites, 159 individuals of 15 species were captured. During the bat emergence period (mid-May to early June), we swabbed 39 individuals for *Pseudogymnoascus destructans* (Pd), the fungus that causes WNS. These swabbed individuals were chosen based on species susceptibility to the disease, as well as the U.S. Geological Survey guidelines for non-lethal sampling of Pd. All 39 collected tests came back negative. Our efforts for monitoring WNS prior to potential disease impacts will continue in the future as a component of this comprehensive project.

ANALYSIS OF GUANO AMONG BAT SPECIES FROM TWO REGIONS SHOWS INFLUENCE OF GEOGRAPHY AND DIET ON THE GUANO BACTERIAL COMMUNITY

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Bat guano studies have demonstrated that microbial community's diversity and structure can be related to factors such as host phylogeny, life history and reproductive stage, geography, and diet. Numerous insectivorous bat species, located in the southeastern United States, have generalists

diets that tend to shift seasonally in order to capitalize on abundant prey species and/or maximize caloric intake. Some data suggests that as seasons change, availability of prey will change and can cause a shift in bat diets. These seasonal shifts in bat diets and prey availability should be reflected in a change in the guano microbiome. We expected to detect diverse and distinct guano microbiomes within and between species. We compared bacterial communities in bat guano from five species and two regions of the USA. Guano samples were collected during mist netting events during a six-month period, May to October, in the Appalachian foothills (Rome, GA) and in the coastal plain (Bluffton, SC). DNA was extracted from the guano. DNA elutions were then pooled based on their collection time and species ID. The 16S rDNA barcode regions (V3, V4) were sequenced. The program Qiime2 was used to filter the reads and assign taxonomy. The Rome, GA samples had bacterial communities which indicated a seasonal shift related to shifts in diet in the big brown bat and red bat samples. These samples had overall greater bacterial diversity among species while the samples from Bluffton were very similar to one another. Overall, the geography and diet were influential factors related to diversity and structure of guano bacterial community.

BAT COMMUNITIES IN THE UPPER COASTAL PLAIN OF THE SOUTHEASTERN U.S. PRIVATE, WORKING FORESTS

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The southern US is characterized by its large expanse of working pine (*Pinus* spp.) forest landscapes, with about 90% privately owned. These forests provide important wildlife habitat, including for bat species negatively affected by white-nose syndrome (WNS) throughout the eastern US. Although most research on bat communities has been conducted during summer, there are a growing number of studies occurring in winter, especially in the Lower Coastal Plain. Here, bats are active during the winter, partly due to mild winter temperatures, and therefore less affected by WNS. However, activity patterns in the adjacent Upper Coastal Plain remain understudied. Therefore, our goal is to assess relationships between forest stand characteristics and bat species occurrences throughout the year within the Upper Coastal Plain, in a 24,000-ha block of privately owned working forests in east central Mississippi. We defined forest stands as one of four pine stages varying by tree canopy closure: [1) early establishment, open canopy (0 – 7 years old), 2) pre-thinned, closed canopy (8 – 15 years old), 3) recently thinned, open canopy (16 – 18 years old), and 4) mature, closing canopy (22 – 28 years old)]. Within each stand (n = 4 per stage), we placed an ultrasonic acoustic recorder to record bat calls starting in late 2021 and paired each recorder with a Kestrel temperature and humidity logger. We set up detectors approximately 4 m high and ≥1.0 km apart to increase detection and maintain independence, respectively. We evaluated call analyses using Bat Call Identification (BCID) software. By deploying recorders in fixed locations for the long term, we will be able to develop an inventory of bat species throughout the lifecycle of a working forest and evaluate how bat species composition changes temporally, by ambient temperature, across landscape characteristics, and with active forest management, including vegetation control and timber harvesting.

SEASONAL AND HABITAT DRIVERS OF TRICOLORED BAT ACTIVITY IN FLORIDA: INSIGHTS FROM ACOUSTIC MONIORING

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The tricolored bat (*Perimyotis subflavus*) ranges throughout Florida and is commonly recorded acoustically in the state. Although white-nose syndrome has yet to be detected in Florida, recent data suggest that tricolored bat populations are still in decline in the state. Our acoustic data have shown tricolored bats are active year-round, but activity varies seasonally. The goal of this analysis was to better understand how seasonality and habitat associations in Florida affect tricolored bat activity for better management of this species. As part of the Florida Fish and Wildlife Conservation Commission's statewide Long-term Bat Monitoring Program, we recorded stationary acoustic data seasonally, up to 4 times per year, from 2021 through 2023 at 104 detector locations across Florida. We created generalized linear mixed effect models based on 5 landscape and seasonal covariates and ranked model fit using AICc. Our results indicated that season and diversity of habitat types were the main drivers of tricolored bat activity across the state. Activity of tricolored bats was highest in spring and summer months and increased as the diversity of habitats around a detector increased. Distance to water was not significant in the models on its own. However, when included as an interaction term with time of year, activity increased most of the year at sites that were close to water. This interaction was most significant at sites close to water in spring (April – June). These results indicate that although the activity of tricolored bat varies seasonally, these bats are active throughout the year, especially in spring and summer months. The results also suggest that a diversity of habitat types located close to water sources may be crucial for this species to thrive in Florida.

PRELIMINARY ANALYSES OF BAT DIVERSITY RESPONSES TO STREAMSIDE MANAGEMENT ZONES ACROSS A LANDSCAPE

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Privately owned and managed pine (*Pinus spp.*) forests make up a large portion of the continuous forested landscape in the southeastern U.S. State-approved forestry Best Management Practices (BMPs) were designed to protect water quality in managed forests and include maintaining riparian areas, (hereinafter, Streamside Management Zones (SMZs)). SMZs are beneficial to wildlife by providing a mature forest component on the landscape, yet the influence of SMZ features and structural characteristics on biodiversity is poorly understood. Our objective is to evaluate how wildlife species and communities respond to different SMZ and adjacent pine stand features, including stream type, SMZ width, canopy cover, basal area, and pine successional stage. Our study included various taxa to measure the response of biodiversity broadly, but here we focus on our preliminary results for bats. During 2023-2025, we are deploying acoustic detectors in SMZs and adjacent planted pine stands to collect data year-round at 36 study sites (12 per year) in Piedmont and Coastal Plain regions of Georgia. We manually confirmed presence of three species (*Eptesicus fuscus* (EPFU), *Nycticeius humeralis* (NYHU), and *Perimyotis subflavus* (PESU)) and three species-groups

(*Lasiurus borealis*/*L. seminolus* (LABOLASE), *Myotis austroriparius/M. septentrionalis* (MYAUMYSE), *L. cinereus*/*Tadarida brasiliensis* (LACITABR)) across our initial 12 sites. The only group detected in both SMZ and pine subplots of all 12 sites was LACITABR. EPFU, LABOLASE, NYHU, and PESU were present at both subplots of all but two sites each, where they were either only detected in the pine subplot or not at all. The MYAUMYSE group had the fewest sites and subplots in which they were detected. By characterizing bat communities on a variety of SMZ sites across a landscape, we will improve our understanding of bat diversity response to stand and SMZ configuration, which will inform conservation efforts in private working forests in the southeastern U.S.

NORTHERN LONG-EARED BAT ROOSTS IN COASTAL SOUTH CAROLINA

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Northern long-eared bats (*Myotis septentrionalis*) were fully documented to occur on the Atlantic Coastal Plain until 2007. Since that time, biologists have increased efforts to locate them and document their habits from Virginia to South Carolina. In 2022 we documented the presence of northern long-eared bats on Sandy Island, Waccamaw National Wildlife Refuge in northeastern SC; this was the first record of northern long-eared bats in Georgetown County. We captured an adult male in 2022 and an adult non-reproductive female in 2023. Bats were tracked to two roosts each, all pine (*Pinus*) trees. The male used two small (13.4 and 20.1 cm diameter at breast heigh) live longleaf pines (*P. palustris*). We were not able to pinpoint the exact roost location, but we saw no cavities or dead branches on the trees and assumed that he was using the area under the flaky bark for roosting. The female used two pine snags, one longleaf and one loblolly (*P. taeda*). We could not pinpoint the exact location of the roosts within the trees but assumed the bat used a spot under sloughing bark. All trees were in areas that were actively managed for red-cockaded woodpeckers with prescribed fire. Our results are in line with other studies conducted in coastal South Carolina and further illustrate the diversity of roosts and roost habitat used by northern long-eared bats across their range.

DO YOU SEE WHAT I SEE? DOCUMENTING VIRGINIA BIG-EARED BATS (*CORYNORHINUS TOWNSENDII VIRGINIANUS*) IN MARYLAND

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Stationary acoustic detectors can be useful for monitoring bat communities, particularly at sites that are difficult or dangerous to access or trap, or for rare species that are present at low levels across the landscape. Acoustic recordings can also be used to document species range expansions and are more efficient for projects with limited staff and resources or in locations where netting would not be feasible. Maryland DNR has been using acoustic recorders as part of an ongoing study to survey rock habitats in western Maryland. As part of this project, we documented the first sustained presence of Virginia big-eared bats (*Corynorhinus townsendii virginianus*), a federally endangered subspecies, from recordings taken at large talus fields and caves in western Maryland. We manually

vetted 107 calls over 51 nights from 5 sites recorded between April 23, 2021 and Jan 6, 2022. Based on these dates, these recordings could indicate the presence of a maternity or bachelor colony, foraging individuals from roosts in West Virginia, or individuals entering hibernacula during fall swarm. We are continuing to deploy acoustic recorders at several of these sites as well as other rock habitats. Manual vetting of 2022 and 2023 recordings is ongoing and we are planning future efforts to visually survey the talus slopes and other potential roost sites in the upcoming 2024 field season. Acoustic monitoring can be a useful tool to document species occurrences and potential range expansions, even for rare species that are relatively difficult to survey.