Nightwing News

The Newsletter of the Southeastern Bat Diversity Network

Volume 110, Number 1 Spring 2020

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In This Issue

Cover Photo: by Will Seiter, Copperhead Consulting

Virginia Big-eared bat, Estill County, KY, Captured as a part of KDFWR hibernacula monitoring in association with HMB.

President's Address:

Welcome to the first 2020 edition of Nightwing News. I would like to start off by acknowledging the 2020 annual meeting host committee and what a great job they did putting together this year's meeting in Athens, GA. That had to be the first time we've ever had an ice skating event at an SBDN meeting, not an easy job considering the southeast is not known for outdoor ice skating. Also, the dinner, poster session, and silent auction were some of the best we've had with more items in the auction than I can remember. Thank you to everyone who donated.

A special congratulations to John McGregor who received the SBDN Lifetime Achievement Award at this year's meeting. John has inspired a whole generation of bat biologists, and I'm not sure he was even trying. He simply led by example with his insatiable appetite for knowledge, humility, and willingness to involve anyone interested in learning more about bats.

To close, I must mention that as I write this, we in the U.S. are feeling the effects of the COVID-19 pandemic. It has likely disrupted many of our lives across the southeast, inconvenienced some, and had or will have a much greater impact on others. I've found that the SBDN is more than a group of like-minded researchers, I consider many of you friends before anything else. If anyone needs help or has questions or issues that we can address as a group, please do not hesitate to reach out. Everyone stay healthy and let's hope we are all back in the field soon.

-Steve-

Executive Committee Contact Information

President:
Steve Samoray
Biologist/Project Manager
Copperhead Environmental Consulting
Paint Lick, KY 40461
615) 542-1000
Ssamoray@copperheadconsulting.com

President Elect:
Holly Ober
Associate Professor
Dept. of Wildlife Ecology and Conservation
University of Florida
155 Research Rd.
Quincy, FL 32351
Office: 850-875-7150
Cell: 850-879-7113
holly.ober@ufl.edu

Past President:
Trina Morris
Wildlife Biologist
Georgia Department of Natural Resources
Nongame Conservation Section
2065 U.S. Hwy. 278 S.E.
Social Circle, GA 30025-4743
Office: 706-557-3220
Cell: 678-836-5769
Fax: 706-557-3580
katrina.morris@dnr.ga.gov

Treasurer:
Luke Dodd
Assistant Professor
Department of Biological Sciences
Eastern Kentucky University
Memorial #183
Richmond, KY 40475
859-622-2523
luke.dodd@eku.edu

Secretary:
Katherine Caldwell Etchison
Wildlife Diversity Biologist
Associate Wildlife Biologist
NC Wildlife Resources Commission
24 Looking Glass Lane
Ashville, NC 28805
828-545-8328
Katherine.caldwell@ncwildlife.org

Board Member at Large:
Scott Bergeson
Indiana State University
sbergeson@gmail.com

Executive Committee

Left to Right:

Trina Morris (Past President)

Holly Ober (President Elect)

Scott Bergeson (Board Member at Large)

Steve Samoray (President)

Katherine Caldwell Etchison (Secretary)

Luke Dodd (Treasurer)

Executive Committee Meeting

Southeastern Bat Diversity Network
Executive Committee
Minutes of the Annual Board Meeting
February 12, 2020

Attendees

Steve Samoray, President
Trina Morris, Past President
Holly Ober, Incoming President
Luke Dodd, Treasurer
Katherine Etchison, Secretary
Scott Bergeson, Member at Large

Action Items

AI1: Morris and 2020 SBDN Meeting Hosts revise meeting host package when 2020 meeting concludes.

AI2: Morris, Burns, and Pattavina revise Bat Blitz host package.

AI3: Morris send final hotel room numbers from 2020 meeting to Risch for next year's meeting planning.

AI4: Morris contact NABCA about potentially creating a Bats of North America poster to go along with the State of North American Bats assessment.

AI5: Samoray ask Robinson to add 2017 Lifetime Achievement Award Winner, Dennis Krusac, to website.

AI6: Samoray ask Robinson to talk to website hosts about making outputs from transactions more streamlined.

AI7: Dodd calculate the percentage of transactions that use PayPal to decide whether to keep this payment option on the website.

Call to order: 3:09PM EDT, President Samoray

September 2019 Executive Committee Meeting Action Items:

AI1: Not complete. Morris and 2020 SBDN Meeting Hosts revise meeting host package while planning 2020 meeting.

AI2: Not complete. Morris, Burns, and Pattavina revise Bat Blitz host package.

AI3: Complete. Morris get information regarding poster committee from Carver for Bats of North America poster.

AI4: Complete. Morris and Bergeson post Washington Post article and other relevant information on bat carcass import to Facebook before Halloween season begins.

AI5: Complete. Morris bring up bat carcass import issue to NABCA for recommendations and for other groups to post information to social media.

AI6: Complete. Dodd follow up with Kentucky Bat Working Group about SBDN's involvement as bank for biodiversity meeting.

AI7: Complete. Samoray follow up with Bats and Mines Hosts to determine expectations for SBDN involvement regarding financial responsibilities. Also offer Ober as SBDN representative for steering committee.

AI8: Complete. Samoray check with Robinson to make sure recent Award Winners are added to website.

AI9: Complete. Samoray and Ober continue to look for 2021 SBDN Meeting hosts (SC, AR, KY, MS, TN).

New Business

Bats and Mines Meeting
The Bats and Mines meeting will occur October 6-7 in Louisville, KY at the Brown Hotel. The hosts have hired SIU and do not need SBDN to accept registration funds like was previously mentioned. SBDN may consider being a sponsor for the event when the call for sponsors goes out. The meeting will have three concurrent sessions over two days and will include invited speakers for the bat-related presentations. The agenda will be sent through the SBDN list serv.

2021 SBDN Meeting
The 2021 SBDN Meeting and Mammal Colloquium will be held in Jonesboro, Arkansas at the new Embassy Suites Red Wolf Convention Center February 18-19. Tom Risch is the local host and he is assembling a host team. Initial quote from the venue is based on 150 guests and the convention is waiving the space rental fees if $7,500 minimum is met on food and beverage expenditure based on breaks during the conference.

2022 SBDN Meeting
The 2022 SBDN Meeting and Mammal Colloquium will be held in Hilton Head, South Carolina. Lydia Moore from the Palmetto Bluff Conservancy is working on assembling a host committee. Lydia has been included in planning calls with this year's host committee to start preparing for 2022.

Treasurer's Report (Dodd):
As of 11 Feb 2020, a total of $89,890.33 was distributed across SBDN accounts. Of that, $3636.09. Membership dues remain our primary source of operating income. The largest expenses to be incurred in 2018 were related to tax preparation ($600) and website maintenance (cumulatively $476.95 since 2019). The inflow of funds for 2019 to date totaled $111,316.75, whereas outflows totaled $91,117.82. All SBDN funds are located in our general checking account. We serve as a bank for 5 different state bat working groups (AL, GA, KY, NC, and TN), and notably account standings have increased across working groups by ca. 38% in the last year. As is readily apparent from the amount of money moving through our bank account, and the amount of money held on behalf of various functions and groups, we perform a valuable service to the bat community. On a final note, there have been 207 transactions from 2019 to date. Respectfully submitted: 11 Feb 2020 – By Luke Dodd – SBDN Treasurer.

Treasurer's Report (Dodd): (Cont.)
Dodd is halfway through his 6-year term. Discussed the need for the next Treasurer to begin early to receive training, but Dodd offered to help during the next Treasurer's first year instead. Also discussed Kentucky Bat Working Group's sponsorship of a broader Biodiversity Meeting for Kentucky. This meeting will occur in November 2020 at Eastern Kentucky University. Dodd will be a local host and doesn't anticipate a strain on SBDN.

COMMITTEE UPDATES

Website Committee (Robinson): Robinson has been working with the 2020 SBDN Meeting hosts to make the outputs from website transactions more clear for meeting planning purposes. Samoray was told by the website hosts that it would be costly to make transaction outputs more streamlined/categorized, but Samoray will ask Robinson to talk to website hosts to see if this is still the case or if there's another way to approach it. Dodd mentioned it may be simpler to use only Stripe instead of Stripe and PayPal.

Blitz Committee (Pattavina/Burns): Gatens will give 2019 Bat Blitz Update at the SBDN Business Meeting. Allison Cochran will present on 2020 Bat Blitz at Bankhead National Forest in Alabama.

Membership Committee (Bergeson): SBDN currently has 85 members and that usually increases a little after the meeting, but membership has been decreasing. Bergeson will dig into membership records to see what demographics of members SBDN is losing. Bergeson sent membership reminder email to the list serv and several membership dues came in immediately. Bergeson plans to send out regular membership reminders. Discussed options for membership like adding membership into the registration cost so everyone who registers for the annual meeting is a member (like NASBR). Another option is to offer a $5 reduction on registration cost for SBDN members. Currently the incentive of membership is to receive the Nightwing News.

Awards Committee (Burnett): Castleberry will present at SBDN Business Meeting.

NABCA Update (Morris): NABCA is planning to create a State of North America's Bats assessment using NatureServe criteria. Species experts will be need for this effort and can talk to Morris.

NEW BUSINESS

Election will occur next year, and Morris will be organizing it as past president. Ober offered use of Qualtrics instead of using Survey Monkey. Morris and Ober will work together on the ballot.

Meeting adjourned at 4:07PM EDT.

Southeastern Bat Diversity Network
Minutes of the Annual Business Meeting
February 13, 2020

Call to order: 4:00PM EDT, President Samoray
Introductory Remarks: thanking meeting hosts and recognizing Executive Committee

Tribute to Kathy Shelton
Remembering Kathy Shelton, SBDN Board Member at Large and Mississippi Bat Working Group Member.

Treasurer's Report, Luke Dodd
Membership dues remain the primary source of operating income. The largest expenses incurred in 2019 were tax prep ($600) and website maintenance ($476.95 since 2019). SBDN serves as a bank for 5 state bat working groups (AL, GA, KY, NC, TN). There have been 207 transactions from 2019 to date. As state working groups conduct their own blitzes and meetings, the SBDN bank is increasingly doing more for those state functions.

Committee Reports
Membership Committee Scott Bergeson
SBDN membership has decreased from 2015 to now (2015: 150 members, 2020: 85 members). Bergeson will look into the demographics of membership over the years to see if there are any patterns in loss of membership. The annual average is 105 members. The annual retention is 44% (for 2016-2019). SBDN has 32 new members this year, which is down from last year (55 new members). SBDN has had 483 members since 2003.

Bergeson will start Current Research on Bats (CRAB) posts on Facebook again soon to highlight graduate student work. Email Bergeson to contribute. Bergeson posted a "dead bats don't make good Halloween décor" post on Facebook, which received a lot of attention and reposts, including by Bat Conservation International. Bergeson will keep posting this and working on it over the years.

Bergeson will send more membership reminder emails.

This committee needs more members. Please email bergesos@pfw.edu if you would like to be on the Membership Committee.

Website Committee Report Jason Robinson
Email Robinson if you encounter issues with the website: jason@biologicalsystemsconsultants.com.

Also email Robinson if you'd like to help with the website (especially if you have experience with Word Press or design skills).

Also send a PDF of any theses or dissertations to be posted on the website.

North American Bat Conservation Alliance (NABCA) Trina Morris
The NABCA website is back up and running: http://batconservationalliance.com

The wiki page is: http://batconservationalliance.wikidot.com

NABCA is focused on creating the State of North America's Bats assessment using NatureServe criteria. Species experts are needed for this effort and can contact Morris for more information. Experts must have experience with research and at least one publication on a North American bat species, experience working on the management of populations of bat species at local, state, or federal levels, and have contributed to at least one written technical report on a North American bat species.

Nightwing News J.D. Wilhide
Updated the format of the Fall/Winter 2019 newsletter.

Please send bat photos for the cover (will be credited) and photos taken at the annual meeting to jwilhide@cecinc.com or nightwingnewsletter@gmail.com.

Bat Blitz Committee Report Pete Pattavina and Leanne Burns
2021 Bat Blitz: early preparations are being made to hold the Bat Blitz in Georgia at Fort Mountain State Park. Bat Blitz occurred here in 2010.

Burns and Pattavina are nearly finished with the Bat Blitz host package.

Lisa Gatens gave the summary of the 2019 Bat Blitz on the Albemarle Peninsula of NC. This blitz included 4 local hosts representing 4 agencies, 15(ish) team leaders, and 50-80 attendees from 7 states. An educational event occurred on the first night and was attended by 12 people. 225 bats were captured: CORA 9, EPFU 19, LABO 96, LASE 6, MYAU 31, MYSE 1, NYHU 60, PESU 3

2020 Bat Blitz: Allison Cochran presented on the upcoming Bat Blitz at Bankhead National Forest, which will be held on August 3-7. This blitz will be hosted by the Alabama Bat Working Group. Lodging will be at Camp McDowell with space for 100 in double occupancy rooms. The hosts would like this blitz to be an exact replica of the 2008 SBDN Blitz (6 years prior to WNS arrival). The hosts would like to net the same sites and have the same team leaders, if possible. This blitz's objective is to compare the bat community pre- and post-WNS arrival. This is also the 20th anniversary of the 1st Alabama Bat Blitz. Species in the area include MYGR, MYSO, MYSE, MYAU, LASE, CORA.

An educational event will be held the first night. Contact Vicki Beckham Smith or the host committee with any questions.

Awards Committee Report Nikki Castleberry
The Student Travel Awards was established in 2006 to financially assist one student to attend NASBR. The maximum award is $500, and the qualification information is on the SBDN website. The call for submissions goes out in March or early April and applications are due around June 1. The 2019 Winner was Alex Grimaudo of Virginia Tech. Previous winners are listed on the SBDN website.

This committee is made of Stephen Burnett (chair), Lisa Gatens, Pallavi Sirajuddin, Kristina Hammond-Rendon, and Nikki Castleberry.

2020 Lifetime Achievement Award Winner: John Roy MacGregor II

Future Meetings Holly Ober

2021: Feb 17-19, Jonesboro, AR at Embassy Suites by Hilton Jonesboro Red Wolf Convention Center. Hosted by Tom Risch.

2022: Hilton Head, South Carolina. Hosted by Lydia Moore and Jen Kindel

Bats and Mines Meeting: Oct 6-7 at the Brown Hotel in Louisville, KY. Meant to be a national meeting to facilitate technical, interactive forums for the discussion of issues facing bats at mines. Audience should include consultants, state and federal agency personnel, mine operators, land managers, and researchers. The agenda includes presentations by invited keynote speakers and themed breakout sessions.

Contact Dave Waldien with questions at: dwaldien@gmail.com.

New Business
Dennis Krusac's 2017 Lifetime Achievement is not on SBDN website.

Meeting adjourned at 5:18PM EDT.

Committee Contact Information

BAT BLITZ COMMITTEE

Member	Affiliation	E-Mail
Pete Pattavina (Co-Chair)	USFWS	Pete_pattavina@fws.gov
Leanne Burns (Co-Chair)	Bat Biologist-Independent Biological Consultant	leanneklb@gmail.com
Tim Carter	Ball State University	tccarter@bsu.edu
Nikki Castleberry	University of Georgia	neotoma@uga.edu
Michael Whitby	University of Nebraska-Lincoln	Michael.whitby@gmail.com
Bree McMurray	MO DOT	mobatgirl1@yahoo.com
Katrina Morris	Georgia DNR	Katrina.morris@dnr.state.ga.us
Joy O'Keefe	Indiana State University	joyokeefe@gmail.com
Gary Libby	Skybax Ecological Services, LLC	garylibby@windstream.net
Jason Robinson	Biological Systems Consultants, Inc.	jason@biologicalsystemsconsultants.com
Katie Teets	Florida FWC	Katie.Teets@MyFWC.com

AWARDS COMMITTEE

Steven Burnett (Chair)	Clayton College & State University	StephenBurnett@mail.clayton.edu
Nikki Castleberry	Georgia Museum of Natural History	neotoma@uga.edu
Pallavi Sirajuddin	Clemson University	psiraju@g.clemson.edu
Kristina Hammond-Rendon	WEST, Inc.	khammond68@yahoo.com
Lisa Gatens	NC Museum of Natural Sciences	lisa.gatens@naturalsciences.org

MEMBERSHIP COMMITTEE

Scott Bergeson (Chair)	Indiana State University	sbergeson@gmail.com
Steve Thomas	Mammoth Cave National Park	steve_thomas@nps.gov
Blake Sasse	Arkansas Game and Fish Commission	dbsasse@agfc.state.ar.us

WHITE-NOSE SYNDROME COMMITTEE

Pete Pattavina (Chair)	USFWS	Pete_pattavina@fws.gov
Katie Gillies	Bat Conservation International	kgillies@batcon.org
Katherine Caldwell	NC Wildlife Resources Commission	katherine.caldwell@ncwildlife.org
Emma Wilcox	UT-Knoxville	ewillcox@utk.edu
Dottie Brown	Ecological Solutions	dottiebrown@ecologicalsolutions.net
Caroline Byrne	Biodiversity Research Institute	caroline.byrne@briloon.org

BYLAWS COMMITTEE

Nikki Castleberry (Chair)	Georgia Museum of Natural History	neotoma@uga.edu
Tim Carter	Ball State University	tccarter@bsu.edu
Brian Carver	Tennessee Technological University	bcarver@tntech.edu

WEBSITE COMMITTEE

Jason Robinson Chair)	Biological Systems Consultants, Inc.	jason@biologicalsystemsconsultants.com

2020 SBDN BAT BLITZ

Brought to you by the

Alabama Bat Working Group

Bankhead National Forest

August 3 - 7, 2020

POSTPONED TILL SUMMER/FALL 2021

20th Anniversary of the first Alabama Bat Blitz

ERRATUM

**The following article was inadvertently cut off and not included in the Fall issue of Nightwing News.
I would like to offer my sincere apology to Gary Jordan for this oversight.
J.D. Wilhide, Editor Nightwing News**

Aiding the northern long-eared bat

Service and partners team up in battle against deadly white-nose syndrome

By Gary Jordan, Fish and Wildlife Biologist, Raleigh, North Carolina, Field Office November 19, 2019

Bats provide valuable ecosystem services that impact the world's economy and our lives. They pollinate cash crops and forests, disperse seeds, produce fertilizer and control pests by devouring insects. Many bat species are in decline, however, due to habitat loss and disease, especially white-nose syndrome (WNS).

The Service has been working with partners promoting conservation, research and innovation to fight back at the national level. In the eastern half of the U.S., the northern long-eared bat (NLEB) has seen severe population declines due to white-nose syndrome (WNS), a disease that kills bats by increasing the amount of energy they use during winter hibernation and by creating physiological imbalances that can inhibit normal body functions.

Northern long-eared bat, Bladen County, North Carolina.

Moved by population declines caused by WNS, the U.S Fish and Wildlife Service (Service) listed the NLEB as threatened under the Endangered Species Act on April 2, 2015. At the time, its distribution and behavior in eastern North Carolina was poorly understood. The NLEB was only recently discovered in eastern North Carolina, in 2007.

The North Carolina Department of Transportation (NCDOT) provided funding for five years of NLEB surveys and studies to better understand the species' distribution and behavior in eastern North Carolina. NCDOT took on this conservation measure to generate the data needed to streamline ESA Section 7 consultations for a large number of transportation projects in eastern North Carolina. NCDOT, the Federal Highway Administration, and the U.S. Army Corps of Engineers entered into a formal five-year agreement (2015-2020).

Photo: Gary Jordan Jordan holding a northern long-eared bat captured in Columbus County.

Photo by John Henry Harrelson, NCWRC.

Four environmental consulting firms were contracted to assist in surveys and studies. Biologists from the Service and the North Carolina Wildlife Resources Commission also conducted bat surveys in eastern North Carolina. Spring/summer mist-netting surveys were conducted to map out the distribution of the species in eastern North Carolina. The researchers also netted and tracked bats during fall/winter to determine where and how NLEBs spend the winter. Additionally, a special maternity study was conducted during spring/summer 2019 to acquire information on reproduction. Since the studies began in 2015, the number of counties in eastern North Carolina with NLEB capture records has increased from four to 18. These captures occurred during all four seasons of the year within the Coastal Plain. Nearly all the captures occurred less than 30 miles from the ocean or sounds and generally occurred either in or adjacent to swamps. Despite significant survey efforts, no NLEBs have ever been captured in the Piedmont Region of North Carolina. The lack of captures within the Piedmont suggests geographically separate populations of these bats in North Carolina, with the centrally-located Piedmont separating the population in the Mountain Region from the population in the Coastal Plain. This hypothesis is supported by North American Bat Monitoring Program acoustic data which suggest little to no presence of NLEB in most of the Piedmont of North Carolina.

"A flooded forest." Typical habitat for NLEB in Pitt County, NC.

Photo by L. Serrano, USFWS.

Perhaps the greatest discovery was the documentation that NLEBs are present and active during the winter in the outer portions of the Coastal Plain. Prior to these studies, it was generally understood that all NLEBs hibernate in caves or mines during the winter. However, small transmitters were attached to 44 bats over three seasons, and the bats were then tracked through all months of winter and were observed utilizing multiple tree cavities. These winter roost trees varied in species and size and mostly occurred in or adjacent to swamps.

This portion of the state is nearly devoid of caves or mines suitable for hibernacula, but also experiences milder winters in comparison to most of the species' range. Although insect activity is reduced during winter, it appears that there is sufficient prey available for the bats to forage during most of the winter. However, during record low temperatures in January 2018, some bats did go into torpor (a state of decreased physiological activity, usually by a reduced body temperature and metabolic rate) for a few days until temperatures returned to normal.

Because federal protections focus mostly on the locations where NLEBs roost during the pup season (a sensitive life stage), researchers conducted maternity studies in spring/summer 2019. In the northeast corner of the Coastal Plain, 20 reproductive females were tracked to 64 roost trees. Although tree species and sizes varied, most were swamp species and tended to be smaller in size than expected.. Reproduction in the Coastal Plain occurs somewhat earlier than in more interior populations of the species. In the Coastal Plain of North Carolina, non-volant (non-flying) pups are likely present in maternity roosts during the months of May-June as opposed to the June-July dates from previous studies in other regions.

"A fuzzy bat seen through a small gap in a tree." Northern long-eared bat inside bald cypress tree cavity during winter. Photo by Dottie Brown, Ecological Solutions.

So far, there is no evidence in the Coastal Plain of WNS or the fungus that causes the disease. Since it is a cold-loving fungus that is generally found in caves and certain types of mines, the lack of caves or suitable mines in the area and the warmer winter temperatures may preclude it from persisting in the Coastal Plain of North Carolina. Even if the fungus was detected in the Coastal Plain, without dependence upon caves or mines for hibernation, this population of bats is less likely to experience mortality from WNS. Since the NLEB populations in the mountains of North Carolina and in most other portions of its range have plummeted, there is hope that the Coastal Plain NLEB population in North Carolina may serve as a refugium for the future survival of the species. Additionally, recently discovered NLEBs in coastal South Carolina may further contribute to this hope.

The studies have provided us valuable information about the bat. Knowing that most winter and maternity roosting sites are in or adjacent to swamps will help us target our conservation efforts more effectively. The Service is now better equipped to provide science based recommendations that will influence not just transportation projects, but any project involving tree removal or forest management.

"A fuzzy brown bat with a metal id on its wing and long ears." A northern long-eared bat captured in Columbus County, NC. Photo provided by Gary Jordan, USFWS.

Contact: Gary Jordan, Fish and Wildlife Biologist
gary_jordan@fws.gov,
(919) 856-4520

Annual Meeting Summary

25th Annual Meeting of the Southeastern Bat Diversity Network
and
30th Annual Colloquium on the Conservation of Mammals in the Southeastern U.S.

February 12—14, 2020

THE CLASSIC CENTER

ATHENS, GEORGIA

Annual Meeting Summary

SBDN 2020 Planning Committee:

Trina Morris

Emily Ferrall

Laci Pattavina

Pete Pattavina

Vanessa Kinney Terrell

Steven Castleberry

Nikki Castleberry

Maggie Hunt

Steve Samoray

Luke Dodd

Let's not forget the sponsors who helped make this years SBDN meeting possible!

Presentations and Exhibits

Hallways are the best for breaks and exhibits. Did someone say coffee?

Below: Mary Kay Clark presents on the History of SBDN.

Above: Tim Carter and Steven Castleberry.

My how times have changed… Wait that's the presentation on Shotguns and Satellites.

Hold Up… Poster Time!

And lots of food and miniature deserts!!!

AWARDS AND RECOGNITION

Student-Professional Teams awarded there prizes for the Mammal Trivia Challenge!

Top: First Place “The Cultural Heroes,” Michael St. Germaine and Marcelo Jorge.

Bottom: Tied for second place Team *Dipodomys elator* and Team Eastern Yellow Bat Shark.

AWARDS AND RECOGNITION

Best Student Poster: Karmren Jefferson

Rest Site Selection of Plains Spotted Skunks (*Spilogale putorius interrupta*) in Southeastern Texas,

Best-Bat Presentation: Reed Crawford

Indiana Bats Select Artificial Roosts Based on Solar Exposure and Weather.

AWARDS AND RECOGNITION

Best Overall: Blaise Newman

Winter Roosting Ecology of Non-Cave Hibernating Tri-Colored Bats in the Upper Coastal Plain of South Carolina.

2020 SBDN LIFETIME ACHIEVEMENT AWARD

Presented by: James Kiser

This year's recipient's vast knowledge of the flora and fauna of the eastern United States is unprecedented and his willingness to share this information with others is equally impressive.

Like many of us, this year's recipient's interest in Natural History started when he was a child. However, his interest in bats did not begin until 1972 when he entered the Masters of Science program at the University of Kentucky. Under the tutelage of Dr. Roger Barbour and Dr. Wayne Davis, the early pioneers of bat research in North America, he would take time away from his water snake graduate research project to venture into the many caves along the Kentucky River Palisades to photograph and study the winter ecology of cave bats. Over the past 46 years, this year's recipient has become the leading authority on the natural history and management of endangered bats in Kentucky and many adjacent states.

Along with other previously selected as SBDN Lifetime Achievement Award recipients, this year's recipient is one of the real pioneers in bat research, monitoring, conservation, and management. He along with Robert Currie and Roy Powers completed assessments and successfully protected dozens of caves harboring populations of endangered bats by constructing bat friendly gates during the 1980's and 1990's. While serving as Kentucky Department of Fish and Wildlife Resources' first Nongame Biologist and Endangered Species Program Leader from 1981 to 1990, he initiated regular population monitoring of caves harboring colonies of rare and/or endangered bats, developed a database to help keep track of bat and herp data, and maintained some of the first county distribution maps for bats in the eastern U.S. Today this type of effort may be standard protocol and simplistic due to the technology available, but in the 80's it was a pioneering effort. When put into proper temporal context, this effort is even more amazing. The amount of data collected, analyzed and track by him and a single assistant is staggering given the lack of interest and funding at that time for bat and herp surveys. Without these early population data there would be a huge gap in species distribution maps and our understanding of early population levels for the Indiana bat and gray bat. Until recently, within the past 12 years, he continued to spend much of his winters conducting hibernacula counts at caves throughout Kentucky, tallying the number of bats for each species present. Much of the monitoring data collected on endangered species, especially the Indiana bat, has been invaluable to the U.S. Fish and Wildlife Service and Indiana Bat Recovery Team and played an integral role in the development of the most recent version of the Indiana bat Recovery Plan.

This year's recipient has represented Kentucky Department of Fish and Wildlife Resources and U.S. Forest Service on the Indiana Bat Recovery Team. He has spent many tireless nights and much of his personal time reviewing draft versions of the Indiana Bat Recovery Plan and/or traveling to multi-agency meetings to discuss bat conservation and management. He has also volunteered countless hours preparing and giving oral presentations at government sponsored trainings, professional meetings (Such as SBDN, Kentucky Academy of Science, and North American Symposium on Bat Research, and at educational weekends like Herp and Wildflower Weekends). As David Saugey stated about this year's recipient "*he has spread the gospel of bats to thousands and thousands of people using his unique presentation style supported by truly remarkable photographs*." A trademark of his presentations is that they are always entertaining, visually stimulating, and educational. One such presentation entitled "*The use of road ruts as water sources by bats in eastern Kentucky,*" contained a photograph that took many attempts and some fancy technology to obtain. This photograph was only one of a million photos that he has taken, but one of the most important because it showed a bat drinking from a muddy road rut, which helped reshape how biologists conducted summer mist net surveys for bats in the mountainous terrain of the eastern United States. This presentation provided not only the necessary data, but also visual validation demonstrating the need to survey bats in a new way; netting road ruts on dry ridgetop versus the standard method of the time which focused almost exclusively on steam corridors. Bat data collected by surveying ridgetop road ruts captured many more northern long-eared bats, which eventually lead to them being delisted from almost all State rare species lists within its core range.

One of his most notable accomplishments in bat conservation and management was the development of the Cliffline Policy on the Daniel Boone National Forest. This policy was drafted prior to any literature having been published concerning the importance of micro-habitats associated with clifflines, especially as they relate to the roosting and foraging habits of the Virginia and Rafinesque's big-eared bats. His vast knowledge of the flora and fauna of these habitats provided enough unpublished information in the late 1980's to formulate the policy. Later studies on these two species of bats, along with the eastern small-footed bat, and other cliffline dependent species proved his random and non-statistical field observations were accurate in terms of determining the importance of clifflines to the local bat fauna. Today more than 3,700 miles of cliffline, encompassing approximately 111,200 acres in the Daniel Boone National Forest are protected/managed to support habitat for populations of flora and fauna, including numerous species of rare bats. This achievement was a result of his early commitment to do what was ecologically right instead of what was politically right.

2020 SBDN LIFETIME ACHIEVEMENT AWARD

2020 SBDN LIFETIME ACHIEVEMENT AWARD

He was also responsible for developing the bat conservation, management, and protection measures found in the *Revised Land and Resource Management Plan for the Daniel Boone National Forest* dated April 2003. Some of the bat protective measures found in this plan include Indiana bat roost tree retention, buffers around endangered bat summer roosts and hibernacula, establishment of upland water sources, management of forest communities to improve bat habitat, and continued protection of cliffline habitats. This plan is the most progressive in the country in- regards to the conservation, management, and protection of rare bats. Since the plan's inception many other southeastern National Forest have patterned their plans after the Daniel Boone National Forest' because of its proactive and progressive approach toward rare species. His effort with protecting bats is best described by Dennis Krusac, "*John single-handedly changed bat conservation for the better on national forests in the eastern U.S*."

While on the Daniel Boone National Forest, this year's recipient, along with a fellow Forest Service biologist, Dan Dourson, created the Post Bat House Design (aka the Rocket-style Bat Box) which was patterned after a natural Indiana bat roost tree. This bat box has been the most successful design for attracting northern long-eared bats and has even been used by Indiana bats. He along with Hal Bryan developed the first guidance document on how to safely complete external evaluations for endangered bat habitat at abandoned underground coal mine portals. They were able to successfully describe important characteristics of abandoned underground mines by foolishly crawling around inside these structures looking for bats in the 1980's. In addition, he also co-authored papers concerning how to capture Indiana bats on coal mine projects, the use of concrete bridges by Indiana bats as night roosts, and roost site fidelity of Indiana bats.

This year's recipient has influenced a large number of young biologists and seasoned biologists alike with his knowledge and eagerness to assist them with research projects and by sharing nearly a half century of data, general observations, and photographs. He has spent many a night radio-tracking Indiana bats as a volunteer until three o'clock in the morning and then show up at his office on-time the following morning. His dedication to do these types of "crazy things" just to learn more about eastern forest bats and to improve bat conservation puts him above all others. Any biologist who has spent much time with him will quickly respect his ability to function on very little rest and his love for, and knowledge of Natural History. On a more personal note, this year's recipient has contributed a great deal to my career, and he continues to shape me as a biologist by sharing a wealth of natural history knowledge.

I am honored to present to you my best friend and mentor, Mr. John Roy MacGregor II, as the 2020 SBDN Lifetime Achievement Award Recipient.

Awards and Recognition

SBDN SERVICE AWARD

Purpose: To recognize outstanding service and contributions to the Southeastern Bat Diversity Network.

Nomination Procedure: The SBDN awards committee will call for nominations in September or October of each year through the SBDN mailing list. Nominations will be submitted to the committee by December 1. Nominations can be submitted by any SBDN member, including members of the Executive Committee and the Awards Committee. Nominations will consist of a letter that describes the nominee's service to SBDN. The committee will review the nominations and evaluate them based on significance of the contributions to SBDN. One name will be forwarded to the SBDN Executive Committee for final approval by January 1. If no worthy nominees have been submitted for consideration, no name will be forwarded to the Executive Committee.

Award Process: The awardee will be announced at the SBDN annual meeting, usually held in February. A plaque will be presented to the awardee by the previous recipient or the SBDN president. The Awards committee will be responsible for obtaining the plaque and funds will be provided by SBDN. A copy of the nomination letter and pictures of the award presentation will be deposited in the SBDN archive.

SBDN LIFETIME ACHIEVEMENT AWARD

Purpose: To recognize individuals who have made significant contributions to the conservation of southeastern bats through research, education, or management efforts. The intent of this award is to recognize more senior individuals who have amassed a variety of accomplishments throughout their careers. The award is SBDN's highest honor. The award may not be given every year.

Nomination Procedure: The SBDN awards committee will call for nominations in September or October of each year through the SBDN mailing list. Nominations can be submitted by any SBDN member, including members of the Executive Committee and the Awards Committee. Nominations will be submitted to the committee by December 1. Nominations will consist of: 1) a letter that describes the nominee's accomplishments and how they have impacted bat conservation in the southeast, and 2) the nominee's Curriculum Vitae. The committee will review the nominations and evaluate them based on the totality of the accomplishments and their impact on bat conservation and/or our understanding of bat ecology. The committee will forward one name to the SBDN Executive Committee for final approval by January 1. If no worthy nominees have been submitted for consideration, no name will be forwarded to the Executive Committee.

Award Process: The awardee will be announced at the SBDN annual meeting, usually held in February. A plaque will be presented to the awardee by the previous recipient or the SBDN president. The Awards committee will be responsible for obtaining the plaque and funds will be provided by SBDN. A copy of the nomination letter, the awardees' CV, and pictures of the award presentation will be deposited in the SBDN archive.

STUDENT TRAVEL AWARD

The Southeastern Bat Diversity Network (SBDN) established an annual Student Travel Award in 2006 to financially assist one student attending the North American Symposium on Bat Research (NASBR). If you are a student enrolled in a university in the Southeastern US and are planning to give an oral or poster presentation at NASBR in 2018 (www.nasbr.org), you are qualified to apply for a student travel award from SBDN. Information on the award and the application process are available at: http://www.sbdn.org/files/SBDN_Student_Award.pdf. **DEADLINE for 2020 applications will be June 15, 2020**. Send applications to Stephen Burnett via email (sburnett@clayton.edu) or snail mail (Stephen Burnett, Department of Natural Sciences, Clayton State University, 2000 Clayton State Blvd, Morrow GA 30260). E-mail submissions are preferred. Contact Stephen Burnett (sburnett@clayton.edu) if you have questions.

History of the Mammal Colloquium and SBDN Meetings

COLLOQUIUM	SBDN	YEAR	LOCATION	HOST
30th	25th	2020	Athens, GA	Georgia Department of Natural Resources
29th	24th	2019	Jacksonville, FL	Florida Fish & Wildlife Commission
28th	23rd	2018	Roanoke, VA	Joint Bat Working Group Meeting
27th	22nd	2017	Asheville, NC	Tim Carter, Mary Kay Clark, Katherine Caldwell
26th	21st	2016	Guntersville, AL	Tennessee Valley Authority
25th	20th	2015	St. Louis, MO	Joint Bat Working Group Meeting
24th	19th	2014	Nacogdoches, TX	Chris Comer
23rd	18th	2013	Fall Creek Falls, TN	Brian Carver
22nd	17th	2012	Louisville, MS	Darren Miller
21st	16th	2011	Louisville, KY	Tim Carter & Brooke Hines
20th	15th	2010	Asheville, NC	Mary Kay Clark
19th	14th	2009	Jonesboro, AR	Tom Risch & Blake Sasse
18th	13th	2008	Blacksburg, VA	Michael St. Germain
17th	12th	2007	Destin, FL	Jeff Gore
16th	11th	2006	Chattanooga, TN	Tim Carter & Troy Best
15th	10th	2005	Paris Landing, TN	John Nelson
14th	9th	2004	Helen, GA	Steven Castleberry
13th	8th	2003	Mississippi State, MS	Darren Miller
12th	7th	2002	Clemson, SC	Susan Loeb
11th	6th	2001	Memphis, TN	Michael Kennedy
10th	5th	2000	Guntersville, AL	Troy Best
9th	4th	1999	Wytheville, VA	Rick Reynolds
8th	3rd	1998	Hot Springs, AR	David Saugey
7th	2nd	1997	Black Mountain, NC	Mary Kay Clark
6th	1st	1996	Somerset, KY	Mike Lacki
5th		1995	Cookeville, TN	Michael Harvey
4th		1994	Athens, GA	Joshua Laerm
3rd		1993	Mountain View, AR	Gary Heidt & Rick McDaniel
2nd		1992	Guntersville, AL	Troy Best
1st		1991	Memphis, TN	Mike Kennedy

Upcoming Events

31st Annual Colloquium on the Conservation of Mammals

in the Southeastern U.S.

And

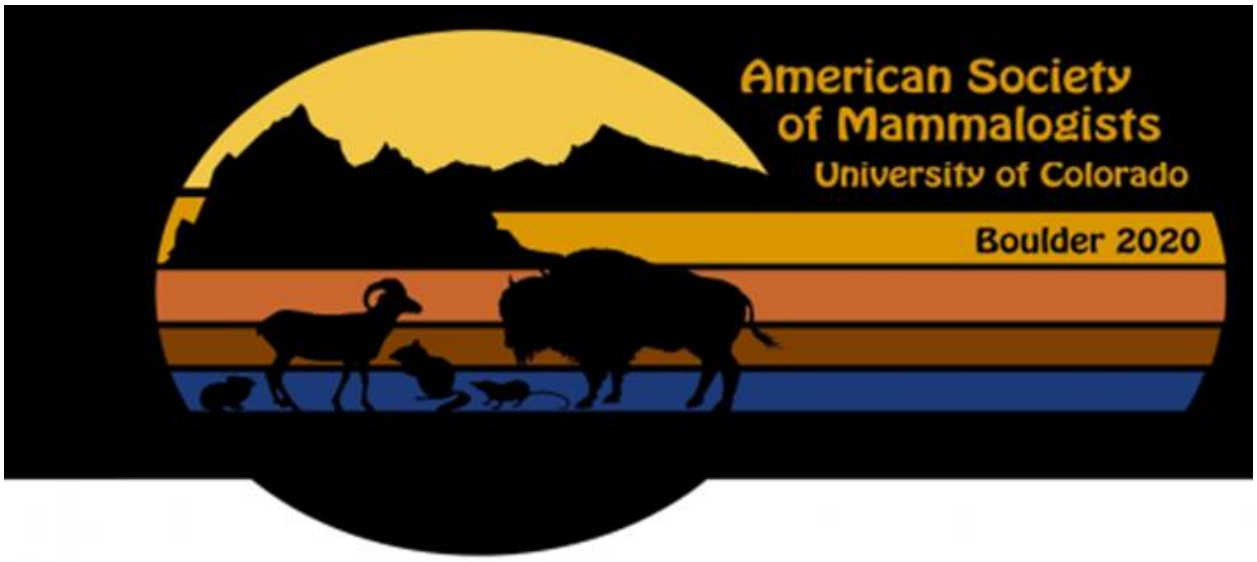
26th Annual Meeting of the Southeastern Bat Diversity Network

Embassy Suites Red Wolf Convention Center

Arkansas State University

Jonesboro, Arkansas

February 18-19, 2021



100TH ANNUAL MEETING OF THE AMERICAN SOCIETY OF MAMMALOGISTS.

June 5th – 9th, 2020

BOULDER, COLORADO

Upcoming Events

27TH ANNUAL CONFERENCE OF THE WILDLIFE SOCIETY

September 27 - October 1, 2020

Galt House Hotel

Louisville, Kentucky

NASBR

North American Society for Bat Research

50th Annual Meeting of the North American Symposium on Bat Research

October 28-31, 2020 Tempe, AZ

Local Hosts:
Angie McIntire - Arizona Game & Fish Department
and
Marianne Moore - Arizona State University

Tempe Mission Palms, Tempe, AZ

Upcoming Events

16TH ANNUAL BAT FEST

August 29th, 2020

Congress Ave Bridge

4pm to Midnight

1.5 million Mexican free-tailed bats emerging from under the bridge

Editors Closing Comments

WOW! I bet no one thought 2020 would start like this!!
I would wager that not in our wildest dreams did we ever expect to be all working from home with no school, no restaurants, no movies, and hoping we have enough TP.
On a more positive note we were able to have our 25th/30th meeting
and have the chance to visit and re-connect with our friends and colleagues.

My wish is that you all are safe and we will all be back to our normal very soon.

Remember: Be safe, take good notes, and pictures!
With everything that has gone on so far this year
try to have a little fun along the way!

2020 MEETING ABSTRACTS

ORAL PRESENTATIONS

Listed alphabetically by first author
Underline indicates presenting author
Asterisk (*) indicates student author

WINTER CULVERT SURVEYS IN LOUISIANA

A. N. Anderson, M. C. Arias, B. C. Upton, M. L. Hoggatt, B. R. Stafford
Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA 70808

In Louisiana, cave dwelling species typically roost in culverts and man-made structures due to a lack of available cave hibernacula. To determine species distribution and abundance, we examined seasonal use of culverts as roost sites. We conducted three consecutive years of winter surveyed from November to March in 2017-2018, 2018-2019, and 2019-2020. In year one we surveyed 707 culvert sites, 18.18% used by bats, and identified 2,626 individuals. During year two we surveyed 790 sites, 25.56% used by bats, and identified 7,152 individuals. Species identified across all three years are: *Eptesicus fuscus*, *Perimyotis subflavus*, *Myotis austroriparius*, *Myotis septentrionalis, Corynorhinus rafinesquii*, and *Tadarida brasiliensis*. In order to determine if patterns of species distribution and abundance are constant, year three surveys are currently being conducted. Results will be presented at the meeting.

BAT TRACKING 2000 VS. 2019: THE MORE THINGS CHANGE…

J. D. Chenger
Bat Conservation and Management, Inc., 1263 Claremont Road, Carlisle PA 17015

Bat Conservation and Management's first Indiana bat (*Myotis sodalis*) VHF radio tracking project during migration was in early 2000. A flurry of similar projects quickly followed, often merging resources with collogues such as Sanders Wildlife, the Pennsylvania Game Commission, and other state and federal agencies. Today, the largest family of little brown bat [*Myotis lucifugus* (MYLU)] summer survivors known in Pennsylvania lives in two concentrations in artificial roosts. However, only a handful of MYLU can be accounted for in locally known, accessible winter hibernacula. We hypothesize that the little brown bat surviving summer colonies are seeking undiscovered/non-standard hibernacula and are not traveling far from their summer roosts. We attempted to monitor over twenty MYLU from one colony in the late fall using as many as thirteen coordinated ground-based observers and a Cessna 172 over the course of a month's time. We again pooled tracking resources and veterans from Sanders, current PGC, and even retired PGC biologists to intensely monitor a 12 square mile core area inside a larger 1,500+ square mile search zone. A few new technologies unavailable to earlier efforts were used. We found some of our existing technology had changed, sometimes for the better or worse, or introduced new, unanticipated results. Our experience highlighted a few tools that were still indispensable, a few not ready for prime time, and a call for a tool that we wished we had, but doesn't quite exist…yet.

IMPROVING BAT SURVEY EFFICIENCY AND PROBABLE PRESENCE RESULTS BY COMBINING PHYSICAL CAPTURE EFFORTS WITH ACOUSTIC RECORDING METHODS

J. D. Chenger, J. D. Tyburec
Bat Conservation and Management, Inc., 1263 Claremont Road, Carlisle PA 17015 (JDC); Bat Survey Solutions, LLC., P.O. Box 86493, Tucson AZ (JDT)

In recent years, many survey protocols for bats have focused primarily on recording and analyzing echolocation calls to determine probable species presence in an area, while largely eliminating the need for physical capture efforts. We illustrate that probable species presence results based upon acoustic survey methods alone do not return accurate information about actual species compositions in an area. These conclusions are based upon annual

summer surveys from 2016 thru 2018 across North America, throughout multiple habitat types, with differing bat species assemblages. Our work has paired acoustic survey efforts using passively deployed bat detectors with physical capture surveys using mist nets and harp traps. In every case, we found that acoustic survey results were biased towards documenting bat species (1) with high-amplitude echolocation calls, (2) with lower echolocation frequencies, and/or (3) with unique or at least well-known acoustic repertoires. This often resulted in erroneous determinations of relative species presence and/or relative abundance when data from simultaneous capture efforts were considered. Relying solely upon acoustic survey results can lead to spurious conservation and management considerations for bat populations in an area. Moreover, the loss of morphometric data from regular physical capture efforts can have significant implications for determining bat population status and critical habitat associations.

RECOGNIZING SUBHARMONICS IN BAT ECHOLOCATION CALLS

C. Corben, A. Poulos

Subharmonics, better called "Sub Fundamental Components" (SFCs), are acoustic features generated by a larynx under stress. They are common in human speech and other mammalian vocalizations and have been recorded from several species of bats. In bat echolocation calls, the phenomenon seems rare and could be a sign of pathology. But in *Tadarida brasiliensis*, they are quite common and might be used to convey social information. SFCs are produced as pairs of signals whose frequencies add up to the frequency of the fundamental. A common result is a single component at a frequency of half the fundamental, so the signal can appear confusingly like a lower harmonic. This can lead to misidentification of bats identified acoustically. In North America, a significant example has been signals which resemble echolocation pulses of distant *Eumops floridanus* but originated from *Tadarida brasiliensis*. This presentation shows examples of the phenomenon and demonstrates how to detect and identify SFCs to avoid any deception

INDIANA BATS SELECT ARTIFICIAL ROOSTS BASED ON SOLAR EXPOSURE AND WEATHER

R. D. Crawford*, L. E. Dodd, J. M. O'Keefe
Department of Biological Sciences, Eastern Kentucky University, Richmond 40475 (RDC and LED); Center for Bat Research, Outreach, and Conservation, Indiana State University, Terre Haute 47809 (JMO)

Artificial roosts are common tools for managing at-risk bat species. When natural roosts are scarce due to anthropogenic land modification, resource managers sometimes erect artificial roosts. The Indiana bat (*Myotis sodalis*) is a focal species for which artificial roosts are commonly used, but many questions remain regarding Indiana bats' preferences for artificial roost design. We aimed to assess Indiana bat preference for roost design, environmental conditions, and landscape position. We deployed 40 rocket-box style roosts of differing designs in clusters at single field sites in Indiana and Kentucky. Box designs were altered to manipulate microclimate (1 reference design, 2 designs increasing TMIN, 2 designs decreasing TMAX), and clusters were positioned at 4 different solar treatments (easterly sun, westerly sun, forest, and open). We conducted spotlight checks and emergence counts ~4 times/week at each site over the 2019 maternity season and used a hurdle model analysis to assess factors important to Indiana bat presence and abundance in roosts and clusters at our sites. Indiana bats did not select any specific box design, but primarily roosted along easterly sun tree lines during lactation and westerly sun tree lines during post-lactation, avoiding roosting in open location clusters. Increasing solar radiation and mean daily temperature along with decreasing mean daily wind speed positively influenced presence and abundance of bats within roosts. Our results indicate Indiana bat artificial roost selection may be driven by reproductive energetic constraints and predator avoidance, as bats selected and switched between solar-exposed roosts along tree lines but avoided clusters in open areas. Finally, calm and warm weather conditions promoted the presence and abundance of bats in roosts. This work underscores the importance of deploying artificial roosts in a variety of locations for Indiana bats, as their thermoregulatory and physiological needs change during maternity season.

PRESCRIBED FIRE EFFECTS ON BAT SUMMER HABITAT USE IN THE CUMBERLAND PLATEAU

C. S. Davis*, S. C. Loeb
Department of Forestry and Environmental Conservation, Clemson University, Clemson, SC 29634 (CSD); USDA Forest Service, Southern Research Station, Clemson University, Clemson, SC 29634 (SCL)

Forests of the Cumberland Plateau and Appalachian Mountains of Tennessee and Kentucky are often managed with prescribed fire. Several declining bat species such as the federally protected *Myotis sodalis* and *M. septentrionalis*, as well as *M. lucifugus* and *Perimyotis subflavus*, use these forests. While many studies suggest prescribed fire improves foraging habitat for bats, more information is needed regarding effects of time since last burn and fire severity on the summer foraging ecology of these bats. Our objective was to determine how activity of bats in Big South Fork National River and Recreation Area in Tennessee and Kentucky was affected by time since last burn and fire severity. From May-August 2018 and 2019 we collected bat acoustic data using Anabat SD2 detectors in 57 prescribed fire sites for 2-5 nights each with varying combinations of time since last burn (0-2, 3-4, 5-7, and >8 years), burn severity (medium or low), and forest type (mixed-oak hardwood, hemlock-hardwood cove, and Appalachian pine-oak forest). We measured vegetative characteristics (percent canopy closure, basal area, and sapling density) within a 0.1 ha circular plot around each survey site. Basal area was lower in Appalachian pine-oak sites than in mixed-oak hardwood and hemlock-hardwood cove sites, and lower in medium severity sites. *Myotis* spp. were more active in medium severity burn sites than low severity burn sites, whereas *P. subflavus* activity was similar in low and medium severity burn sites. *Lasiurus borealis* were more active in medium severity sites than low severity sites, whereas activity of *Eptesicus fuscus, Lasionycteris noctivagans*, and *Nycticeius humeralis* was not affected by time since last burn or burn severity. Our findings suggest burn severity may influence summer bat species composition and activity in the study sites whereas time since last burn may have minimal impact.

MULTI-SCALE HABITAT SELECTION BY NORTHERN LONG-EARED BATS ON THE COASTAL PLAIN OF NORTH CAROLINA

J. L. De La Cruz, M. True, H. Taylor, D. Brown, G. Jordan, C. Manley, W. M. Ford
Conservation Management Institute at Virginia Tech, Blacksburg, VA, 24061; Department of Fish and Wildlife Conservation, College of Natural Resources and Environment, Virginia Tech, Blacksburg, VA, 24060 (MT, HT, WMF); VHB Ecological Engineering, Raleigh, NC, 27606 (DB); United States Fish and Wildlife Service, Raleigh, NC, 27636 (GJ); North Carolina Division of Transportation, Raleigh, NC, 27699. (CM); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA 24061 (WMF)

Although well documented throughout much of its range, information regarding northern long-eared bat (*Myotis septentrionalis*) day-roost selection, roosting home range size, and roosting habitat selection is limited for the Coastal Plain of North Carolina where populations have recently been discovered. During 17 June–28 June 2019, we radio-tagged northern long-eared bats (n = 7) at the North Carolina Wildlife Commission's North River Game Land to determine day-roost selection, roosting home range size, and second- and third-order, home range within a region and core home range (50% UD) within a periphery (95% UD), habitat resource selection. For day-roosts here, 6 tree species were used, but > 50% occurred in suppressed and mid-story water tupelo (*Nyssa aquatica*) or Carolina ash (*Fraxinus caroliniana*). Most observed day-roosts (> 70%) occurred in cavities. Similar to previous research in other regions, our 50% UD and 95% UD home range estimates were 11.3 ha and 43.6 ha, respectively. At the second-order spatial scale, northern long-eared bats selected for large (> 200 ha) forested wetlands and mixed upland forests, and, specifically, forests nearer open water that contained small canopy breaks. Additionally, at the third-order spatial scale, areas farther from forest edge, non-forest areas, and large forest perforations were selected. Based on these models, and a random sample of the region (2.5 km buffer), suitable day-roosting habitat appears limited and comprises < 10% of the landscape. Our results suggest the need to conserve complex and large tracts of forested wetlands containing suppressed and mid-story cavity bearing trees. However, the juxtaposition of mixed upland forests appears likely beneficial and is consistent with management efforts for the species throughout its traditional range .

SEASONAL BAT ACTIVITY PATTERNS IN HIGH-ELEVATION MONTANE CONIFER SKY ISLANDS

C. A. Diggins, W. M. Ford
Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA (CAD); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA (WMF)

Understanding bat distribution patterns across space and time is important to bat conservation. Within the Southern Appalachians, while most areas have been widely surveyed or monitored for bats, the higher elevations have typically have received less sampling effort. We conducted a bat acoustic study in high-elevation (>1,525 m) red spruce (*Picea rubens*)-Fraser fir (*Abies fraseri*) sky islands across western North Carolina We surveyed 10 survey sites, placing 3 Pettersson D500x acoustic detectors at each survey site. Sites were surveyed in May, July, and October for 10 days in 2017. We detected hoary bats (*Lasiurus cinereus*), silver-haired bats (*Lasionycteris noctivagans*), eastern red bats (*Lasiurus borealis*), big brown bats (*Eptesicus fuscus*), evening bats (*Nycticeius humeralis*), tri-colored bats (*Perimyotis subflavus*), northern long-eared bats (*Myotis septentrionalis*), and little brown bats *(Myotis lucifugus*). However, we only had enough detection data for hoary bats and silver-haired bats to model activity with environmental parameters. We used finite mixture models to assess occupancy and activity across seasons. We found that season, elevation, and canopy height influenced occupancy for both species. Although hoary and silver-haired bats were found at our study sites during all seasons, contrary to our initial hypotheses, the highest activity patterns for both species occurred in the summer, highlighting the importance of this habitat type as summer foraging habitat regionally.

HABITAT USE AND HOME RANGE OF APPALACHIAN COTTONTAILS IN WESTERN NORTH CAROLINA

C. A. Diggins, L. P. Erb, J. Apadoca
Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA (CAD); Department of Biology and Environmental Studies, Warren Wilson College, Asheville, NC (LPE); Tangle Bank Conservation, LCC, Asheville, NC (JA)

The Appalachian cottontail (*Sylvilagus obscurus*) is a rare lagomorph that occurs in the Appalachian Mountains south of the Hudson River. Despite its large geographic range, little information is known about the ecology of this species. Currently, Appalachian cottontail are considered a federal species of concern and a knowledge gap species in North Carolina. We conducted a large-scale study in western North Carolina from 2018-2020 across 6 study sites ranging from 1020 -1870 m in elevation. Since our study is ongoing until March 2020, we are going to discuss our preliminary results of home range size and habitat selection on the 2nd order and 3rd order scales from telemetry data obtained from 23 radio-collared individuals (10 females, 13 males). From data collected in 2018-2019, minimum convex polygon home range estimates using 50% core use areas were an average of 0.84 ha (range 0.06 – 3.04), whereas 95% use areas were 4.1 ha (range 0.05 – 18.45). Habitat selection ranged from spruce-fir forests and high-elevation balds to low elevation oak forests and early successional habitat.

MONITORING BAT POPULATIONS ON THE BLUE RIDGE PARKWAY: USING ACOUSTIC SURVEY DETECTION RATES TO DETECT TRENDS FROM 2011 TO PRESENT

C. Dorin*, Z. Vegso, C. Kempter, R. P. Cherry
Department of Biology, Appalachian State University, Boone, NC 28608 (CD, ZV, CK); Blue Ridge Parkway, National Park Service, Blowing Rock, NC 28605 (RC)

Since it was first detected near Albany, NY in 2006, white-nose syndrome has been implicated in the killing of an unprecedented number of bats throughout much of the United States. In the North Carolina Blue Ridge Mountains, WNS was first detected in 2011; as ecologically essential insect predators and pollinators, declines in bat populations are cause for great concern not only for the species themselves, but for the stability and health of the forest ecosystems of the Appalachians in their entirety. As small, flying, nocturnal animals with cryptic and wide-ranging behaviors, bats are difficult to survey, and our inability to measure population size has been

described by leading bat conservationists as possibly the greatest limitation on effective management. However, the presence or absence of bat species in an area may be much more readily determined, especially by the use of acoustic monitoring. Since 2011, the National Park Service at the Blue Ridge Parkway has monitored the distribution of bat species along the Parkway via acoustic surveys, both stationary and along driving routes. Although these surveys may be difficult to gauge bat abundance from, they do provide information on the spatial occupancy of bat species on the Parkway and how those geographical distributions have changed since 2011. Prior to this study, the stationary acoustic survey data was not examined for any significant trends of bat decline as might be anticipated following the spread of white-nose syndrome throughout the region. By assessing trends in detection rates over time, our study utilizes acoustic survey data to evaluate changes in bat populations in the region, especially as it may inform on their conservation status.

ENVIRONMENTALLY DRIVEN ACTIVITY AND MOVEMENT PATTERNS OF EASTERN SPOTTED SKUNKS BASED ON ACCELEROMETER-INFORMED GPS TELEMETRY

A. J. Edelman, K. J. Arts, N. Sharp

Department of Biology, University of West Georgia, Carrollton, GA 30118 (AJE and KJA); Alabama Department of Conservation and Natural Resources, Huntsville, AL 35671 (NS)

Daily and seasonal fluctuations in environmental conditions can significantly impact survivorship and reproductive success of animals by altering energetic requirements and predation risk. Behaviorally, animals often respond to changes in their environment through regulation of activity and associated movement patterns. We used accelerometer-informed GPS telemetry to assess nightly activity and movement patterns in response to environmental conditions in a small endotherm, the eastern spotted skunk (*Spilogale putorius*). Eastern spotted skunks were strictly nocturnal, exhibiting almost no daytime activity bouts. Total time active and distance moved each night increased with ambient temperature and rainfall. Variation in moon illumination, which may affect predation risk, did not impact skunk nightly activity or movement. Strict nocturnality likely benefits skunks by allowing them to avoid daytime periods where they would be more visible to predators. Lower activity and movement at cooler temperatures significantly reduces thermoregulatory costs for small endotherms. Increased activity during or shortly after precipitation may be driven by increased prey availability and decreased predator presence activity. These results highlight that complex behavior of endothermic species such as eastern spotted skunks is influenced daily and seasonally by environmental conditions.

WHITE-NOSE SYNDROME ANTIFUNGAL TREATMENTS: BLACK DIAMOND TUNNEL AND BEYOND

K. T. Gabriel, A. McDonald, K. Lutsch, C. T. Cornelison

Department of Cellular and Molecular Biology, Division of Research and Advanced Studies, BioInnovation Laboratory, Kennesaw State University, Kennesaw, GA 30144

In an effort mitigate precipitous declines in bat populations due to WNS, Kennesaw State University, in conjunction with the Georgia Department of Natural Resources, The Conservation Fund, and the US Fish and Wildlife Service, has developed a multi-year mitigation strategy for Black Diamond Tunnel (BDT) in Clayton, Georgia, once the home to the largest known tri-colored bat population in Georgia. The mitigation approach at this site involves the use of antifungal volatile organic compounds that have demonstrated an *in vitro* ability to inhibit and reduce spore germination and mycelial growth through gaseous, atomizer-mediated, exposure. The compounds being evaluated have been discovered from naturally-occurring fungistatic soils and plants and their associated microbes. Initial mitigation efforts in the winter of 2016/2017 successfully demonstrated the feasibility of this approach. Subsequent winters have resulted in population stabilization and the end-of-season survey on February 28th, 2019 was particularly promising, with surveyors noting a distinct decrease of fungal colonization on bats roosting in the site compared to previous years. Cumulatively, these observations suggest a potentially significant positive impact on the mitigation of WNS related declines at BDT. Partnering this year with Texas A&M and the Texas Parks and Wildlife Department, and funded by the Bats for the Future Fund, we have expanded our treatment sites to include several Texas roadway culverts, enabling both experimental replication and the use of untreated control sites.

SPECIES DIVERSITY AND GEOGRAPHIC VARIATION OF PIROPLASMS IN STRIPED SKUNKS (*MEPHITIS MEPHITIS*) AND SPOTTED SKUNKS (*SPILOGALE* SPP.) IN THE UNITED STATES

K. B. Garrett, J. D. Brown, M. Gabriel, D. Jachowski, S. Harris, M. J. Yabsley

Southeastern Cooperative Wildlife Disease Study, Veterinary Medicine, University of Georgia, 589 D. W. Brooks Dr., Athens, GA 30602 (KBG, MJY); Warnell School of Forestry and Natural Resources, University of Georgia, 180 E. Green St., Athens, GA 30602 (KGB, MJY); Pennsylvania Game Commission, 2001 Elmerton Ave, Harrisburg, PA 17110 (JDB); Karen C. Drayer Wildlife Health Center, University of California Davis School of Veterinary Medicine, Davis, CA 95616 (MG); Integral Ecology Research Center, 239 Railroad Ave, Blue Lake CA 95525 (MG); Department of Forestry and Environmental Conservation, Clemson University, 258 Lehotsky Hall, Clemson, SC, 29634-0310 (DJ, SH) 10

Babesia species are intraerythrocytic protozoan piroplasm parasites that infect a high diversity of hosts, including striped skunks (*Mephitis mephitis*). Previously, a single species, *Babesia mephitis*, was morphologically described from striped skunks in Maryland and a *B. microti*-like sp. sequence was detected in a striped skunk from Massachusetts. We aimed to determine the prevalence and diversity of piroplasm species in striped skunks and spotted skunks (*Spilogale* spp.) in selected areas of the United States. We also obtained partial 18S rRNA and cytochrome oxidase subunit 1 (*cox1*) gene sequences to investigate intraspecific variation. We tested DNA isolated from spleen and/or blood samples from Georgia, Kentucky, Missouri, Texas, Pennsylvania, Florida, Louisiana, South Carolina, and California for piroplasms. We used two PCR assays to screen skunks for infection with *Babesia* sensu stricto (s.s.) and/or *Babesia microti*-like sp. piroplasms. Positive samples were further tested by amplifying and sequencing partial 18S rRNA and cytochrome oxidase subunit 1 (*cox1*) genes to evaluate diversity and intraspecific variation. We tested 59 skunks (46 striped skunks, 5 western spotted (*S. gracilis*) and 8 eastern spotted (*S. putorius*)) and 66% [39/59] were positive, all for a *Babesia microti*-like sp. The 18S and *cox1* analyses indicate that there are two distinct *Babesia microti*-like sp. in skunks and they are different from other *B. microti*-like spp. from carnivores (e.g., fox, raccoons, badgers, etc.). Also, based on *cox1* sequences, one piroplasm species had 'eastern' and 'western' lineages which were not associated with specific skunk species (i.e., the 'western' lineage was found in striped and spotted skunks from California). Our data show that piroplasms are common in skunks and that striped and spotted skunks can host multiple piroplasm species. Additional work is needed to determine if there are any morphological differences between these two piroplasm species and if one of them represents *B. mephitis*.

36-YEAR RETROSPECTIVE REVIEW OF BAT MORBIDITY AND MORTALITY IN THE SOUTHEASTERN USA

C. C. Goodwin*, K. D. Niedringhaus, M. R. Kunkel, M. G. Ruder, M. K. Keel, H. M. A. Fenton, N.M. Nemeth

Southeastern Cooperative Wildlife Disease Study, Departments of Pathology and Population Health, College of Veterinary Medicine, University of Georgia, 589 D.W. Brooks Drive, Athens, GA (CCG, KDN, MRK, MGR, MKK, HMAF, NMN); Department of Pathology, Microbiology, and Immunology, School of Veterinary Medicine, University of California, 944 Garrod Drive, Davis, CA (KDN, MKK); School of Veterinary Medicine, Ross University, Basseterre, St. Kitts, West Indies (HMAF)

Although bats play a significant role in ecosystem health, agriculture, and zoonotic disease transmission, large scale evaluations of morbidity and mortality data are rare. In addition to seasonal environment changes and infectious disease, bats face numerous anthropogenic pressures (e.g., feral/domestic cat predation, structure collision). We evaluated the causes of morbidity and mortality, as well as taxonomic, demographic, temporal, and geographic patterns, among all bat submissions to the Southeastern Cooperative Wildlife Disease Study (SCWDS) from 1983-2019. A total of 296 submissions, including 806 bats, from 19 states were reviewed. Data for each bat included: age, sex, location, date collected, clinical history, gross necropsy findings, histopathology, and ancillary diagnostic test results such as aerobic culture, fungal culture, PCR tests, and toxicological testing. Cases were divided into categories based on major cause of mortality, such as infectious, traumatic, toxicological, and physiologic stress. The cause of death was determined for 343 bats, with trauma being the most common (53.6%) followed by infectious etiologies (29.2%). Among the 79 bats tested for rabies, 2.2% were positive, representing

85% of viral causes of morbidity or mortality. Of 449 samples tested for *Pseudogymnoascus destructans* (the causative agent of white-nose syndrome), 6.8% tested positive; no bats tested positive in 2019. No toxicoses (8.5%) were diagnosed after 1991. Adults (74.1%) were the most commonly submitted age group, followed by juvenile/subadult (19.5%), and pups/neonates (5.9%). The majority of the submissions were from North Carolina (15.1%), Georgia (13.5%), and South Carolina (13.2%). Understanding historic and present causes of mortality may aid developing bat conservation management strategies and future areas of research. Investigation into environmental contributions to mortality, such as temperature, severe weather, and specific anthropogenic pressures (e.g., proximity to wind turbines, land development) may be necessary to more completely understand the potential impacts of trauma

FORAGING BEHAVIOR AND HABITAT-USE OF FEMALE RAFINESQUE'S BIG-EARED BATS ON A FRAGMENTED LANDSCAPE IN RURAL ARKANSAS

C. A. Griffin*, B. N. Spitz, T. S. Risch
Department of Biological Sciences, Arkansas State University, Jonesboro, AR 72401

Studies have been conducted on the foraging behavior and habitat-use of Rafinesque's big-eared bats (*Corynorhinus rafinesquii*; CORA) in different habitats types, however not much is known about their behavior on a highly-fragmented, agricultural landscape. Bottom-land hardwood forests is the main habitat type for CORA located in the Mississippi Alluvial Valley but is rapidly being converted for alternative land use practices. The purpose of this study was to compare foraging behavior and habitat-use between lactating and post-lactating females from a barn colony during the months of July and August (2018 and 2019) on a farm in Jackson county, Arkansas. In total, 24 lactating females and 13 post-lactating females were transmitted and radio-tracked. Semi-fixed, simultaneous triangulation was the method used to collect spatial data during foraging. The software program LOAS calculated the coordinates of their locations during triangulation, and BIOTAS estimated home ranges and core foraging areas. To assess habitat-use, a compositional analysis was run in R (adehabitat HS) and land-usage maps were created in ArcGis. Both lactating and post-lactating bats used habitat based on its the availability in the landscape. Because cultivated crops were the dominated habitat type, the bats foraged primarily over agriculture. These findings highlight the importance of man-made structures for maternity colonies when natural habitat is lacking. Also, because their core foraging areas are over agriculture, this species could provide regulation of crop pests and there is a possibility the bats are being exposed to a bioaccumulation of pesticides. Further research is needed to determine the full effects of foraging on a highly-agricultural landscape.

BAT USE OF UPLAND PONDS WITHIN A HARDWOOD FOREST ECOSYSTEM, SOUTHERN INDIANA

K. P. Harrison*, T. C. Carter
Ball State University, Department of Biology, Muncie, Indiana 47306

The watershed systems of the Morgan-Monroe and Yellowwood State Forests (MMYSF) of southern Indiana are largely composed of ephemeral streams. To provide year-round fresh water, the Indiana Department of Natural Resources (DNR) created small man-made ponds within the state forests for the benefit of game species. Previous studies have supported the positive correlation between bat activity and open water resources. The goal of this study is to determine which of these ponds are used by bat species living within state forest boundaries. During the summer months of 2018, we conducted acoustic surveys at 25 ponds within the MMYSF boundaries to determine bat activity levels for the season. Vegetation density and aquatic fauna surveys were conducted around each pond to quantify pond attributes that could affect bat use. The results of our 2018 survey season showed a negative correlation between high vegetation densities and acoustic files. In 2019 the same ponds were resampled and a small treatment experiment was conducted on a subsample of five ponds with the lowest bat activity. Four 11m x 2m flyways were created around each of the five ponds to determine if lower vegetation clutter will increase overall bat activity levels at these ponds. Using a paired t-test, our results showed no difference between bat activity levels before or after vegetation removal.

INTRAGUILD INTERACTIONS OF MESOPREDATORS IN APPALACHIAN KENTUCKY.

C. R. Hayes*, K. Watson, L. E. Dodd
Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475 (CRH and LED); Department of Geosciences, Eastern Kentucky University, Richmond KY 40475 (KW)

The presence of select mesopredators in an ecosystem may influence the composition of the greater community or be indicative of habitat condition. The extent to which Appalachian mesopredators overlap in their habitat use is not well studied; examining interspecific relationships within these communities is important to better understand trophic ecology and consequences for at-risk mesopredators. We are investigating whether mesopredator richness might relate to the presence of select community members, namely eastern spotted skunks (*Spilogale putorius*), bobcats (*Lynx rufus*), and coyotes (*Canis latrans*). Baited camera trap surveys were conducted December 2018 - March 2019 across eastern Kentucky. Interspecific relationships across species were assessed by comparing rates of detection and co-occurrence. Trapping stations (n = 48, deployments ≥2 weeks each) spanned 7 counties at landholdings managed by the Office of Kentucky Nature Preserves (OKNP). Species detected (% of mesopredator images) included bobcats (2%), coyotes (11%), eastern spotted skunks (0.01%), gray foxes (*Urocyon cinereoargenteus*, <0.01%), long-tailed weasels (*Mustela frenata,* <0.01%), raccoons (*Procyon lotor*, 60%), and Virginia opossums (*Didelphis virginiana,* 25%). All species were detected across ≥2 counties, indicative of varied co-occurrence across sites. We are determining the influence of focal species on mesopredator diversity using regression analyses and model selection procedures. Due to a more carnivorous diet, we hypothesize sites where bobcats were detected will have higher mesopredator richness, but low detection rates of coyotes. Conversely, we expect lower diversity of mesopredators at sites that include higher detection rates of coyotes, due to coyotes' generalist habits. This study continues to inform active management efforts by OKNP for oak-hickory and short-leaf pine restoration.

COASTAL SWAMP BATS: FIVE YEARS OF NORTHERN LONG-EARED BAT STUDIES IN EASTERN NORTH CAROLINA

G. W. Jordan, C. D. Manley
US Fish and Wildlife Service, P.O. Box 33726, Raleigh, NC 27636; North Carolina Department of Transportation, 1598 Mail Service Center, Raleigh, NC 27699

Although previously well-documented in the Blue Ridge Mountains Region of western North Carolina, the Northern Long-eared Bat (*Myotis septentrionalis*) was only recently discovered in coastal North Carolina in 2007. After being listed as a federally threatened species in April 2015, a five-year effort of mist net surveys and tracking was initiated to better understand the species' distribution and behavior in eastern North Carolina. Since 2015, the documented range of the species has expanded from four Coastal Plain counties to 18. Captures occurred during all four seasons of the year and mostly occurred in or adjacent to swamps. Spring/summer netting and tracking indicated that reproduction in the Coastal Plain occurs approximately one month earlier than in more interior portions of the species' range. During winter netting and tracking, bats were observed to be active throughout most of the winter and utilized multiple tree roosts. This portion of the state is nearly devoid of caves or mines suitable for hibernacula, but also experiences milder winters in comparison to most of the species' range. Without dependence upon caves or mines for hibernation, this population of *M. septentrionalis* is less likely to experience mortality from white-nose syndrome (WNS). Neither WNS nor *Pseudogymnoascus destructans* (*Pd*) have been detected in the Coastal Plain of North Carolina. The lack of captures within the Piedmont Region of North Carolina suggests geographically disjunct populations of *M. septentrionalis* in North Carolina, with the centrally-located Piedmont separating the WNS-affected population in the west from the non-WNS-affected population in the east.

WINTER DAY-ROOSTS OF SEMINOLE BATS IN NORTH-CENTRAL FLORIDA: A BURNING QUESTION

M. J. Jorge*, M. True, S. Freeze, S. Sweeten, M. Cherry, W. M. Ford
Department of Fish and Wildlife Conservation, College of Natural Resources and Environment Virginia Tech, Blacksburg, VA, 24060 (MT, SF, SS, MC, WMF); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA 24061 (WMF)

Day-roost selection by tree bats during the winter season generally and their response to dormant season fires, specifically, is poorly known throughout much of the South. During late February and then again in early December of 2019, we mist-netting and radio-tagged 13 (11 males and 2 females) Seminole bats (*Lasiurus seminolus*) at the Camp Blanding Joint Training Facility in Florida. Subsequently, tagged bats were tracked daily to day-roosts. We observed most individuals roosting high in the canopy of dominant water oaks (*Quercus nigra*) or pines, i.e., loblolly pine (*Pinus taeda*), slash pine (*P. elliotti*) or longleaf pine (*P. palustris*), though some bats roosted in the foliage of small red bay (*Persea borbonia*) under the forest canopy. Of the 57 day-roosts we found, 89% were located in mesic hardwood sideslopes or bottomlands where dormant season prescribed fires are infrequently applied and/or of low-intensity. Roost-switching was common and on average, bats moved 220 m between days with a mean residence time of 1.24 days per roost. For a smaller subset of individuals (n = 3) where topographic and vegetation conditions permitted, we burned stands with occupied day-roosts. Flame heights < 2 m and heavy smoke did not cause day-roosting bats to exit roosts, though a single individual roosting in a mid-aged longleaf pine plantation where flame heights exceeded 2 m did leave as fire approached the bole. Our preliminary results suggest that Seminole bats choose day-roost sites that maximize solar exposure whereas also minimizing risks associated with fire.

OVERALL DECLINE AND COMMUNITY COMPOSITIONAL CHANGES OBSERVED IN SUMMER BAT FIELD SURVEYS SINCE WHITE-NOSE SYNDROME ARRIVED IN NORTH CAROLINA

H. Li, K. C. Etchison, K. A. Parker, G. Graeter, K. C. Weeks, M. C. Kalcounis-Rueppell
Department of Biology, University of North Carolina Greensboro, Greensboro, NC 27412 (HL); North Carolina Wildlife Resources Commission, Asheville, NC 28805 (KCE, KAP, GG, KCW); Department of Biology, University of Alberta, Edmonton, AB T6G 2R3, Canada (MCKR)

Epidemiological and physiological studies have shown that White-Nose Syndrome (WNS) has species-specific mortality rates. Certain species such as big brown bats, *Eptesicus fuscus* are less susceptible to WNS than other species (e.g. little brown bats, *Myotis lucifugus*). In contrast, some species such as eastern red bats, *Lasiurus borealis* might not be affected by WNS. Evidence also suggests that empty niches of WNS affected species can be filled by other species. Therefore, compositional changes can be expected in local bat communities impacted by WNS over time whereas the total amount of bats might not change. Our goal was to investigate whether total bats indicated by captures and acoustic activities would change over time and whether community compositional changes would be observed in a manner consistent with species-specific WNS mortality rates. We hypothesized that over time the absolute number of individuals/acoustic activities would not change; however, species less susceptible to WNS would increase proportionally as compared to species more susceptible to WNS. Our study took place in the North Carolina mountains where WNS was first confirmed in the winter of 2010-2011. We examined mist-netting captures between 2001 and 2018 and two separate acoustic monitoring datasets (one between 2011 and 2018, one between 2015 and 2018). The total capture numbers and total acoustic activities from the 2011-2018 dataset both showed decline over time. Compositional changes were found in these datasets as hypothesized. However, no decline or compositional change was found in the 2015-2018 acoustic dataset. Our results, supported by the congruent acoustic and capture data, show that the impact of WNS is strongest in the first a few years of its arrival and there might be a time lag to fill empty niches. We argue that an immediate response plan is needed for areas where WNS has not been detected.

ASSESSMENT OF CULVERTS AND BRIDGES AS ROOSTING HABITAT FOR *PERIMYOTIS SUBFLAVUS* (TRI-COLORED BAT) AND DISEASE TRANSMISSION CORRIDORS FOR PSEUDOGYMNOASCUS DESTRUCTANS

K. E. Lutsch*, C. T. Cornelison
Department of Cellular and Molecular Biology, Division of Research and Advanced Studies, BioInnovation Laboratory, Kennesaw State University, Kennesaw, GA 30144

Pseudogymnoascus destructans is an emerging fungal pathogen causing precipitous declines in North American bats due to the development of white-nose syndrome. Since 2006, 38 U.S. states and 7 Canadian provinces have confirmed the presence of *P. destructans*. Due to the rapid spread of *P. destructans* across the eastern United States, habitat characterization and disease monitoring has become vital to conserving remnant populations. Bats have been observed in multiple states using non-traditional habitat, such as interstate culverts, for roosting. To investigate their use of anthropogenic structures in coastal Georgia, an area where *P. destructans* has yet-to-be detected, comprehensive bridge and culvert surveys were conducted during the hibernation season. Over 240 swabs of bats and substrates were collected and analyzed for fungal presence using qPCR. Monthly culvert surveys were conducted to assess bat presence and collect culvert average daily temperature. Seasonal data further characterized optimal tri-colored bat habitat and, along with WNS surveys, identified suitable habitat for developing WNS. This data addresses the seasonality of bat use of culverts in coastal Georgia, *P. destructans* presence and burden, and the potential role culvert roosts play in disease transmission.

DIET ANALYSIS OF ENDANGERED INDIANA BAT (*MYOTIS SODALIS*) MATERNITY COLONIES IN KENTUCKY

R. Milam*, T. Derting
Department of Biological Sciences, Murray State University, Murray, KY 42071 (RM, TD)

The endangered Indiana bat (*Myotis sodalis;* MYSO*)* suffered declines in the eastern U.S. due primarily to loss and disturbance of forested areas with suitable summer roosting and foraging habitat. Loss of habitat that is important for reproduction and survival of insect prey items likely impacts the ability of MYSO to recover from population decline. Knowledge of the diet of MYSO and the types of habitats that support key prey species is important for effective management of protected areas in which MYSO occur. We investigated potential spatiotemporal and reproductive differences in the diets of MYSO maternity colonies in Kentucky throughout the 2018 breeding season. We collected guano samples from guano traps at the base of artificial roost structures at four MYSO maternity colonies. To determine MYSO diet composition, guano samples were PCR purified and analyzed using DNA metabarcoding. A nested (permutation) nonparametric multivariate analysis of dissimilarity (adonis) was used to determine whether MYSO diet differed significantly among the four sample sites and among different reproductive stages. Indicator values for species that drove taxonomic variation among sites and reproductive stages were assigned in the indval package in R studio. The diets of MYSO colonies was diverse with an emphasis on soft-bodied aquatic and terrestrial insect prey. Prey from Ephemeroptera, Lepidoptera, and Diptera were consumed most frequently at all sites and reproductive stages; Coleoptera prey was consumed frequently at one site and during lactation and post-lactation. Prey species differed significantly among all sites and reproductive stages. Evidence of opportunistic foraging strategies was prevalent in the dataset as the diets of MYSO maternity colonies was taxonomically diverse, especially during pregnancy. Diets of MYSO were dictated primarily by available habitat types. Oak forests and wetland habitats need to be managed for in order to support the most important terrestrial and aquatic prey items of MYSO.

BAT COMMUNITY SPECEIS RICHNESS, DIVERSITY, AND CONDITION TRENDS AT STREAM SITES IN BANKHEAD NATIONAL FOREST FROM 2009 TO 2019

J. M. Nemati*, W. E. Stone
Alabama A&M University, Normal, AL 35762

Pseudogymnoascus destructans, the fungus responsible for White Nose Syndrome (WNS), was detected for the first time in Alabama in 2012 and was first detected in Bankhead National Forest (BNF) in 2013. WNS primarily affects cave-dwelling bat species and has caused massive declines in many species, although forest-dwelling bats tend not to be affected by it. This study evaluates the response of bat communities to the arrival of WNS based off of capture data from 9 sites in BNF for an 11-year period stretching from 2009 to 2019, assessing whether forest bat species have exhibited any changes in condition or in population. Bats were netted at stream sites using a set of mist nets, and, after identifying captured bats, we recorded their body mass to the nearest gram using a Pesola scale and measured their right forearm length in millimeters using calipers to derive an index of physical condition. The condition index was calculated by dividing the body weight in grams by the forearm length in centimeters. Over the study period, major declines in the capture rate for many bat species have been observed, while red bats have seen major increases in the capture rate since 2013. However, preliminary analysis indicates that the condition index of the red bats captured has decreased along with the increases in population. In this presentation we will discuss our preliminary results and review potential explanations for observed changes.

WINTER ROOSTING ECOLOGY OF NON-CAVE HIBERNATING TRI-COLORED BATS IN THE UPPER COASTAL PLAIN OF SOUTH CAROLINA

B. N. Newman*, S. C. Loeb, D. S. Jachowski
Department of Forestry and Environmental Conservation, Clemson University, Clemson, USA (BAN and DSJ); US Forest Service, Southern Research Station, Clemson, USA (SCL)

Cave and mine hibernating tri-colored bats (*Perimyotis subflavus*) have experienced precipitous declines from white-nose syndrome (WNS). However, tri-colored bats also use tree cavities, bridges, culverts, and foliage during winter in parts of their range. Our objective was to determine roost use by non-cave hibernating tri-colored bats and the weather (temperature and humidity) and habitat characteristics influencing roost selection. From November to March 2017-2019, we used radio-telemetry to track 15 bats to their day roosts in bridges and trees on the Savannah River Site in south-central South Carolina. We characterized habitat and tree characteristics of 24 used trees and 153 random, available trees and used discrete choice models to determine selection. Tree roosts were in cavities with basal (n=5) and mid-bole openings (n=6) in live trees, a hollow snag with a chimney and mid-bole opening, Spanish moss (n=2), a cluster of dried sweetgum leaves, and unverified structures in the canopy (n=9). Daily mean (±*SD*) roost temperature and vapor pressure deficit were 11.0 ± 4.6°C and 0.036 ± 0.059 kPa in accessible cavities and 12.9 ± 4.9°C and 0.421 ± 0.320 kPa in bridges, respectively. Daily mean (±*SE*) ambient temperatures significantly differed on days that various structures were used with bridges used on cooler days (8.3°C ± 0.78) than tree roosts (11.8°C ± 0.71). Roost selection was positively correlated with diameter at breast height, canopy closure, and cavity abundance within a 0.1 ha plot of the tree; cavity abundance was the most important variable in the model. Our results suggest access to multiple roost microclimates may be important for tri-colored bats during winter and forest management practices which foster cavity formation will likely benefit this population. An understanding of tri-colored bat winter roosting ecology in areas devoid of caves and mines is increasingly important due to WNS-related declines in cave populations.

UPDATE ON PLAINS SPOTTED SKUNK SPATIAL ECOLOGY PROJECT IN SOUTHEASTERN TEXAS

J. C. Perkins*, K. P. Jefferson, M. H. Hamilton, R. C. Dowler, R. D. Stevens
Department of Natural Resources Management, Texas Tech University, Lubbock, Texas, 79409 (JCP and RDS); Department of Biology, Angelo State University, San Angelo, Texas, 76909 (KJP, MHH, and RCD)

Habitat loss, fragmentation, and alteration are leading causes of biodiversity decline worldwide. Prairie ecosystems and the species found within are especially impacted. The western gulf coastal plain ecoregion, situated along the western Gulf of Mexico in Texas and Louisiana, is an example of such an impacted ecosystem. This ecosystem has undergone extensive anthropogenic alteration in the forms of fragmentation, fire suppression, agriculture and grazing, and localized development and urbanization. The plains spotted skunk (*Spilogale putorius interrupta*) was historically distributed throughout the Texas portion of the coastal plain ecoregion. Currently the species has been isolated to remnant patches in the ecoregion, one of which is Katy Prairie, a peninsula shaped segment of coastal prairie located immediately west of the city of Houston. In January 2019, we initiated research into the spatial ecology and population demographics of the plains spotted skunk at 2 locations within the Katy Prairie. We initiated camera trap surveys, based on stratified random sampling, to locate skunks and record seasonal occupancy. After detection, we initiated live trapping surveys centered on the camera location. As of January 2020, we have recorded 36 detections of spotted skunks via camera trap. We have captured 19 unique spotted skunks (11♂, 8♀) 45 times and recorded 11 individuals (19 total seasons) with data sufficient for home range analysis. We estimate that we have captured and collared 60% of all known spotted skunks at the survey sites. Based on preliminary results, skunks are primarily using minimally grazed and managed pastures. Early results seem to indicate that one of the more prevalent invasive species, Macartney rose, does not negatively impact the skunks. Finally, it appears the strategy of managing for multiple resources (general prairie conservation and cattle production) is a strategy that allows the plains spotted skunks to persist in the Katy Prairie.

TRANSLOCATION OF SOUTHEASTERN POCKET GOPHERS (*GEOMYS PINETIS*) IN GEORGIA

J. T. Pynne*, S. B. Castleberry, L. M. Conner, E. Parsons, R. Gitzen, S. Duncan, R. McCleery, J. D. Austin
Daniel B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA, 30602 (JTP, SBC); Jones Center at Ichauway, 3988 Jones Center Dr, Newton, GA, 39870 (JTP, LMC); School of Forestry and Wildlife Sciences, Auburn University, Auburn, AL, 36849 (EP; RG); Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, FL, 32611 (SD, RM, JDM); Eckerd College, Natural Sciences Collegium, Biology, 4200 54th Avenue South, St. Petersburg, FL, 33713 (SD)

Southeastern pocket gophers (*Geomys pinetis*) were once found throughout pine forests and other open-canopied vegetation communities in the southeastern U.S., but have been extirpated from much of their historic range. Because pocket gopher tunneling, mounding, and selective herbivory are ecologically important, use of translocation to restore formerly extirpated pocket gopher populations may be an effective approach for enhancing ecological services to recently restored open pine communities. We radiotracked pocket gophers for 0.5 - 4.0 months to assess translocation methods (hard-, soft-, and control) and develop a relocation protocol. Hard-released individuals (n = 6) were released into a shallow (100-cm wide by 20-cm deep) hole surrounded by a silt fence to prevent above-ground movement. Soft-released individuals (n = 8), were released into an established tunnel system created with a custom-built plow. Control individuals (n = 9) were released back into the tunnel where captured. We found no difference in mean daily movement between hard-released (4.32 m ± 0.891 SE), soft-released (15.0 m ± 5.89 SE), and control (10.7 m ± 3.80 SE) pocket gophers, indicating that providing starter burrows does not promote site fidelity. Translocated gophers had lower (Kaplan-Meier test; $\chi_{21,40} = 4.3$, $p = 0.04$) daily survival rates (56%) than control gophers (90%). Our results are consistent with studies on other pocket gopher species showing translocation as a viable technique. However, reduced survival rates suggest more individuals may need to be released to establish viable populations.

LANDSCAPE AND ROOST USE BY SPRING MIGRATING FEMALE INDIANA BATS (*MYOTIS SODALIS*)

P. L. Roby, A. G. Davis, M. W. Gumbert, M. J. Lacki
Department of Forestry and Natural Resources, University of Kentucky, Lexington, KY 40506 (PLR, AGD, and MJL); Copperhead Environmental Consulting, Inc., 471 Main St., Paint Lick, KY 40461 (PLR and MWG)

Landscape use by wild animals is an important topic for land managers and for understanding the ecology of species. Migrating animals are not confined to a home range and the landscape variables available are likely more extensive than those available to a stationary group of animals. We aerially radio-tracked individual female Indiana bats during spring migration from hibernacula to summer maternity areas over 9 years. We identified diurnal roosts during pre-migration staging, along the migration route, and within early use of the summer home range. Of the 137 roosts visited, 1 was a bridge and 136 were 25 species of trees within 10 genera. Four species comprised 63% of all roosts used: *Carya ovata* (n = 53), *Ulmus americana* (n = 13), *Pinus echinata* (n = 10), and *Pinus taeda* (n = 10). Roosts were categorized as either staging, migration, layover, or arrival, and there was no difference in tree metrics (i.e., diameter at breast height, tree height, or roost height). The majority of staging trees were live *Carya ovata* whereas arrival trees were mostly snags of various species. High amounts of useable bark for roosting were found on staging trees and layover trees, but there was no preference for usable bark on migration or arrival trees. In addition, there was no difference between migration trees and those used during summer months in other studies. We determined resource use compared to availability for 20 migrating bats using compositional analysis. Bats used landscape resources, topography, and water as they were available, resulting in high use of forests and low vegetation for all individuals during both foraging and traveling behaviors. Although Indiana bats require forests for foraging and roosting, overall, spring migrating bats travel in a relatively straight line from hibernacula to summer grounds with little regard to the landscape cover.

INFLUENCE OF REPRODUCTIVE CONDITION ON POST-WNS RECOVERY OF INDIANA BATS IN KENTUCKY

M. L. Rogers*, Z. L. Couch, L. E. Dodd
Department of Biological Sciences, Eastern Kentucky University, Richmond KY, 40475 (MLR, LED); Kentucky Department of Fish and Wildlife Resources, Frankfort KY, 40601 (ZLC)

Recovery of bat species impacted by white-nose syndrome (WNS) will inherently depend on population growth. We assessed reproductive capability of the endangered Indiana bat (*Myotis sodalis*) in Kentucky, where WNS was detected in 2011. Due to loss of fat reserves associated with WNS infection, coupled with the energetic expenditures associated with pregnancy, we hypothesized mass of females captured during the maternity season would decrease across our data collection period (2017-2019). Further, we predicted that reproductive rates in the study population would be lower than historic rates for Kentucky. Mist net surveys around artificial roosts resulted in the capture of 866 Indiana bats, and the collection of reproductive and morphometric data across 22 netting events during the 2017-2019 maternity seasons. Generalized linear models (GLM) are being used to examine the effect of year (an analog for WNS impact) on mass of female bats during the maternity season within our study term. We are also implementing analyses to determine if body mass differs between our field-collected data and historic records for Kentucky across the four reproductive classes. To assess the influence of other variables (study site, season and survey month) on female mass, we are using model selection procedures to limit our inferences to relevant predictors. Counter to expectations, population-level data indicate 92% of adult female Indiana bat captures exhibited signs of reproduction (pregnant, lactating or post-lactating). Further, juvenile bats comprised 55% of captures during post-parturition phase surveys of the maternity season, and instances of juveniles recaptured as reproductive adults were also observed during the study. Our data suggest reproductive potential has been sustained in our study colonies despite presumed exposure to WNS during hibernation. This is promising evidence for persistence of the species. However, optimized management of maternity roosts will remain critical in supporting population recoveries from WNS.

RAFINESQUE'S BIG-EARED AND SOUTHEASTERN BATS SWITCH HABITS FROM FALL TO WINTER IN ARKANSAS, USA.

S. J. Scherman, T. S. Risch, V. Rolland.
South Carolina State Park Service, South Carolina Department of Parks, Recreation and Tourism, Columbia, SC 29201 (SJS); Department of Biological Sciences, Arkansas State University, Jonesboro, AR 72467 (TSR and VR)

Tree roosts in bottomland forests are critical resources for Rafinesque's big-eared (*Corynorhinus rafinesquii*; CORA) and Southeastern (*Myotis austroriparius*; MYAU) bats. Both bat species are considered rare across their range and little is known about their movements as seasons change from fall to winter. We characterized activity patterns from fall to winter as temperatures dropped and water levels increased in Cache River National Wildlife Refuge, Arkansas, one of few remaining tracts of intact bottomland hardwoods. In October-December of 2016 and 2017, we radio-tracked 21 CORAs and 17 MYAUs to 33 and 42 confirmed roost trees, respectively. Tree species, cavity type (e.g., basal cavities), and GPS coordinates were recorded for each confirmed roost tree. Both bat species switched their roosting habits from fall to winter, although neither stopped roost-switching behaviors as temperatures approached freezing. MYAUs switched from using mainly water tupelo in the fall to include varied hardwood species located in adjacent floodplain forests in the winter. CORAs increased the number of consecutive days they spent at roost trees before switching roosts from 1.75 ± 0.31 days to 3.99 ± 0.64 days after the first freeze event. With adverse weather and higher water levels, the change from fall to winter also brings a reduction in prey abundance, new priorities of breeding activity, and new challenges for young-of-the-year animals. Behavior changes exhibited by these species may coincide with changing priorities from foraging to avoiding seasonally rising flood waters, maintaining homeostatic balance, or breeding and social interaction. Additionally, the MYAU switch from cypress-gum swamps to hardwood floodplain forests in the winter will require managers to consider different summer and winter habitats for this species year-round roosting requirements.

ROOST USE AND SELECTION OF NORTHERN YELLOW BATS AND TRI-COLORED BATS IN COASTAL SOUTH CAROLINA

K. E. Shute*, S. C. Loeb, D. S. Jachowski
Department of Forestry and Environmental Conservation, Clemson University, Clemson, SC 29631 (KES and DSJ); USDA Forest Service, Southern Research Station, Clemson, SC 29631 (SCL)

The southeastern Coastal Plain is projected to have one of the largest urban expansions in the U.S. Two species of special concern, the northern yellow bat (*Lasiurus intermedius*) and the tri-colored bat (*Perimyotis subflavus*), occupy this region. The objective of this study was to determine summer roost use and selection for these two species to inform conservation and management. During May-August 2018 and 2019 we captured both species in Beaufort County, SC and placed radio transmitters on 6 northern yellow bats, and 7 tri-colored bats. We tracked bats to daytime roosts and characterized roost trees, the surrounding forest structure, and landscape features. For each roost occasion we selected two random available trees and measured the same characteristics. We developed a priori models explaining roost selection for both species and used discrete choice modeling to analyze our data. We located 37 and 32 roosts for northern yellow bats and tri-colored bats, respectively. Both species used only foliage structures including Spanish moss (*Tillandsia usneoides*). Northern yellow bats also used dead palm fronds, and tri-colored bats used other dead foliage. Both species used a variety of trees for roosting including *Quercus virginiana*, *Liquidambar styraciflua*, and *Nyssa aquatica*, but only northern yellow bats used *Sabal palmetto*. The top models for both species included availability of roost structures. Northern yellow bats selected trees with higher densities of Spanish moss and dead palm fronds. Tri-colored bats selected trees with high densities of Spanish moss and avoided pine trees compared to other tree groups. Our results indicate that the retention of trees and forests with abundant roosting structures are important to both species. Our results will assist in development of management plans that can be considered as the southeast Coastal Plain continues to urbanize.

ARE SOME BATS SNOWBIRDS? THE SUMMER ORIGINS OF TRI-COLORED BATS OVERWINTERING IN FLORIDA CAVES

L. M. Smith, J. A. Gore, T. J. Doonan, C. Campbell
Florida Fish and Wildlife Conservation Commission, 1105 SW Williston Rd, Gainesville, FL 32601 (LMS); Florida Fish and Wildlife Conservation Commission, 3911 Hwy 2321, Panama City, FL 32409 (JAG); Florida Fish and Wildlife Conservation Commission, 3377 E US Highway 90, Lake City, FL 32055 (TJD); University of Florida, Gainesville FL 32611(CC)

Tri-colored bats (*Perimyotis subflavus*) have been considered nonmigratory bats that do not move large distances to reach winter hibernacula, but recent studies using isotopes and radio telemetry have indicated that some individuals may make long-distance movements. Seasonal movements to hibernacula are a likely contributing factor of white-nose syndrome (WNS) transmission into new sites. Florida is currently WNS-free, so identifying potential routes of infection is essential for managing the disease. We investigated the movement patterns of tri-colored bats from the summering grounds to winter hibernacula using stable hydrogen isotope (deuterium) analysis of fur samples. Our objectives were to 1) determine the summering location of tri-colored bats overwintering in Florida caves, 2) determine the direction and distance of movements of tri-colored bats to hibernacula, and 3) evaluate differences in movements between different sexes, karst regions, and hibernaculum size. We collected fur samples from 111 tri-colored bats hibernating in 34 caves and 6 culverts in Florida. We then used fur deuterium levels to calculate the minimum distance traveled by an individual to have originated in a region with similar probability-of-origin to that of known-origin individuals. We found strong evidence of moderate-distance (>50 km) movements in at least six individuals, which generally moved from northerly summering grounds to caves in Florida's panhandle. No bats in north-central Florida had a minimum movement distance >50 km. There are preliminary indications of potential short-distance south-to-north movement along the Florida peninsula. Panhandle Florida caves are at risk of WNS infection from natural seasonal movements, but north-central region caves may provide a temporary stronghold for tri-colored bats and are currently more at risk from human-facilitated transfer.

ECTOPARASITE LOAD EFFECT ON BLOOD CELL COUNT IN RAFINESQUE'S BIG-EARED BATS

B. N. Spitz*, C. A. Griffin, T. S. Risch
University Department of Biological Sciences, Arkansas State University, Jonesboro, USA

In Arkansas, roosts for Rafinesque's big-eared bats (*Corynorhinus rafinesquii*) can be variable and consist of bottomland hardwood trees and manmade structures. Due to anthropogenic change a maternity colony in northeast Arkansas has persisted in an area of intensive agriculture, which was previously part of an expansive habitat of bottomland hardwoods. Because a maternity colony in a manmade structure is rare; in July of 2018 and 2019, individuals (n = 41) were sampled from a storage barn and were found to be the hosts for ectoparasites in the family Cimicidae, which contains bat bugs (*Cimex adjunctus*) and bed bugs (*Cimex lectularis*). The ectoparasites on *C. rafinesquii* are understudied. Ectoparasite loads were recorded and parasites were collected in 90% ethanol. In 2019, small samples of blood were taken from a subset of lactating and post-lactating individuals for blood smears. Neutrophils and lymphocytes will be counted to compare neutrophil-lymphocyte ratios that were collected from a subset of individuals. Other immune cell counts were made with the stained slides. Finally, temperature-sensitive transmitters were fitted to a subset of bats (n = 10) to determine how torpor pattern affects ectoparasite load and immune cell ratios. Understanding physiological tradeoffs in this species is important due to their integral role in environmental services.

FLORIDA'S LONG-TERM BAT MONITORING PROGRAM: REVIEW AND LOCATION SPOTLIGHTS

K. D. Teets
Florida Fish and Wildlife Conservation Commission, 3377 East U.S. Hwy 90, Lake City, FL 32055

Bats play an important role in the environment and help people by consuming vast numbers of insect pests. While bats are found in many different places and sometimes in large numbers, threats like disease and habitat loss negatively impact bat populations across the U.S. Thirteen species occur in the state of Florida, two of which

are Federally endangered. Because bats are difficult to study, very little data exists in the state on bat use of available habitats and areas of high bat diversity. Because of this lack of knowledge, biologists do not fully know which habitats are the most valuable for bats and how management actions affect bat populations. In November 2018, Florida established its Long-term Bat Monitoring Program to address these data gaps. This program is based on the North American Bat Monitoring Program (NABat) but protocols have been expanded to accommodate local objectives for Florida. Within the first year, we vetted and claimed the top 60 NABat priority cells, established monitoring efforts in both priority and targeted cells, brought on over 50 partners into the program, and collected more than a terabyte of acoustic data from 102 stationary points and two mobile routes. We have examined initial results from a subset of cells within north central Florida, including a grid cell in Osceola National Forest (ONF), that have been monitored quarterly since the start of the program. Using stationary point data, we examined seasonal species diversity and activity, habitat use by each species detected in ONF. We also examined southeastern myotis presence during the winter throughout the region. These results serve as an example of how a long-term statewide bat monitoring program can be used to fill data gaps and inform management decisions.

GENETIC DIVERSITY AND POPULATION STRUCTURE OF EASTERN SPOTTED SKUNKS (*SPILOGALE PUTORIUS*) IN VIRGINIA

E. D. Thorne*, E. M. Hallerman, W. M. Ford
Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA 24061 (EDT, EMH); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA 24061 (WMF)

The adaptive potential of a species relies on genetically effective migration among populations. Habitat fragmentation causing barriers to migration can reduce or prevent geneflow between neighboring populations. Negative effects of genetic isolation can include reduced effective population size, loss of genetic diversity, and inbreeding depression. Following large populations declines in the 1940s, eastern spotted skunk populations were reduced by over 90% range-wide. In Virginia, reduction of core forested areas due to agricultural practices and urbanization may have contributed to a spatially disjunct distribution of small patches of spotted skunk habitat. Home-range selection and movement patterns by spotted skunks in Virginia appear to be limited by availability of forested areas and restricted by unsuitable environmental conditions surrounding these areas. Using tissue collected from spotted skunks in Virginia and West Virginia, we assessed the genetic diversity and population structure of eastern spotted skunks in the central Appalachians. Our goals were to assess whether reduction of core forest area creates a barrier to gene flow among neighboring populations and to identify signals of decreased genetic diversity that may further threaten spotted skunk populations in Virginia. Initial results suggest that population genetic structure of spotted skunks corresponds broadly to the Blue Ridge and Ridge and Valley sub-provinces, and that within the Ridge and Valley, between ridges separated by human-dominated valleys.

SUMMER USE OF MAN-MADE STRUCTURES IN LOUISIANA

B. U. Upton, A. N. Anderson, B.R. Stafford
Louisiana Department of Wildlife and Fisheries, Baton Rouge, LA 70808

We examined bat utilization of man-made structures as summer roost locations in Louisiana. During the summer 2019 season, we surveyed 278 culverts, 193 bridges, and 16 buildings. Bats used 23.02% of culverts, 12.44% of bridges, and 68.75% of buildings. All three site types were utilized by *Eptesicus fuscus*, *Corynorhinus rafinesquii*, and *Tadarida brasiliensis*. *Myotis austroriparius* used bridge and culvert sites, *Perimyotis subflavus* and *Myotis septentrionalis* used only culvert sites. Of the 278 culverts surveyed 64 (23.02%) contained bats, 80% were single species sites. *M. austroriparius* were the most widely distributed species, occurring in 65.62% of culverts utilized by bats. Twenty-four (12.44%) bridges and 11 (68.75%) buildings surveyed contained bats, both site types were predominately single species locations. *C. rafinesquii* were the most widely distributed species for both bridge (87.5%) and building (36.36%) sites. In total, we identified 1,795 individual bats in culvert sites and 707 in bridge sites. In buildings, we identified more than 10,000 individuals, predominately *T. brasiliensis*. With limited natural hibernacula available, monitoring man-made structures will help to determine additional roost sites for management purposes.

STUDIES ON SARCOPTIC MANGE IN BLACK BEARS (*URSUS AMERICANUS*)

M. J. Yabsley, K. Niedringhaus, J. D. Brown, M. A. Ternent, S. K. Peltier.
Southeastern Cooperative Wildlife Disease Study, College of Veterinary Medicine, University of Georgia, Athens, GA, 30602, USA (MJY, KN); Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA, 30602, USA (MJY); Pennsylvania Game Commission, Harrisburg, PA, 17110, USA (JDB, MAT); Florida Fish and Wildlife Conservation Commission, Naples, FL, 34114, USA (SKP)

There have been increasing reports of black bears (*Ursus americanus*) with severe skin disease in the Eastern and mid-Western United States over the last three decades. Diagnostic evaluations determined the majority of cases were due to *Sarcoptes scabiei*. We investigated if exposure to one of several pathogens commonly infecting black bears (canine distemper virus, canine parvovirus, canine adenovirus-1, *Toxoplasma gondii*, and *Trichinella* sp.) was a potential risk factor for clinical mange; no associations were noted. We also used a serological approach to determine the extent of exposure in bears without clinical disease to gain a better appreciation for which populations of bears are exposed to mites. We validated a commercially-available ELISA, designed for dogs, for use in black bears. To further examine the assay performance, serial serum samples from seven black bears with confirmed sarcoptic mange were collected posttreatment to determine the persistence of antibodies. Antibodies waned to below the detection limit between 4 and 14 wk, suggesting that serology studies might underestimate the number of exposed black bears. State-wide serosurveys in Pennsylvania showed a significant difference in seroprevalence between regions with high occurrence of mange (mean seroprevalence 6.7%) and low occurrence of mange (no seropositive black bears were detected). In another study, we determined the ability of mites to survive off the live host to investigate the role of indirect transmission of mites between black bears. Temperature significantly affected mite survival, shortest at 0 °C (mostly ≤ 4 h) and longest at 4 °C (up to 13 days). No mites survived beyond 8 days at 18 °C or 6 days at 30 °C. Collectively, our data advance our understanding of sarcoptic mange in wildlife and also can be used to drive management decisions or lay the groundwork for future research of this disease in bears.

Listed alphabetically by first author
Underline indicates presenting author
Asterisk (*) indicates student author

HABITAT SUITABILITY MODELLING FOR *LONTRA CANADENSIS* IN SOUTHEASTERN TENNESSEE

J. N. Allen*, T. P. Wilson, T. J. Gaudin
Department of Biology, Geology and Environmental Science, University of Tennessee Chattanooga, Chattanooga, TN 37403

Predictive niche modeling is an essential tool in effectively managing and conserving wildlife habitats and populations. Through the use of geospatial tools predictive ecological niche models can be developed to better elucidate species habitat suitability and landscape associations. Using environmental and landscape data, we can determine and assign priority areas for conservation efforts targeting *Lontra canadensis* in southeastern Tennessee and beyond. The focus of the present study is the relationship between land cover and use and water quality with otter presence. Using public GIS data collected from Great Smoky Mountains National Park, analysis will be conducted using Maxent to determine habitat suitable for river otters. The results of this study will detail a more comprehensive habitat suitability map for river otters in southeastern Tennessee. This information can be utilized by state officials in managing wildlife and its associated habitats. As river otters are indicators of ecosystem health, maintaining and conserving habitat that is suitable to *L. canadensis* would also mean providing quality habitat for many other wildlife species.

SURVEY OF BAT DIVERSITY IN AN URBAN WETLAND

A. P. Barton*, S. M. Bergeson
Department of Biology, Purdue University Fort Wayne, Fort Wayne, IN 46804

In the summers of 2018 and 2019 a survey of bats was undertaken at a previously restored, 290 ha wetland (Eagle Marsh Nature Preserve) that lies in close proximity to Fort Wayne, Indiana (the 2nd largest city in the state). A biodiversity blitz was conducted in the property in 2014, but did not collect data on the local bat community. The objective of this study was to survey the preserve's bat community and to determine if threatened or endangered bat species were present. In 2018, acoustic bat detectors were placed in 16 sites in various habitats across the preserve. The next year, 4 sites were surveyed using mist nets to confirm the previous years' acoustic data. In the acoustic survey, we identified the calls of 9 bat species, including the endangered Indiana bat (*Myotis sodalis*), federally threatened northern long-eared bat (*Myotis septentrionalis),* and the state endangered evening bat (*Nycticeius humeralis*). Through the mist-netting survey, we confirmed the presence of northern long-eared bats in the site, but could not confirm the presence of Indiana or evening bats. We also captured big brown bats (*Eptesicus fuscus*; the most common species encountered), silver-haired bats (*Lasionycteris noctivagans*), and eastern red bats (*Lasiurus borealis*). This preserve provides scarce habitat for a diversity of bats, and other animals, within the surrounding agricultural and urban dominated landscape. Wildlife management strategies should target these areas as hotspots for conservation.

ROOST TREE SELECTION BY ENDANGERED FLORIDA BONNETED BATS

E. C. Braun de Torrez, J. A. Gore, H. K. Ober
Florida Fish and Wildlife Conservation Commission, 1105 SW Williston Rd, Gainesville, FL 32601 (ECB); Florida Fish and Wildlife Conservation Commission, 3911 Hwy 2321, Panama City, FL 32409 (JAG); Department of Wildlife Ecology and Conservation, University of Florida, 155 Research Road Quincy, FL 32351 (HKO)

The endangered Florida bonneted bat (*Eumops floridanus*) can traverse extensive areas to forage, but their distribution and abundance may be restricted by the availability of roosting sites. However, we know very little about what types of natural roosts are used by these bats, which precludes our ability to effectively manage and restore

roosting habitat. Further, because the species is rare and high-flying, it is extremely challenging to capture free-flying bats. Here, we use a combination of methods (acoustic surveys, passive integrated transponders [PIT] tags, acoustic lures, mist nets, and aerial radio-telemetry) to locate and characterize natural roost sites of Florida bonneted bats. Thus far, we have located 19 roost trees occupied by one to 80 bats for several nights to several years. Our results to date suggest that Florida bonneted bats are using woodpecker cavities in cypress and royal palm snags, woodpecker cavities of live pine trees (slash and long-leaf), and cavities and loose bark of pine snags. Of the 19 roosts, 7 have been damaged or destroyed by natural causes since discovery, suggesting that these bats face ongoing threats to their roost habitat. This is an ongoing research effort to locate roosts across the species range. Information gained on roosts and surrounding vegetation will allow us to develop guidelines for conserving known roost structures and enhancing roosting habitat for this endangered species.

PROFILING BAT SPECIES ACTIVITY AT DIFFERENT ARTIFICIAL LIGHT INTENSITIES

T. Bryan, T. C. McElroy
Department of Ecology, Evolution and Organismal Biology, Kennesaw State University, Kennesaw, GA 30144

Human intervention in most ecosystems across the globe is causing unprecedented change with urbanization having major impacts on bat activity and species disbursement within a community. The nocturnal nature of bats suggests that the increase in light pollution over the past years likely affects bat activity leading to the question of how bats respond to artificial lighting. Some studies have examined what effects artificial light intensities have on bats through species activity and insect availability. Documenting bat species presence and activity at different artificial light intensities may reveal bat species that benefit from artificial light and if some bat species are negatively affected. The three study sites were located in a highly urbanized area within a one-mile radius of each other. The Publix shopping center parking lot represents high artificial light intensity (48-72 lux); the apartment complex parking lot represents low artificial light intensity (5-12 lux); the KSU Field Station represents no artificial light presence (0-1 lux). We found significant differences in bat activity levels among the sampled areas. There were also significant differences among species percent presence among areas overall. This was a preliminary data analysis with a relatively small sample size. The data indicated differences among the sampled locations. The differences in species presence and activities may be related to light levels at the different sites; however, light level may not be the only factor driving the detected differences between the sites. Future work should include multivariate analysis of other data variables, such as weather conditions, seasonality, canopy density measurements, roost availability, access to water, and more comprehensive prey abundance counts for the sampled sites. Further manual confirmation of bat species auto-identification labels provided by Wildlife Acoustics® Kaleidoscope Pro 4.0.0 will be continued and may change species presence as well as bat pass data.

A REVIEW OF CAVE AND MINE USE BY TREE-ROOSTING BATS

C. J. Campbell*, H. B. Vander Zanden
Department of Biology, University of Florida, Gainesville FL USA

The North American "tree bats" (*Lasiurus cinereus*, *Lasiurus borealis*, and *Lasionycteris noctivagans*) are named for their propensity for arboreal roosts. However, there remains a dearth of understanding of year-round roosting behavior and habitat selection, and there exist many records of these species found underground. We conducted a literature review and assembled a database of records of these species found in caves and mines, which include > 30 publications and museum records dating back to 1893. These include observations of *Lasiurus cinereus* and *borealis* both captured alive in caves during the fall, and many captures of *Lasionycteris noctivagans* throughout North America primarily in winter months. These results increase understanding of *Lasionycteris noctivagans* as a partial migrant that may use hibernacula to overwinter and support the hypothesis that *Lasiurus borealis* and *L. cinereus* may enter caves and mines during fall swarming behavior. We argue that entry into caves and mines represents an important and detectable type of habitat use for tree bats, and encourage researchers and managers to document observations of this kind. This unexpected form of cave and mine use informs our understanding of swarming and hibernating behavior of these species and represent potential changes in our understanding of tree-roosting bat natural history and pathogen spread among caves and mines.

SPECIES DIVERSITY AND LAND TYPE USAGE OF BATS IN A SOUTHEASTERN URBAN PARK (U.S.)

M. J. Cavalieri*
North Carolina State University, Raleigh, NC 27695

Though bats are sensitive to many environmental changes and disruptions, some species can thrive in our anthropogenically modified world. As many populations are in severe decline due to habitat loss and fragmentation as well as disease, the urban landscapes utilized by bats and the ecological importance of these spaces require intensive research. In advance of an upcoming long-term redevelopment project - including a major stream restoration, we collected foundational acoustic data at multiple sites within a large urban park in Raleigh, NC to assess the species diversity, seasonal activity, and landscape usage of the local bats. Over 30 nights between May and September, 2019, we monitored five landscape types within the park: large oaks, creek/riparian, open field, pine forest, and suburban houses. Of these, the "large oaks" site yielded the highest number of calls detected, representing 28% of the call total for all sites. Six species were identified at all landscape types monitored with slight variation on average number of species per night. Silver-haired bats, *Lasionycteris noctivagans*, were identified most frequently at three of the five sites and overall, comprising 35% of total identified calls. Big brown bats, *Eptesicus fuscus*, and evening bats, *Nycticeius humeralis*, were each most frequently identified at one of the remaining sites, comprising 23% of total identified calls respectively. These results add to our knowledge of bats in urban environments and provide valuable information to park planners for preparing the upcoming redevelopment process in a bat-friendly manner. Continued monitoring at the park would provide novel data on bats' responses to restoration efforts and disturbance in urban areas.

DESCRIPTION OF THE SKULL MORPHOLOGY OF THE TRICOLORED BAT (*PERIMYOTIS SUBFLAVUS*) IN KENTUCKY

R. D. Crawford*, L. E. Dodd
Department of Biological Sciences, Eastern Kentucky University, Richmond 40475 (RDC and LED)

Museum collections provide a valuable role in not only documenting patterns of relatedness, but also as repositories of morphological data. The mammal collection at Eastern Kentucky University (EKU) holds ca. 150 bat specimens, many of which are skulls. For insectivorous bats, skull morphology is a critical determinant of prey size and type, thus skull measurements are a useful tool for delineating foraging ecology within and across species. The objectives for this study were to establish a measurement protocol for bat skulls in the EKU mammal museum. We used our most specimen-rich species, the tricolored bat (*Perimyotis subflavus*), as a benchmark for assessing intraspecific variation in skull morphology. We collected 10 common measurements from 32 tricolored bat skulls (21 male, 7 female, 4 unknown) using a digital caliper and a dissection microscope. Measurements included: greatest skull length (GSL), cranial depth (CD), zygomatic breadth (ZB), braincase breadth (BB), mastoid breadth (MB), upper canine-canine width (UCCW), maximum canine length (MCL), interorbital constriction width (ICW), mandible length (ML), and mandibular tooth row length (MTRL). We then conducted a principal components analysis to explore sources of variation in the skull morphology of this species. While our results show little evidence for sexual dimorphism, principal component (PC) 1 accounted for 44.4% of the variation and PC2 accounted for 12.7% of the total variation in the dataset. Of our measured variables, all save MCL loaded highly on PC1. This pilot investigation establishes a basis for expanded skull mensuration in the EKU mammal museum.

POST-EMERGENCE MIGRATION PATTERNS AND HABITAT ASSOCIATIONS OF FEMALE INDIANA BATS IN ARKANSAS

H. N. Custer*, P. L. Roby, T. E. Inebnit, T. S. Risch
Department of Biological Sciences, Arkansas State University, Jonesboro, AR (HNC and TSR); Copperhead Environmental Consulting, Paint Lick, KY (PLR); United States Fish and Wildlife Service, Conway, AR (TEI)

In Arkansas, hibernacula used by federally endangered Indiana bats (*Myotis sodalis*) are well-known, however, migration patterns and maternity colony site selection remains unclear. Vulnerability to disturbance during pup-rearing poses a significant risk to the species making it crucial to gain an understanding of their summer habitat use. Despite extensive survey efforts in Arkansas, little evidence about the existence of maternity colonies has been revealed. In 2006, one maternity colony was documented at the Dave Donaldson Black River Wildlife Management Area in Clay County, Arkansas. Additionally, in July 2015 a single post-lactating Indiana bat was captured in the Ozark-St. Francis National Forest – Big Piney Ranger District in Newton County, Arkansas. To better understand migration patterns and summer habitat use, we used radio-telemetry to track female Indiana bats from hibernacula to maternity roost sites in Arkansas during 2018 and 2019. Preliminary data generated in 2018 provided insight of initial migration trajectories, but maternity colonies were not located. In 2019, we tracked one individual from Newton County to Lawrence County, Arkansas which resulted in the location of one maternity colony comprising two primary and five alternate roost trees. Our results confirm that Indiana bats do form maternity colonies in Arkansas, in the Mississippi Alluvial Plain ecoregion, specifically in the Black River floodplain. We anticipate the discovery of additional maternity sites within the state of Arkansas during the remaining two years of the project.

HABITAT CONDITIONS AFFECTING OCCUPANCY BY THE ANASTASIA ISLAND BEACH MOUSE

T. J. Doonan, L. M. Smith, E. H. Evans, C. Meilink
Florida Fish and Wildlife Conservation Commission, Lake City, FL 32055 (TJD, EHE, CM); Florida Fish and Wildlife Conservation Commission, Gainesville, FL 32601 (LMS)

The Anastasia Island beach mouse (AIBM; *Peromyscus polionotus phasma*) is a federally listed subspecies of the oldfield mouse (*Peromyscus polionotus*) that occurs only in beach dune habitats on Anastasia Island, on the Atlantic coast of Florida. In response to impacts from Hurricanes Matthew (2016) and Irma (2017) we implemented a monitoring program to evaluate the relative abundance of AIBM populations within available habitats. To assess conditions affecting habitat occupancy by AIBM, we measured a set of habitat variables at every sampling location in our study sites at Anastasia State Park (ASP) and Fort Matanzas National Monument (FMNM). For the occupancy analysis, we used single-season occupancy models (Mackenzie et al. 2006) in package *unmarked* (Fiske and Chandler 2011) in program R. Of the two top-ranked models for AIBM occupancy, one included bare ground only and one included herbaceous vegetation plus bare ground. Sea oats (*Uniola paniculata*), expected to be an important predictor of beach mouse occupancy, was not significant. Thus, finding that bare ground alone was a strong predictor of AIBM occupancy was somewhat unexpected. Coverage by bare ground and herbaceous vegetation were both positively correlated with AIBM occupancy, while coverage by woody vegetation was negatively correlated with AIBM occupancy. Plots of occupancy against percent coverage by bare ground and herbaceous vegetation showed occupancy increased up to about 25% and 30% coverage, respectively. The results indicated that where patches of bare ground and herbaceous vegetation were maintained, beach mice would tolerate low rates of coverage by woody vegetation. Overall, when restoring dune systems for beach mice, species of plants used as well as planting density should be evaluated to ensure appropriate herbaceous vegetation coverage is retained along with areas of bare sand.

INCREASE IN BAT USE OF BRANDENBARK™ POLES OVER TIME IN WESTERN KENTUCKY

E. Fehlker Campbell*, S. J. Holst, T. L. Derting
Department of Biological Sciences, Murray State University, Murray, KY 42071

BrandenBark™ is a type of artificial roost structure used to provide increased roosting habitat for tree-dwelling bat species, many of which exhibit limited use of other types of artificial roost structures. BrandenBark™ roost structures (BRS) were installed near to known Indiana bat (*Myotis sodalis*) maternity colonies in four locations in western Kentucky. Our goal was to monitor the occupancy of BRSs by bats in the first few years after their installation. We examined each BRS for occupancy approximately biweekly during summer after installation in 2017 through 2019. Occupancy was determined by the presence of guano in guano catchers that were installed near the base of each pole and by listening for bat calls. Temperature and canopy cover were measured each visit. There was a significant increase in the occupancy of the BRSs from 16% occupancy (n=3/18) in 2017, 39% (n=7/18) in 2018, to 85% (n=17/20) in 2019. Neither canopy cover nor ambient temperature differed significantly between occupied and unoccupied BRSs. Based on our results, wildlife managers may be able to expect occupancy rates of 50% or more by bats during the summer two years post BRS installation.

THE PREVALENCE OF HANTAVIRUS AND SPECIES RATIO OF WILD POPULATIONS OF MICE ACROSS INDIANA

A. Fletcher*, T. C. Carter
Ball State University Department of Biology, Muncie, IN 47306

Hantavirus is a rapidly increasing ecological issue throughout the midwestern United States due to its negative implications on humans. Understanding where the presence of this epizootic virus throughout the environment is a priority for future management decisions since it has a 40% mortality rate among humans. *Peromyscus* sp. are the main vector for the spread of the virus. There is presence of hantavirus in that state of Indiana, but it is unsure if the presence is statewide or localized. Looking for the presence of hantavirus across the state will give a better understanding of where the virus can be found. Detecting the presence may have the implications in changing of protocol for how biologists are to interact with *Peromyscus* sp. and may change how the public approach areas that have large populations of *Peromyscus* sp. in the urban landscape. During the summer of 2019, Sherman traps were deployed in transects in Allen, Morgan and Delaware counties in Indiana. Traps were checked daily and general morphological characteristics were collected on captured individuals. Blood and tissue samples were collected from captured individuals to determine the presence of hantavirus within the community and to genetically identify each *Peromyscus* sp. Our trapping efforts yielded at least 20 samples. We plan to increase our sampling effort and continue to collect data in the summer of 2020. The results of this research may guide management decisions for future hantavirus surveying and public health implications. Results will be discussed following complete analyses.

IMPACTS OF PRESCRIBED FIRE ON INSECT DIVERSITY IN MONTANE LONGLEAF PINE FORESTS

J. Gembe Garcia*, J. Stober, A. Edelman
Department of Biology, University of West Georgia, Carrollton, GA 30118 (JGG and AE); Shoal Creek Ranger District, National Forests in Alabama, Heflin, AL 36264 (JS)

Restoration of southeastern longleaf pine (*Pinus palustris*) forests depends heavily on the use of prescribed fire. Frequent burning maintains open pine stands and their herbaceous understory by killing competing woody vegetation. Endangered bat communities also depend on public lands where longleaf pine restoration occurs, but their response to prescribed fire management is not clearly understood. Our objective is to assess how the availability of insects that bats feed on, are influenced by prescribed fire regimes in montane longleaf pine forests of northeastern Alabama. During May–August 2019, insect sampling was conducted at 73 sites in areas of the Shoal Creek Ranger District with short (1.8–3.5 year) and medium fire intervals (>3.5–8 year). Within each fire interval, fire recency impacts were examined by sampling sites that were <1-year post-fire, 1-year post-fire, and 2–3-

year post-fire. At each site, we placed an elevated black light trap for 1 fair weather night and collected insects the following morning. The insects in each sample were oven dried, identified to taxonomic order, counted, and weighed. Preliminary results suggest that insect biomass is greater at sites with short fire intervals compared to medium fire intervals. These data will provide forest managers with feedback on how forest restoration efforts using prescribed fire impact food resources that support the endangered bat community.

MIST NET AND ACOUSTIC SURVEYS FOR BATS IN THE LONG CANE RANGER DISTRICT OF THE FRANCIS MARION AND SUMPTER NATIONAL FOREST IN SOUTH CAROLINA

N.S. Gikas, D.J. Judy
USFS *Environmental Solutions & Innovations, Inc., Maitland, FL 32751; U.S. Forest Service, Sumter National Forest, Long Cane Ranger District, Edgefield, SC 29824*

The Long Cane Ranger District of the Francis Marion and Sumpter National Forest is located in the Piedmont ecoregion in South Carolina, and there has never been a comprehensive study of the bat communities in this area. Mist net and acoustic surveys were completed from 15 May through 28 July 2019 on the Long Cane in Abbeville, Edgefield, Greenwood, McCormick, and Saluda counties, South Carolina. One thousand three hundred and one bats were captured in mist nets, including eastern red (*Lasiurus borealis*; 463), big brown (*Eptesicus fuscus*; 398), evening (*Nycticeius humeralis*; 336), Seminole (*L. seminolus*; 35), southeastern (*Myotis austroriparius*; 35), tri-colored (*Perimyotis subflavus*; 32), hoary (*L. cinereus*; 1), and silver-haired (*Lasionycteris noctivagans*; 1) bats. Acoustic surveys documented the presence of the above species as well as Brazilian free-tailed (*Tadarida brasiliensis*) and Rafinesque's big-eared (*Corynorhinus rafinesquii*) bats. We report the first documentation of the southeastern and Rafinesque's big-eared bat within the Piedmont ecoregion, as well as the first recorded southeastern bats in Abbeville, Edgefield, McCormick, and Saluda counties, South Carolina. Maternity colonies of southeastern bats are believed to be present in the Long Cane forest, as reproductive females and juveniles were captured during this study.

THE CURENT STATUS AND IMPLICATIONS OF POTENTIAL CHANGES IN FUTURE CONDITIONS FOR CONSERVATION OF THE SOUTHEASTERN BEACH MOUSE

M. N. Gillikin, J. A. Emanuel, T. J. Doonan, W. B. Brooks, S. I. Sneckenberger
Florida Fish and Wildlife Conservation Commission, Lake City, FL 32055 (MNG and TJD); U. S. Fish and Wildlife Service, North Florida Ecological Services Office, Jacksonville, FL 32256 (JAE and WBB); U. S. Fish and Wildlife Service, South Florida Ecological Services Office, Vero Beach, FL 32960 (SIS)

The Southeastern beach mouse (SEBM; *Peromyscus polionotus niveiventris*) is a subspecies of oldfield mouse (*Peromyscus polionotus*) that is primarily restricted to beach dunes and associated communities along Florida's Atlantic coast. Historic and ongoing habitat loss and fragmentation led the U.S. Fish and Wildlife Service (USFWS) to designate the SEBM as Threatened in 1989. The SEBM previously occupied 360 km of habitat, from Volusia County south to Dade County, but the current distribution has been reduced to about 80.5 km, with most of that area occurring within federal lands on Cape Canaveral. Recently, the USFWS initiated a Species Status Assessment for the SEBM. To evaluate resilience of the SEBM, the ability for a population to persist over time, the USFWS completed a coarse assessment of available beach mouse habitat. Under current conditions, this assessment indicated that resilience generally ranged from very low to moderate. Forecasts of future conditions for SEBM included sea-level rise (SLR) projections from NOAA and varying levels of management effort. For the population at Cape Canaveral, SLR projections showed substantial habitat loss by 2070 and 2100. By 2070, under current management efforts, resilience of SEBM was expected to decline from moderate to low. However, with increased management, resilience remained moderate. Remaining SEBM habitat varies in quality, primarily due to insufficient management, yet little is known of how beach mice respond to specific restoration and management actions. To better understand which management actions are most effective at improving the quality of SEBM habitat, we have implemented long-term monitoring, primarily using track tubes in combination with habitat assessments. Results will be used to develop guidelines to maintain or improve SEBM habitat quality as conditions change over time and accomplish USFWS recovery objectives for the SEBM.

PRE-MANAGEMENT BAT SPECIES DIVERSITY AT CLARK'S RIVER NATIONAL WILDLIFE REFUGE

S. J. Holst*, M. M. Fehlker Campbell, T. L. Derting
Department of Biological Sciences, Murray State University, Murray, KY 42071

Clark's River National Wildlife Refuge (CRNWR) encompasses 3900 acres of mostly secondary bottomland hardwood forest. A forest management plan is being implemented over the next five years at CRNWR that aims, in part, to enhance habitats for bats. Ten bat species were documented at CRNWR using acoustic surveys since 2012, with evening (*Nycticeius humeralis*), red (*Lasiurus borealis*), and tri-colored (*Perimyotis subflavus*) bats being the most common. Acoustical bat call surveys are being used to establish baseline inventories of bat species at each management location. In 2019, we used Pettersson and SM4Bat acoustic recorders to determine bat species presence for two nights at each of the 13 sites located on two management units prior to their treatment. Acoustic data were analyzed using Kaleidoscope Pro. We estimated the understory, midstory, and overstory cover and tree basal area at each site. Of the four land cover types present, plantations had the highest bat diversity with five species. Hardwood forests and xerohydric forests each had four bat species. No bat species were present at the single reforested site. The mean number of identifiable bat calls in each forest type over two nights was low with much variation among sites. There was no significant correlation between bat species diversity and vegetative cover, basal area, or distance to water for sites in any forest type. We anticipate bat species presence will increase over the next decade following implementation of the proposed management treatments.

WHERE'S OUR WEASELS? CONSERVATION ASSESSMENT OF WEASELS IN NORTH AMERICA

D. S. Jachowski, R. Kays, M. Gompper
Department of Forestry and Environmental Conservation, Clemson University, Clemson, SC, *USA (DSJ); Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC, USA (RK); North Carolina Museum of Natural Sciences, Raleigh, NC, USA (RK); Department of Fish, Wildlife and Conservation Ecology, New Mexico State University, Las Cruces, NM, USA (MG)*

Some declines of wildlife populations are dramatic and obvious, allowing conservation groups to discover the causes of the problem and protect the species. Other species are more cryptic, making it difficult to know if a paucity of recent observations is due to a real decline in their numbers or just because they are hard to see. Here we offer the first large-scale assessment of trends in weasel (*Mustela erminea, M. nivalis,* and *M. frenata*) populations across North America, making use of historical fur trapping records, Global Biodiversity Information Facility (GBIF) records, and a recent nation-wide standardized camera trap survey conducted in the United States. Across all three datasets we observed the highest and most consistent recording of weasels in the midwestern US, particularly in the northern states. By contrast, the proportion of furbearer harvest that was composed of weasels in the southeastern US has declined from 7.2% in the 1970's to 0.2% in the 2010's, and the western US from 21.3% in the 1970's to 4.1% in the 2010's. While GBIF records indicate that weasel sightings in the western US have remained stable over the last 50 years (composing over 40% of total sightings), weasel sightings in the southern US have declined from being 4-8% of all weasel records from 1920-1980's, to only consisting of 2.1% of weasel biodiversity records since 2010. The causes of this potential decline in weasels in the southeast are unknown, however much of this apparent change is due to fewer records of *M. nivalis* and *M. frenata.* Further, most recent weasel records from the southeast come from the Appalachian Mountains, suggesting the need to investigate potential species- and habitat-specific responses by weasels to global change and the potential need for conservation action in the southern portion of their range.

REST SITE SELECTION OF PLAINS SPOTTED SKUNKS (*SPILOGALE PUTORIUS INTERRUPTA*) IN SOUTHEASTERN TEXAS

K. P. Jefferson*, J. C. Perkins, M. H. Hamilton, R. C. Dowler
Department of Biology, Angelo State University, San Angelo, Texas, 76909 (KJP, MHH, and RCD); Department of Natural Resources Management, Texas Tech University, Lubbock, Texas, 79409 (JCP)

The plains spotted skunk (*Spilogale putorius interrupta*) is a subspecies of the eastern spotted skunk and is distributed from south-central Canada through the central United States to northeastern Mexico. The species faces population decline from habitat loss and expanding urbanization. Understanding habitat selection at the local scale of diurnal rest sites is important in determining conservation and management strategies for plains spotted skunks and their habitat. Our study focuses on a population of plains spotted skunks occurring on Katy Prairie, an undeveloped, though heavily altered peninsular portion of the West Gulf Coastal Plains ecoregion of southeastern Texas. From May to December 2019, we fitted eleven skunks with a GPS-collar and tracked them on a weekly basis to their diurnal rest site. We conducted habitat surveys at 85 daytime rest sites and recorded skunks using Macartney rose (*Rosa bracteata*), an aggressively invasive shrub species, as an overhead vegetative substrate at 77.6% of the rest sites. We observed a difference between the sexes in the selection of an overhead vegetative substrate at a rest site (chi-square = 17.76, p = 0.0005). Our preliminary results indicate that females are more likely to have grass or litter as a significant part of the overhead cover than males. Our results support early findings indicating that the presence of Macartney rose is significant to diurnal rest site selection of plains spotted skunks within the Katy Prairie.

TALUS HABITAT MODELING FOR EASTERN SMALL-FOOTED BATS AT SHENANDOAH NATIONAL PARK

N. J. Kalen*, A. S. Foy, P. R. Moosman, W. M. Ford
Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA 24060 (NJK); Department of Geospatial Science, Radford University, Radford, VA 24142 (ASF), Department of Biology, Virginia Military Institute, Lexington, VA 24450 (PRM); U.S. Geological Survey. Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA 24060 (WMF)

Many aspects of the ecology and abundance of eastern small-footed bats (*Myotis leibii*) remains poorly understood due to limited research and ineffectiveness of winter hibernacula counts. Moreover, the impacts of white-nose syndrome (WNS) to this species are uncertain in many regions, particularly in the Central Appalachians. To better understand eastern small-footed bat habitat use, roost requirements, and presence/abundance, we sampled talus slopes, a known, preferred day-roost habitat type, within Shenandoah National Park, Virginia for use in developing a species habitat model. We surveyed 15 talus slope locations in the park using visual searches and passive acoustic monitoring. We recorded eastern small-footed bats at 13 of 15 talus locations and identified presence acoustically at all 15 locations. We recorded a total of 234 visual bat observations and measured characteristics at 79 rock roosts. Widespread prevalence of eastern small-footed bats, as well as observations of successful reproduction suggest at least locally, the species might be is less impacted by WNS than other *Myotis* spp. in the park. We used several geospatial models to predict talus slopes and potential abundance of bats. Random forest algorithms produced plausible habitat suitability models and insights into talus slope occupancy. Continuing work will include further visual searches of additional talus habitat in the park and elsewhere in Virginia to validate the efficacy of this model.

DISTRIBUTION AND DAY ROOST PREFERENCES OF EASTERN SMALL-FOOTED BATS IN THE OUACHITA MOUNTAINS OF ARKANSAS

V. Kearny*, R. Perry, T. Risch, V. Rolland
Department of Biological Sciences, Arkansas State University, P.O. Box 599, State University, AR 72467 (VK, TR, and VR); Forest Service Southern Research Station, PO Box 1270, Hot Springs, AR 71902 (RP)

Eastern Small-footed Bats (*Myotis leibii*, MYLE), a declining species found throughout eastern North America, was listed as endangered by the International Union for Conservation of Nature in 2018 yet denied listing under the Endangered Species Act by the United States Fish and Wildlife Service in 2013, largely due to insufficient data. Abundance and distribution data are lacking, because MYLE seem to appear in clusters, resulting in hit-or-miss searches. Similarly, in Arkansas, MYLE's abundance and distribution is unclear and its roosting habitat preferences are unknown. Our objectives were to 1) map MYLE distribution in the Ouachita Mountains and 2) determine roost characteristics at the local and landscape scales. Using acoustic monitoring, rock formation searches, and mist-netting, we found 17 MYLEs at seven of 25 surveyed sites during the 2019 field season. Roosts containing MYLE were all on Rich and Black Fork Mountains and consisted of 0.64–5.08-cm wide cracks between boulders. These crevices had multiple openings, were smooth, straight, and generally free of debris. All MYLE detections were on talus slope sites and sites with MYLE were at higher elevation (648.87 ± 35.06 m) than sites without MYLE (559.50 ± 18.91 m). Overall, our preliminary data confirm that MYLE appear in clusters on the landscape.

A RETROSPECTIVE SUMMARY OF BLACK BEAR MORBIDITIES AND MORTALITIES SUBMITTED TO A WILDLIFE DIAGNOSTIC LABORATORY (SOUTHEASTERN COOPERATIVE WILDLIFE DISEASE STUDY)

M. Kunkel*, M. Ruder, M. J. Yabsley, K. Niedringhaus, N. Nemeth
Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of Georgia, 589 D.W. Brooks Drive, Athens, GA, 30602 (MK, MR, MJY, and NN); Department of Pathology, Microbiology, and Immunology, School of Veterinary Medicine, University of California, 944 Garrod Drive, Davis, CA, 95616 (KN)

American black bear (*Ursus americanus*) populations have recovered in recent decades with few documented causes of morbidity and mortality until recently; however, published data summarizing these causes are lacking. To address this, we retrospectively examined diagnostic data from black bears submitted to the Southeastern Cooperative Wildlife Disease Study (SCWDS) from 1975 to November 2019 (n=200). Bear submissions included full carcasses and select tissues and originated from 12 states across the southeastern United States. Sarcoptic mange (causative agent *Sarcoptes scabiei*) (38/200; 19%) and trauma (38/200; 19%) were the most common diagnoses. Morbidity and mortality were less commonly attributed to known infectious causes (19/200; 9.5%), capture-related and/or physiologic stress (10/200; 5%), emaciation (7/200; 3.5%), neoplasia (6/200; 3%), and toxicoses (3/200; 1.5%). 'Undetermined' (i.e., either no significant lesions or non-specific lesions) and 'other' categories (includes targeted surveillance testing) accounted for an additional proportion (79/200; 39.5%) of the bear submissions. Sarcoptic mange was first diagnosed at SCWDS in 2012, and over half (114/200; 57%) of all the black bear submissions to SCWDS have occurred since this time. The increased number of sarcoptic mange diagnoses likely in part reflects recent increased black bear mange surveillance efforts by state wildlife agencies. Other noteworthy cases included rabies in a bear from North Carolina, canine distemper in 2 bears from Pennsylvania, and anticoagulant rodenticide toxicosis in a sow from Georgia. There are inherent limitations in the retrospective evaluation of diagnostic data, including submission variation in seasonality, frequency, and location. Additionally, submissions for targeted pathogen/parasite surveillance, such as rabies virus, mange mites, and canine distemper virus, is an additional limitation that may skew results. Notwithstanding, our data provide a baseline to begin to address broader questions of causes of free-ranging black bear morbidities and mortalities.

CITIZEN SCIENCE IN THE NORTH AMERICAN BAT MONITORING PROGRAM (NABAT): ONE STEP FORWARD INVESTIGATING QUESTIONS ASKED BY CITIZEN SCIENTISTS

M. Liverman, H. Li, K. Clark
North Carolina Wildlife Resources Commission Outer Banks Center for Wildlife Education, Corolla, NC 27927 (ML, KC); Department of Biology, University of North Carolina Greensboro, Greensboro, NC 27412 (HL)

Citizen science as a model for wildlife monitoring has gained recent momentum as a credible data collection technique, particularly with increased access to technology through widely accessible tools such as smartphones, social media and other web-based technology. The citizen science approach may increase the study area, reduce the labor cost, broaden the research scope, and educate a bigger audience. However, in most citizen science-based projects, volunteers are only involved in the data collection process and do not directly contribute to the scientific question. The North American Bat Monitoring Program (NABat) has been implemented in many states in the US. The NABat mobile transect survey protocol has been shown suitable for the citizen science approach. In this presentation, we showcase the collaboration between bat biologists at the University of North Carolina Greensboro and education specialists with the North Carolina Wildlife Resources Commission. Through collaboration, we successfully implemented the NABat mobile transect survey in the summer of 2019 by volunteers across North Carolina. Furthermore, with skills provided by the education specialists, we encouraged volunteers to observe in the field and ask questions based on observations. After reviewing questions and comments provided by volunteers, we investigated one ecological question: whether the immediate environment affected the probability of bats being present. The preliminary results suggest that the immediate environment along a transect affect the bat presence in a species-specific manner. Our project shows that volunteers in citizen science projects are capable of asking meaningful scientific questions and contributing beyond quality data. The education and communication skills provided by education specialists are crucial to the success of involving citizen scientists in scientific knowledge contribution.

EAGLECAM; CAMERA TRAP BYCATCH DATA OFFERS VALUABLE INSIGHTS INTO SCAVENGER COMMUNITIES

C. J. Marneweck, T. Katzner, D. Jachowski
Department of Forestry and Environmental Conservation, Clemson University, SC 29631 (CJM and DJ); Forest & Rangeland Ecosystem Science Center, U.S. Geological Survey, ID, 83706 (TK)

In 2008, a citizen science project began by placing camera traps baited with road-killed white-tailed deer during winter months with the purpose of monitoring eagles (EagleCam). However, bycatch of the cameras includes a significant number of scavenging species, allowing us to also use these data to investigate questions pertaining to scavengers. To date, we have collected 2.9 million images capturing >40 species (including both avian and mammalian) from 82 locations across 14 states in the Appalachian region. While these images are still being processed, we present some preliminary results of the EagleCam project, demonstrating how bycatch data can be of great value, and promote the use of camera trap networks. Ultimately, we aim to use these data to ask the following questions about both avian and mammalian scavengers (and the interaction between the two); 1) What are the biotic and abiotic drivers of a scavenger community? 2) How do long term food subsidies affect scavenger communities over time? 3) Which factors influence scavenger community assembly across ecosystems and 4) how will future climate affect this community assembly and interaction networks?

EVALUATING VOLATILE ORGANIC COMPOUNDS FOR CONTACT-INDEPENDENT ANTAGONISM OF *PSEUDOGYMNOASCUS DESTRUCTANS*

A. G. McDonald*, K. T. Gabriel, C. T. Cornelison
Department of Molecular and Cellular Biology, Kennesaw State University, Kennesaw, GA 30144

A vast array of microorganisms produces volatile organic compounds (VOCs) that exhibit antimicrobial activity. Some of these VOCs have shown to inhibit the growth of *P. destructans,* the causative agent of white-nose syndrome in North American bats, in previous experiments. In an effort to develop tools to reduce bat mortality attributed to WNS, an in vitro experiment was conducted to quantify the inhibitory effects of select

VOCs on *P. destructans* growth as well as explore potential synergistic activities between these compounds. The experiment involved exposing *P. destructans* mycelial plugs to various concentrations of an array of bacterially produced VOCs. Measurements of the mycelial plugs were taken throughout the experiment to determine which of the compounds, if any, had the greatest inhibitory effect. Three of the VOCs, nonyl aldehyde, octyl aldehyde, and benzothiazole, exhibited >50% inhibition on *P. destructan*s mycelial growth when compared to the control. It was also found that some formulations of nonyl aldehyde, benzothiazole, and decanal displayed synergistic activity, inhibiting the growth of *P. destructans* mycelium more effectively in combination with other VOCs than individually. The results thus far suggest that the use of VOCs in a disease management strategy could effectively mitigate the impact of WNS on impacted bat species.

MULTI-SPECIES BAT ROOSTS MAY BIAS EMERGENCE COUNT SURVEYS

A. Motz, S.M. Bergeson
Department of Biology, Purdue University Fort Wayne, Fort Wayne, IN 46804

Summer day roosts provide bats with refugia where they can avoid predators, thermoregulate, digest food, nurture young, and conduct other important functions. Because of their importance and the fact that bats congregate within them, roosts are often used to survey the size of bat populations. Emergence counts are the prevailing method of estimating the size of colonies within roosts, which are then used to estimate population sizes. This method of counting bats as they emerge from roosts during the evening may not be very accurate due to observation bias, visual obstructions, low light situations, etc. Another possible confounding factor is the presence of multiple bat species in a single roost. The effectiveness of emergence counts in population sampling relies on the assumption that all bats observed are of the same species. If this assumption is broken (i.e., some bats are of a non-target species), the method would produce inflated colony/population sizes. To investigate the occurrence of multi-species bat roosts, we reached out to a community of bat researchers to request any data they had collected where two or more species of bats were living in the same roost. We collected data on 22 multi-species bat roosts from 10 counties and 7 states throughout the eastern USA. Multi-species roosts were shared by a number of different bat species (common species included *Myotis lucifugus* and *M. sodalis*). On average, a single bat species made up 45 ± 5% of all bats in a multi-species roost. These data suggest that bat species in the eastern United States often share the same roosts. Researchers and conservationists should keep this in mind when estimating bat population sizes and making management decisions.

DURING MIGRATION PERIODS, GRAY BATS (*MYOTIS GRISESCENS*) USE TREES AS DAY ROOSTS IN NORTH CAROLINA AND TENNESSEE

S. N. Patterson, N. Davis, S. T. Samoray, J. Weber, J. O'Keefe
Copperhead Environmental Consulting, Inc. 471 Main St., Paint Lick, KY 40461, USA (SNP, NK, and STS); Center for Bat Research, Outreach, and Conservation. 600 Chestnut St. Terre Haute, IN 47809 (JW and JO)

During fall and spring migration studies, we found female gray bats (*Myotis grisescens*) using two different live trees and one snag as diurnal roosts. The gray bat is classified as a year-round cave obligate, and to our knowledge, these observations represent the first documented use of tree roosts by gray bats.

COMPARING HOW FIRE HISTORY AND AGE OF LONGLEAF PINE FORESTS AFFECT SMALL MAMMAL POPULATIONS IN THE GEORGIA COASTAL PLAIN

S. Perez*, M. Cawthorn
Department of Biology, Georgia Southern University, Statesboro, GA 30458

The maintenance of longleaf pine forests requires regular burns every few years which affects other organisms in the community, including small mammals. This study was conducted to determine the effect of tree age in pine plantations with a similar burning regime on species diversity of small mammal communities. Two plots were chosen to conduct this experiment, one with trees planted in 2008 and the other with trees planted in 2015. Both plots are on an every-other year burning regime and were most recently burned in 2018. In each plot, a 100 m^2 grid was set up with two Sherman traps placed every 20 meters. Trapping was carried out once a month for

four months. Four small mammal species were found in the young trees, and one was trapped in the old trees. The most common species trapped were the hispid cotton rat (*Sigmodon hispidus*), which was only found in the young pine field, and the oldfield mouse (*Peromyscus polionotus*), which was found in both plots. The young pines supported on average 51 individuals /ha and the older pines supported on average 6 individuals /ha. Small mammal diversity was higher in the young pines (Shannon Index = 0.74) than the older pines (Shannon Index = 0). The older pine plot had taller trees that shaded out understory grasses and forbs and lower small mammal species richness and evenness. As the pines mature and the canopy is thinned, we predict that native grasses will return and that small mammal diversity will rebound and be similar to that found in young pines.

SURVIVAL AND PERSISTENCE OF TRI-COLORED BATS HIBERNATING IN ARKANSAS MINES

R. W. Perry, P. N. Jordan.
Southern Research Station, Forest Service, United States Department of Agriculture, Hot Springs, AR USA.

The disease white-nose syndrome (WNS) has caused significant declines in bat populations across eastern North America, making information on population demographics for affected species critical for determining their risk for extinction. We used Cormack-Jolly-Seber models to estimate apparent survival rates of hibernating tri-colored bats (*Perimyotis subflavus*) for 5 years in 4 small abandoned mines in the Ouachita Mountains of Arkansas, located within the WNS endemic area of the U.S. Individual mines varied greatly in survival rates, with one mine having annual survival as high as 0.706 and another as low as 0.101. Differences in survival among mines could not definitively be attributed to WNS, but may have varied based on a combination of WNS, disturbance, mine climate, and other unknown factors. Further, some hibernacula may have served as temporary winter shelter for young transient males. Sites housing small colonies of hibernating bats may support high survival rates despite WNS, and protecting these smaller sites may be important for overall species perseverance.

THE SOUND OF BATS AND BOMBS: LARGE SCALE ACOUSTIC MONITORING OF FLORIDA BONNETED BATS AT AVON PARK AIR FORCE RANGE

K. A. Pitcher*, K. V. Pawlaczyk, T. D. Hershberger, R. A. Aldredge
United States Fish and Wildlife Service, Avon Park AFR, FL 33825 (KAP and RAA); United States Air Force, Avon Park AFR, FL 33825 (TDH); Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO 80523 (KVP)

Avon Park Air Force Range (APAFR) is a 106,034-acre military training installation located in central Florida and represents a valuable link in the regional ecosystem. The U. S. Air Force (USAF) has partnered with the U.S. Fish and Wildlife Service (USFWS) and Colorado State University (CSU) to ensure the long-term sustainability of military lands and recovery of endangered species throughout Florida. Endemic to the region, the Florida bonneted bat (*Eumops floridanus*) has one of the most restricted distributions of any bat species in the New World. A primary threat to recovery is the loss of forested habitat, particularly roost trees. *E. floridanus* roosts are difficult to detect and no practical methodology exists for large scale surveys. To facilitate the detection of roosts and better inform land management practices, the USFWS enacted a yearlong acoustic monitoring project at APAFR. Over 13 months researchers deployed 511 SM4 ultrasonic acoustic detectors across 52,000 acres of potential roosting habitat for *E. floridanus*. Preliminary spatial interpolation of the acoustic data indicates high *E. floridanus* activity occurring near currently known roosts, but also suggest additional activity extending south-west across APAFR. There also is elevated activity along the southeastern border near the Kissimmee River, a previously under-surveyed area. This information considerably narrows down the search area for *E. floridanus* roosts and increases the likelihood of their detection. Overall, these findings will promote more focused and informed management of this species across the installation. Our study highlights the potential utility of implementing large -scale, detailed, acoustic detection in the conservation of endangered bats across large military lands.

BOT FLY PARASITISM OF ALLEGHENY WOODRATS (*NEOTOMA MAGISTER*) IN VIRGINIA

K. E. Powers, M. T. Mengak, R. R. Sheehy, W. M. Ford, R. J. Reynolds
Biology Department, Radford University, Radford, Virginia 24142 (KEP and RRS); Warnell School of Forestry and Natural Resources, University of Georgia, Athens 30602 (MTM); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg 24061(WMF); Virginia Department of Game and Inland Fisheries, Verona, Virginia 24482 (RJR)

The Allegheny woodrat (*Neotoma magister*) is a species of high conservation concern and relatively well-studied with respect to habitat use/associations, food habits, conservation genetics, and population trends. However, with the exception of raccoon roundworm (*Baylisascaris procyonis*) occurrence and etiology in woodrats, most disease and parasite ecology aspects for the woodrat are unknown. Herein, we examined the prevalence of botflies (*Cuterebra*) over nearly 3 decades of woodrat surveys (1990-2018) in the central Appalachian Mountains of western Virginia. We used genetic analyses to identify recent bot fly specimen collections from a woodrat captured in 2017. Though highly variable from year to year, the overall prevalence was low (typically < 4% of captures). Therefore, at this time, bot flies do not appear to be a serious threat to Allegheny woodrats in Virginia. Genetic analysis of two collected bot fly larvae was inconclusive, as the genetic signature of these woodrat bots did not match any of the six bot species known to parasitize rodents and lagomorphs in the eastern United States. Genetic analyses continue to determine if the genetics database is incomplete or incorrect, or if our find is a new species not yet taxonomically recognized.

ESTIMATING ARTIFICIAL ROOST USE OF INDIANA BATS USING STANDARDIZED GUANO SURVEYS

E. P. Robinson*, R. D. Crawford, L. E. Dodd
Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475 (EPR, RDC, and LED)

Artificial roosts are increasingly installed for the conservation of at-risk bats. It is important that artificial roosts are effectively monitored to gauge efficacy and frequency of use so that more informed decisions can be made for conservation efforts. Considering the benefits afforded by indirect sampling approaches, we sought to develop a cost-effective guano trap that would allow standardized collection of fecal material and be suitable for different types of artificial roosts installed for bats across North America. Our guano trap is made from polyvinylchloride (PVC) pipe, PVC fittings, and other affordable materials, and is constructed as two L-shaped halves for ease of installation and removal. Using this design, we created 20 replicates of the trap for less than $300 (USD). In total, we deployed this design beneath 16 rocket boxes and 18 bark mimic roosts during the 2019 maternity season at a site in Kentucky with a detailed history of artificial roost use by the Indiana bat (*Myotis sodalis*). We collected guano (mass and pellet counts) on a standardized two-day interval and paired this data with emergence counts and weather measurements collected on site for AIC model selection. For our best-fitting model, we found that guano dry mass, roost type, seasonality (relative to reproductive condition), and the interacting relationship of guano dry mass with roost type were all informative predictors. We found that both guano mass and individual pellet counts from traps were strongly correlative with emergence count data. Moving forward, our data suggest that standardized guano collection holds promise as a cost-effective, non-invasive approach for quantifying use of artificial roosts by bats.

ASSESSING INSECT ASSEMBLAGES AT NATURAL AND CONSTRUCTED WETLANDS IN THE DANIEL BOONE NATIONAL FOREST, KY

B. Ryan*, K. Watson, L. E. Dodd
Mansfield University of Pennsylvania, Mansfield, PA 16933 (BR); Department of Geosciences, Eastern Kentucky University, Richmond KY 40475 (KW); Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475 (LED)

Wetlands support high biodiversity and providing numerous ecosystem services to an expanded landscape, including habitat and source of forage for many organisms. In the Cumberland Ranger District of the Daniel Boone

National Forest in Kentucky, more than 400 upland-embedded wetlands (UEWs) have been constructed to provide a permanent water source for bats and other game species. These constructed UEWs are not ephemeral and do not function hydrologically or ecologically as natural wetlands. Bat activity is currently being quantified at sites in the DBNF to compare natural and constructed wetlands. In order to better understand the importance of these wetlands in the context of foraging requirements for bats, we assessed insect activity at 2 natural and 2 constructed UEWs in the Cumberland Ranger District over the summer of 2019 using malaise and sticky traps. Collected insects were identified to the ordinal level, and abundance, richness, and diversity (H') were calculated in the context of wetland type (both trap types) and distance of traps from wetland (sticky traps only). For malaise traps, Kruskal-Wallis analyses indicated no differences between wetland types for abundance or richness ($P > 0.05$), but natural UEWs were less diverse than constructed UEWs ($P \leq 0.05$). Additionally, less insects were captured with sticky traps at natural UEWs versus constructed UEWs ($P \leq 0.05$). Finally, we did not find any evidence that distance from wetland influenced insect captures on sticky traps ($P > 0.05$). This study is important because it piloted methods to be used in continued research on wetlands in the DBNF and can inform future wetland restoration efforts.

THE EFFECTS OF AUDITORY PREDATOR CUES ON FORAGING BEHAVIOR IN *PEROMYSCUS POLIONOTUS*

C. Sartain*, M. Cawthorn
University Honors Program, Georgia Southern University; Department of Biology, Georgia Southern University. Statesboro, GA 30460

Foraging patterns are determined by a variety of factors associated with perceived predation risk, vegetation cover and moonlight exposure. Perceived predation risk includes the presence of predator cues. Predator cues come in many forms, both direct and indirect. Past research suggests that oldfield mice, *Peromyscus polionotus*, may react to indirect cues more often than some direct cues, such as urine of a predator. In this study we evaluated the importance of acoustic signals as direct cues. We attempted to minimize indirect cues, such as vegetation cover and variation in moonlight. From November 2018 to March 2019, we conducted trials at five active *Peromyscus polionotus* burrows (four used each trial) with relatively equal vegetation cover. At each burrow, we placed three closed and covered foraging trays with a known weight of millet seed and an iPod emitting a predator call. These calls included coyote, Barn Owl, white noise (control) or no noise (control). Calls played intermittently over a 12-hour period, and data were collected every 24 hours for two to three nights. Treatments were rotated each trial. At the end of a trial, we reweighed the seeds to calculate giving up density (GUD). Our results showed that the coyote site had the highest GUD, and no noise had the lowest. White noise and barn owl sites did not significantly differ. This suggests that *Peromyscus polionotus* may use auditory cues, in addition to olfactory cues, to assess foraging risk.

USING NABAT TO DETERMINE FACTORS AFFECTING OVERALL BAT ACTIVITY AT VARIOUS SPATIAL SCALES THROUGHOUT SOUTH CAROLINA

A. C. Siegfried*, S. C. Loeb, D. S. Jachowski, J. Kindel

Department of Forestry and Environmental Conservation, Clemson University, Clemson, SC (ACS and DSJ); USDA Forest Service, Southern Research Station, Clemson, SC (SCL); South Carolina Department of Natural Resources, Union, SC (JK)

With many bats rapidly declining throughout the US, there is a need to monitor bat populations and their response to land use change. Using the North American Bat Monitoring Program (NABat) guidelines, our goal was to monitor bat activity in South Carolina to aid in management decisions for bat conservation. During the summer of 2019 (15 May to 17 July), we conducted stationary and mobile surveys in 38 100 km^2 cells that were selected using the NABat sampling design for South Carolina. We conducted only stationary surveys in eight cells, only mobile surveys in 13 cells, and stationary and mobile surveys in 17 cells. We surveyed each mobile route on two nights during the designated survey week and set out stationary detectors for four consecutive nights during their designated survey weeks. We examined whether overall average activity varied by physiographic region and

white nose syndrome (WNS) presence and whether activity was related to forest structure. We expected overall activity in the Blue Ridge region to be lower than the other regions and expected activity at WNS confirmed sites to be lower than WNS negative or suspect areas. Also, we predicted average activity to be negatively related to basal area and tree density. However, overall activity did not differ by region nor by WNS presence ($P > 0.05$) and was not related to basal area or density. Physiographic region, WNS presence, and forest structure did not appear to significantly influence average bat activity in South Carolina during the summer of 2019.

GRAY BAT (*MYOTIS GRISESCENS*) ACTIVITY LEVELS ACROSS SOUTHWEST VIRGINIA

H. Taylor*, K. M. Gorman, M. C. True, K. E. Powers, W. M. Ford
Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA 24060 (HT, KMG, and MCT); Radford University, Radford, VA 24142 (KEP); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA 24060 (WMF)

The gray bat (*Myotis grisescens*) is an endangered, cave-obligate, bat that is showing positive population growth trends and possibly a range expansion as well – perhaps due to ecological niche vacancy due to the decline of other species affected by White-Nose Syndrome. Associated strongly with riparian habitats, and particularly with high order streams, gray bats will day-roost, on occasion, in bridges and culverts during the maternity and migration seasons. To better understand current distribution along with bat use of transportation structures in southwest Virginia, we continuously deployed 40 acoustic detectors near bridges throughout the upper Tennessee River basin and adjacent portions of the New River and Big Sandy River basins from April through November, along with bridge inspections. Gray bats appeared near the Tennessee line following hibernation emergence and eventually were present throughout much of the area, including in the adjacent New River and Big Sandy River basins. Following the cessation of maternity activity and pups gaining volancy, another increase in activity was noted. Day-roost use of bridges and other anthropogenic structures was noted. Although we do not know if overwintering activity is occurring, we did document gray bat presence via acoustic detection and via mist-netting and radio-tracking in the Wolf Creek tributary of the New River > 30 km outside the upper Tennessee River Basin. Implications for Virginia Department of Transportation will be discussed.

HOME RANGE IS WHERE THE HABITAT IS: FOREST FRAGMENTATION MAY RESTRICT SPOTTED SKUNK MOVEMENTS IN APPALACHIAN VIRGINIA

E. D. Thorne*, W. M. Ford
Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA 24061 (EDT); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA 24061 (WMF)

Throughout much of western Virginia, forest ecosystems have experienced heavy reduction of core forest areas into smaller fragments as a result of land use change and urbanization. Extant populations of rare wildlife species may be restricted to forest fragments and isolation from neighboring populations by a surrounding matrix of less than optimal environmental conditions. The eastern spotted skunk (*Spilogale putorius*) is classified as vulnerable on the IUCN Red List and is considered a species of concern in many states. This includes Virginia where populations are believed to have declined and the overall distribution has constricted from historic. Nonetheless, our previous research defined small and spatially disjunct areas of environmentally suitable conditions that contained spotted skunks in the Appalachian Mountains of western Virginia. Accordingly, we caught and radio-tagged spotted skunks in the region to determine if current habitat fragmentation is restricting skunk movements and hence distribution, potentially leading to isolation within suitable habitat patches. Home range size (~ 1-1.5 km^2) in our study was smaller than other studies in the South and Midwest and excursive movements were limited to core forested areas. Additionally, core forested areas larger than 2 km^2 were strongly selected for by skunks whereas non-forested and forest-edge areas were avoided. We conclude that reduction in core forest areas and increases in the unsuitable surrounding matrix areas, i.e., pastoral land and development, limit spotted skunk movement between mountain ridges. Management actions that increase forest patch connectivity may help prevent further genetic and demographic isolation of extant populations, reduce the likelihood of local extinctions, and facilitate colonization of unoccupied suitable areas.

CHIROPTERAN COMMUNITY ECOLOGY AT BLUFF HABITATS IN THE OUACHITA MOUNTAINS

V. E. Veerhusen*, V. M. McDonald
Department of Biology, University of Central Arkansas, Conway, AR 72035 (VEV and VMM)

Bioacoustic monitoring can identify sites that maximize payoff and labor ratios when using manual efforts to determine presence/absence or conduct individual counts in areas that are difficult to search, such as bluff habitats. Using passive bioacoustics surveys, presence/absence data was used to build Chiropteran species richness curves for five bluff sites in the Ouachita Mountains from March 2019 to November 2019, demonstrative of how the makeup of these communities within this habitat type may change between spring migration and fall swarming in their life cycle. The results of this effort can help identify locations and habitat types that may be ideal for catching elusive species in Arkansas such as the Small-footed myotis (*Myotis leibii)*.

LOCATING TREE ROOSTS OF THE TRICOLORED BAT (*PERIMYOTIS SUBFLAVUS*) IN OSCEOLA NATIONAL FOREST, FLORIDA

M. A. Wallrichs, K. Teets
Florida Fish and Wildlife Conservation Commission, Lake City, FL 32055

Previous winter acoustic surveys in 2018-19 revealed unexpectedly high levels of tricolored bat activity in Osceola National Forest (ONF, Florida). ONF is in northern Florida along the Georgia state line and is characterized by wet pine flatwoods and swamps, and lacks open-air caves found in other regions of the state. In Florida, tricolored bats (*Perimyotis subflavus*) have been well-documented using caves and culverts in the winter; however, little is known about what other types of natural roosts may be used by tricolored bats in the winter, especially in areas with unexposed karst features. We are interested in locating winter roosts of tricolored bats in areas without caves and quantifying the physical characteristics of tree roosts at the microhabitat and landscape level. In November 2019, we captured and attached VHF radio transmitters to 4 tricolored bats. Five tree roosts were located within 2 kilometers of the original capture site in the Big Gum Swamp Wilderness of ONF. Bats were found roosting in bald cypress (*Taxodium distichum*) and black gum (*Nyssa sylvatica*) trees, likely within epiphytic *Tillandsia* spp. that covered the tree trunks and branches. Roost-finding efforts will continue in January 2020 and preliminary results will be presented. Results from this study will provide guidance for Florida land managers interested in including best management practices for bats in forest management plans.

GREEN LUNG SYNDROME: PNEUMONIA DUE TO FUNGAL-LIKE ORGANISMS IN WHITE-TAILED DEER

A. A. W. Weyna*, M. R. Kunkel, K. D. Niedringhaus, N. M. Nemeth
Southeastern Cooperative Wildlife Disease Study, Departments of Pathology and Population Health, College of Veterinary Medicine, University of Georgia, 589 D.W. Brooks Drive, Athens, GA, 30602 (AAWW, MRK, NMN); Department of Pathology, Microbiology, and Immunology, School of Veterinary Medicine, University of California, 944 Garrod Drive, Davis, CA, 95616 (KDN)

"Green lung" is a syndrome in which affected white-tailed deer develop variably-sized, green-hued, pulmonary nodules. Between 2003 and 2019, 27 white-tailed deer from 10 states (Arkansas, Florida, Georgia, Louisiana, Maryland, North Carolina, Pennsylvania, South Carolina, Virginia, and West Virginia) were diagnosed with green lung syndrome at the Southeastern Cooperative Wildlife Disease Study, with increased numbers of cases in recent years. Full carcasses or select samples collected at field necropsy were assessed grossly and tissues underwent standard histology processing for microscopic examination. Lung sections were additionally evaluated with Grocott's methenamine silver (GMS) stain for fungal elements. Laboratory testing of lung samples included polymerase chain reaction test for *Pythium* species (an oomycete), and fungal culture. Over half of the deer were diagnosed from September to November (15/26; 57.7%), 26.9% (7/26) were between June and August, and 15.4% (4/26) were diagnosed between December and February. Affected deer originated from a wide geographic region, most commonly the state of Florida (8/26; 30.8%). The majority of affected deer were female (16/25; 64%), and nine were male (9/25; 36%). Ages ranged from 0.5 to 5.5 years, with two thirds of the deer (14/21) under 3.5

years old. Lung lesions consistently included large foci of predominantly granulomatous inflammation, with numerous eosinophils, abundant fibrosis and necrosis, as well as intralesional fungal-like hyphae that often stained with GMS (14/15; 93.3%). Although whole lungs were not available from all deer, lesions were often limited to one lobe. In some tested cases, *Pythium* species were detected via polymerase chain reaction testing (5/13; 38.5%). Further characterization of the causative organisms, other than *Pythium*, is pending (electron microscopy). This study will help determine the cause of this syndrome, characterize disease manifestations, and identify potential risk factors.

TRACKING AN INVADER: WILDLIFE SURVEILLANCE FOR *HAEMAPHYSALIS LONGICORNIS* IN THE EASTERN U.S.

S. White, A. Thompson, K. Dominguez, S. Vigil, D. Shaw, A. Randall, S. N. Bevis, J. W. Mertins, J. T. Alfred, E. Dominguez, P. VanWick, J. Riley, S. Garvin, K. Frierson, M. G. Ruder, M. J. Yabsley
Southeastern Cooperative Wildlife Disease Study, Department of Population Health, College of Veterinary Medicine, University of Georgia, Athens, Georgia (SW, AT, KD, SV, DS, KF, MGR, and MJY); Warnell School of Forestry and Natural Resources, University of Georgia, Athens, Georgia (SW, KF, and MJY); US Department of Agriculture Animal and Plant Health Inspection Service—Wildlife Services, New Jersey (AR); US Department of Agriculture Animal and Plant Health Inspection Service—Wildlife Services National Wildlife Research Center, Fort Collins, Colorado (SNB); United States Department of Agriculture, Animal and Plant Health Inspection Service, Veterinary Services, Science, Technology, and Analysis Services, National Veterinary Services Laboratories, Ames, Iowa (JWM and JTA); Wildlife Center of Virginia, Waynesboro, Virginia (ED and PVW); Blue Ridge Wildlife Center, Boyce, Virginia (JR); Southwest Virginia Wildlife Center of Roanoke, Roanoke, Virginia (SG)

Haemaphysalis longicornis, also known as the Asian longhorned tick, is native to eastern Asia, but it has become invasive in several countries including, Australia, New Zealand, and now the U.S. Since its 2017 discovery in New Jersey, the presence of *H. longicornis* has been confirmed in 9 additional states in the eastern U.S., on a variety of domestic animals, wild and feral carnivores, cervids, rodents, and avian species. Archived specimens previously identified as *H. leporispalustris*, the native rabbit tick, were recently re-examined and determined to be the first detection of *H. longicornis* on free-ranging wildlife in the U.S. (white-tailed deer [WTD] in 2010). To address misidentification concerns, we developed a restriction fragment length polymorphism (RFLP) assay that can quickly and accurately distinguish between morphologically similar native and exotic *Haemaphysalis* species. To better assess the current geographic distribution of *H. longicornis* and to identify wild mammal and avian host species, we conducted active wildlife surveillance at two sites in New Jersey and Virginia with known infestations. In addition, we conducted a passive regional survey in collaboration with wildlife biologists and rehabilitation centers in the southeastern U.S. For rehabilitation centers, all wildlife species were sampled, whereas regional surveillance targeted cervids and bears. Collectively, our surveillance detected *H. longicornis* infestations on 16 individual cervids (WTD and elk) from six states, 50 mesomammals (raccoon, Virginia opossum, striped skunk, red fox, and gray fox) from three states, 2 coyotes, 4 woodchuck, 1 eastern cottontail, and 1 red-tailed hawk, from one state each. This surveillance effort resulted in numerous new host, state, and county records for *H. longicornis*. Although infestation prevalence was high for several wildlife species, the availability of cervid samples (specifically WTD), through vehicle strike, rehabilitation, depredation removals, and seasonal hunting, suggests they are potentially efficient sentinels to determine geographic distribution of *H. longicornis.*

BACTERIAL FLORA AND INSECTS DETECTED IN GUANO FROM SEVERAL LOCAL SPECIES OF BATS

S. Whitney*, T. C. McElroy
Department of Ecology, Evolution and Organismal Biology, Kennesaw State University, Kennesaw, GA, 30144

Bat diversity in northwest Georgia consists of 16 insectivore species. These bat species consume similar food resources, so ecologists wonder how these bats deal with interspecies competition. A known way of reducing interspecies competition is by partitioning the resource available, however this implies that bats are actively selecting certain prey instead of feeding on whatever is available. Collecting data to support or reject this hypothesis is difficult to obtain. Bat feces was collected from 105 individuals (6 different species) from the area around

Rome, GA. With the use of NextGen Sequencing (NGS) we are able to collect DNA from fecal material and determine what each bat is consuming. This method serves as a noninvasive measure to profile a bat's diet and even to identify what species the sample came from. The data collected indicates differences in diet among bat species and seasonal shifts. Future work will require multifactorial approaches to establish a relationship between diet shifts and spatial/ temporal feeding behaviors, or to discriminate between optimal foraging models vs. marginal value theorem predictions. This study also looked at bacteria present in the guano samples as an initial report on the bacterial diversity in guano from local bat species. Difference in bacterial diversity among species and temporal samples may be related to differences of host species, diet and other physiologic or morphologic characteristics of the bat species. To the best of our knowledge, this first report on bacterial communities in bat guano collected in Northwest Georgia, USA. This stirs scientific interest for possibilities of isolating and characterizing novel bacteria with multiple functions for production of antibiotics or other purposes.

MESOS IN THE IMPOUNDMENTS

A. Williams*, M. Childress, E. Wiggers, D. Jachowski
Clemson University Department of Forestry and Environmental Conservation, Clemson, SC, 29634 (AW and DJ); Clemson University Department of Biological Sciences, Clemson, SC, 29634(MC); Nemours Wildlife Foundation, Yemassee, SC, 29945(EW)

South Carolina has 28,000-ha of marshes that exist as tidally-managed impoundments, which have been shown to be more productive than natural marshes to some species. These estuarial systems are significant to a multitude of species, especially birds. Terrestrial mammalian predators also use these wetlands, but their use has been understudied. We used camera-traps placed on dikes in impoundments to evaluate which predators use the impoundments and measured abiotic and biotic factors that could influence the predators' intensity of use. Results of this study will contribute to our understanding of which mammalian predators use these impoundments, what factors are important to predators' intensity of use, and inform how management conditions could influence their use. More broadly, our study will provide novel insight on how anticipated changes (e.g. climate change, urbanization, land-use) could influence distribution and activity of these predators within impoundments, which could have implications to gamebird conservation and management.

ACTIVITY TIMES OF SOUTHERN FLYING SQUIRRELS IN TENNESSEE

J. Wogsland*, B. Carver
Department of Biology, Tennessee Technological University, Cookeville, TN 38505

Southern flying squirrels (*Glaucomys volans*) are common and relatively abundant residents of Tennessee forests. They are often associated with mast producing trees (ie. *Quercus* spp., oaks) because they provide essential food resources and nest sites. However, they are widespread and occur in many different habitat types including high-elevations in Eastern Tennessee where spruce-fir forests are dominant. Despite their extensive distribution little is known about temporal foraging activity or how factors such as elevation, temperature, or habitat composition influence timing and duration of foraging activity. To better understand what influences activity, two passive monitoring methods (camera traps and acoustic detectors) were used to survey for southern flying squirrels across Middle and Eastern Tennessee. This effort resulted in 2,311 pictures of southern flying squirrels, of which 665 were independent. We considered observations independent if they were separated by ≥30 min or if multiple individuals were documented in the same picture. Among the analyzed acoustic recordings 258 southern flying squirrel calls have been observed. Using the date and time stamps associated with each observation, circular statistics will be used to compare activity patterns and improve our understanding of what impacts timing and duration of foraging in southern flying squirrels.

LONG-TERM, MULTI-SEASON BAT MONITORING ON THE EASTERN SHORE OF VIRGINIA'S BARRIER ISLANDS – IMPLICATIONS FOR FUTURE WIND DEVELOPMENT

M. C. True*, W. M. Ford, R. Reynolds

Department of Fish and Wildlife Conservation, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061 (MT); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA 24061 (WMF); Virginia Department of Game and Inland Fisheries, Region 4 Office, Verona, VA 24482 (RR)

Tree bats (*Lasiurus* spp*., Lasionycteris noctivigans*) comprise most wind turbine collision fatalities among eastern North American bats, particularly during the August through November period of southward movement, mating, and juvenile dispersal. While evidence points to a concentration of migrating bats near or off-shore on the Atlantic coastline as bats travel from the Northeast in autumn, data gaps exist for regions to the south where large-scale off-shore wind turbine development may expand, such as the Eastern Shore of Virginia. Beginning in 2012 through present, we have continuously monitored, across three seasons, an acoustic detector station on lighthouses on four barrier islands and one stilted light off the Eastern Shore. Although we documented relatively low amounts of activity at most sites, eastern red bats (*Lasiurus borealis*) and silver-haired bats (*Lasionycteris noctivagans*) showed peaks in activity during fall and spring seasons, respectively, indicative of migratory movements. Irrespective of season and weather condition, bat activity was considerably higher at Chincoteague Island which contains more acreage of forest and closer proximity to fresh water versus any of the more offshore islands. Preliminary results show strong relationships between nightly activity and weather variables such as wind, precipitation, and temperature, however the strength of these relationships fluctuate by season.