

15th Annual Meeting of the Southeastern Bat Diversity Network

Thursday, 18 February 2010 Windsor Ballroom

1:00 p.m. to 3:00 p.m.: SBDN Business Meeting

Call to Order, Introductions	Darren Miller, SBDN President
Treasurer's Report	Tim Carter, SBDN Treasurer
SBDN Election Results	Joy O'Keefe, SBDN Secretary
Committee Reports	
Awards Committee	Susan Loeb, Committee Chair
Bat Blitz Committee	Joy O'Keefe, Committee Chair
Bat Database Committee	Eric Britzke, Committee Co-Chair
SE Bat Coordinator Position	Bree McMurray, Committee Chair
WNS Committee update	Tom Risch, Incoming Committee Chair
Member State Update Summary	Bree McMurray
Awards Presentations	Darren Miller, SBDN President
SBDN Service Award	
Lifetime Achievement Award	
Discussion-Proposed Change to SBDN Structure	Darren Miller, SBDN President
2011 SBDN/Colloquium	Tim Carter, SBDN Treasurer
Other Business from the Floor	Membership

3:00-3:30 BREAK

3:30-5:30 White Nose Syndrome (WNS) Session - Moderator: Eric Britzke

Current status of WNS

Jeremy Coleman, WNS coordinator, US Fish and Wildlife Service

Decontamination procedures, Hazel Barton, Northern Kentucky University

Current lab investigations of WNS, Kevin Keel, Assistant Research Scientist,
Southeastern Cooperative Wildlife Disease Study

Kentucky state WNS response plan, Brooke Slack, Kentucky Dept. of Fish and Wildlife

Using acoustic transects to monitor bat populations, Eric Britzke, US Army Engineer
Research and Development Center

Panel Discussion

Adjourn

Darren Miller, SBDN President

20th Colloquium on the Conservation of Mammals in the Southeastern United States

Friday, 19 February 2010 Windsor Ballroom

7:00 – 12:00 Registration in Windsor Corridor

- 8:00 **MITOCHONDRIAL DNA VARIATION IN THE EASTERN FOX SQUIRREL (*SCIURUS NIGER*)** Nancy D. Moncrief and Ronald A. Van Den Bussche. *Virginia Museum of Natural History, Martinsville, VA 24112, and Department of Zoology, Oklahoma State University, Stillwater, OK 74078*
- 8:15 **STATUS OF THE ALLEGHENY WOODRAT (*NEOTOMA MAGISTER*) IN VIRGINIA BLUE RIDGE MOUNTAINS** T. Menken*, M. T. Mengak, and S. B. Castleberry. *D.B. Warnell School of Forestry & Natural Resources, University of Georgia, Athens, GA 30602*
- 8:30 **CONSERVATION OF A LARGE CARNIVORE: THE RED WOLF** J. A. Dellinger* and T. L. Best. *Department of Biological Sciences, Auburn University, Auburn University, AL 36830 (JAD and TLB).*
- 8:45 **INDIVIDUAL CONTEXT OF ULTRASONIC VOCALIZATIONS PRODUCED BY WILD BRUSH MICE (*PEROMYSCUS BOYLII*)** Radmila Petric* and Matina Kalcounis-Rueppell. *Bat and Mouse Lab, University of North Carolina at Greensboro, Greensboro NC 27402.*
- 9:00 **SMALL MAMMAL USE OF NATIVE WARM-SEASON AND EXOTIC COOL-SEASON GRASS FIELDS** R.L. Klimstra* and C.E. Moorman. *College of Natural Resources, Fisheries and Wildlife Sciences Program, North Carolina State University, Raleigh, NC 27607*
- 9:15 **IMPACTS OF MANAGING LOBLOLLY PINE PLANTATIONS FOR BIOFUELS PRODUCTION ON RODENT ABUNDANCE, DISTRIBUTION, AND DEMOGRAPHICS** M. M. Marshall*, M.C. Kalcounis-Rüppell, D.A. Miller, J.A. Homyack. *Biology Department, University of North Carolina at Greensboro, Greensboro, NC 27402-6170 (MMM and MCKR); Weyerhaeuser Company, P.O. Box 2288, Columbus, MS 39701 (DAM); Weyerhaeuser Company, 1785 Weyerhaeuser Road, Vanceboro, NC 28586 (JAH)*
- 9:30 **EFFECTS OF SUPPLEMENTAL FEEDING, MAMMALIAN PREDATOR EXCLUSION, AND PRESCRIBED FIRE ON TWO SPECIES OF *PEROMYSCUS* MICE IN A LONGLEAF PINE ECOSYSTEM** G. Morris*, L.M. Conner, M.K. Oli. *Joseph W. Jones Ecological Research Center, Newton, GA 39870 (GM and LMC); Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, FL 32611 (GM and MKO).*
- 9:45 **THE INDIRECT EFFECTS OF PRESCRIBED FIRE ON BATS IN THE HIGH PINE ECOSYSTEM** D.W. Armitage* and H.K. Ober. *Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, FL 32611*

10:00-10:30 BREAK and POSTER SESSION

- 10:30 **DO EDGES ACT AS CONDUITS OR FILTERS FOR FORAGING BATS?**
K.M. Briones*, M.M. Marshall, D.A. Miller, J.A. Homyack, and M.C. Kalcounis-Rueppell.
Biology, University of North Carolina at Greensboro, NC, 27402 (KMB, MMM and MCKR);
Weyerhaeuser Company, Columbus, MS 39701 (DAM); Weyerhaeuser Company, Vanceboro, NC
28586 (JAH).
- 10:45 **BAT COMMUNITY STRUCTURE WITHIN RIPARIAN AREAS OF NORTHWESTERN GEORGIA** J. B. Johnson*, W. M. Ford, J. W. Edwards, and M. A. Menzel.
Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV 26506
(JBJ and JWE); US Army Engineer Research and Development Center, Vicksburg, MS 39180
(WMF); Federal Bureau of Investigation, Kansas City, MO 64105 (MAM)
- 11:00 **K-NEAREST-NEIGHBOR CLASSIFICATION TO IDENTIFY BAT CALLS; PERFORMANCE WITH A SUITE OF COASTAL PLAIN FOREST SPECIES AND COMPARISON TO DISCRIMINANT FUNCTION ANALYSIS.** Michael J. Bender*, Steven B. Castleberry, Darren A. Miller, and T. Bently Wigley. *Daniel B. Warnell School of Forestry and Natural Resources, University of Georgia (MJB and SBC); Weyerhaeuser Company); National Council for Air and Stream Improvement, Inc.*
- 11:15 **SNAG POPULATION DYNAMICS RELATIVE TO INDIANA BAT ROOST HABITAT SELECTION IN THE SOUTHERN APPALACHIAN MOUNTAINS** Joy M. O'Keefe, Heather L. Stewart, and Susan C. Loeb. *USDA Forest Service, Southern Research Station, Clemson, SC 29634*
- 11:30 **TEMPORAL ROOSTING PATTERNS AND POPULATION DYNAMICS OF TWO BRIDGE POPULATIONS OF EASTERN SMALL-FOOTED BATS (*MYOTIS LEIBII*)** M. E. Frazer and J. M. O'Keefe. *NC Department of Transportation, Raleigh, NC, 27699-1598 (MEF); USDA Forest Service, Southern Research Station, Clemson, SC, 29634 (JMO)*

11:45-1:00 LUNCH (on your own)

Symposium on the Summer and Winter Ecology of Three Cave Myotis in the Southeast Moderated and facilitated by Matina Kalcounis-Rueppell, University of North Carolina at Greensboro

- 1:00 **Towards a Better Understanding of the Ecology of *Myotis leibii*, *Myotis lucifugus*, and *Myotis septentrionalis***, Joy M. O'Keefe and Matina C. Kalcounis-Rueppell - *USDA Forest Service, Southern Research Station (JMO), University of North Carolina at Greensboro (MCKR)*
- 1:10 **Niche Breadth, Foraging Plasticity and Conservation Risk of *Myotis leibii*, *M. lucifugus*, and *M. septentrionalis***, Aaron Corcoran - *Wake Forest University*
- 1:25 **Ecology of *Myotis lucifugus* in the Southeast: Comparisons with the Northeast**, Eric R. Britzke - *U. S. Army Engineer Research and Development Center*
- 1:40 **Review of the Ecology of Eastern Small-footed Bats (*Myotis leibii*) in the Southeastern United States**, Paul R. Moosman, Jr., Jacques P. Veilleux, M. Erin Hawes, and Timothy J. Brust - *Virginia Military Institute (PRM, MEH & TJB), Franklin Pierce University (JPV)*
- 1:55 **Ecology of *Myotis septentrionalis* in the Southeastern United States**, Roger W. Perry and David Saugey - *USDA Forest Service, Southern Research Station (RWP); USDA Forest Service, Ouachita National Forest (DS)*

2:15–2:45 **Group Discussion**

2:45 -3:15 BREAK AND POSTER SESSION

- 3:15 **DETERMINATION OF CALVING INTERVAL AND PREGNANCY RATE OF BOWHEAD WHALES (BALAENA MYSTICETUS) VIA ANALYSIS OF STABLE ISOTOPES AND TRACE ELEMENTS IN BALEEN** Samuel Hirt* 331 Funchess Hall Auburn University, Alabama 36849
- 3:30 **CHARACTERIZATION OF ULTRASONIC CALLS IN TWO SPECIES OF GLIDING MAMMALS: GLAUCOMYS SABRINUS AND G. VOLANS** L. M. Gilley* and T. L. Best. Department of Biological Sciences, 331 Funchess Hall, Auburn University, AL 36830
- 3:45 **OCCUPANCY RATE AND DETECTION PROBABILITY OF THE CAROLINA NORTHERN FLYING SQUIRREL IN NORTH CAROLINA** C. A. Kelly and W. M. Ford. North Carolina Wildlife Resources Commission, 1751 Varsity Drive, Raleigh, NC 27606 (CAK); U.S. Army Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199 (WMF)
- 4:00 **CAROLINA NORTHERN FLYING SQUIRRELS USE WOOD POLES TO GLIDE ACROSS A ROAD BARRIER IN THE UNICOI MOUNTAINS, NORTH CAROLINA** Chris Kelly. North Carolina Wildlife Resources Commission, 32 Amber Lane, Asheville, NC
- 4:15 **OVERVIEW OF RESEARCH AND SURVEY EFFORTS IN VIRGINIA TO ADDRESS WHITE NOSE SYNDROME (WNS)** W. D. Orndorff, R. J. Reynolds, and C. S. Hobson. Virginia Natural Heritage Program, Richmond, VA 23219 (WDO and CSH); VA Department of Game and Inland Fisheries, Verona, VA 24482 (RJR)
- 4:30 **WNS EDUCATION EFFORTS IN VIRGINIA** Carol Zokaites, W. D. Orndorff; Virginia Department of Conservation and Recreation, 102 Radford Street, Christiansburg, VA
- 4:45 **STUDENT AWARDS**
- 2011 COLLOQUIUM**
- CLOSING REMARKS**
- 5:30 **ADJOURN**

20th Colloquium on the Conservation of Mammals in the Southeastern United States

POSTER SESSION

FRIDAY 19 FEBRUARY 2010 WINDSOR BALLROOM

MITIGATING ROAD IMPACTS TO WILDLIFE IN NORTH CAROLINA

A. M. Burroughs, *North Carolina Department of Transportation, Raleigh, NC 27604.*

ROOST COMMUNICATION IN THE INDIANA BAT *MYOTIS SODALIS*

Caroline M. Byrne*, Dylan A. Horvath, Joy M. O'Keefe. *Binghamton University, NY 13903 (CMB and DAH); USDA Forest Service, Southern Research Station, Clemson, SC 29634 (JMO).*

THE SBDN/NEBWG BAT CAPTURE DATABASE: CURRENT STATUS AND FUTURE USES

Heather Irwin, Susan Loeb, and Eric Britzke. *Department of Forestry and Natural Resources, Clemson University, Clemson, SC; USDA Forest Service, Southern Research Station, Clemson, SC; Eric Britzke, U.S. Army Engineer Research and Development Center, Vicksburg, MS.*

NEITHER RAIN NOR SLEET NOR GLOOM OF NIGHT: STUBBORN BRIDGE ROOSTING HABITS OF BIG BROWN BATS (*EPTESICUS FUSCUS*)

M. E. Frazer and M. R. Miller. *NC Department of Transportation, Raleigh, NC, 27603-1598*

EVALUATION OF EXPERIMENTAL CROSSING STRUCTURES FOR THE CAROLINA NORTHERN FLYING SQUIRREL IN GRAHAM COUNTY, NC

Andrew Lawrence*, Chris Kelly. *North Carolina State University, 110 Brooks Avenue, Raleigh, NC, 27607; North Carolina Wildlife Resources Commission, 1751 Varsity Drive, Raleigh, NC 27606.*

EFFECTS OF DIET QUALITY ON THE ACTIVITY PATTERNS AND GUT MORPHOLOGY OF THE WHITE-FOOTED MOUSE, *PEROMYSCUS LEUCOPUS* K. E. Lucia* and J. A. Cranford.

Department of Zoology, Center for Animal Behavior, Miami University, Oxford, OH 45056 (KEL); Department of Biology, Virginia Polytechnic Institute and State University, Blacksburg, VA 24060 (JAC)

MAMMALIAN PALAEOECOLOGY ACROSS THE LAST GLACIAL MAXIMUM IN THE SOUTHERN ROCKY MOUNTAINS B.S. McLean and S.D. Emslie *Department of Biology and Marine*

Biology, University of North Carolina at Wilmington, Wilmington, NC 28403

COMPARISON OF INDIANA BAT (*MYOTIS SODALIS*) MATERNITY COLONY HOME RANGES AMONG THREE SITES Melanie L. Michaels and Timothy C. Carter. *Ball State University,*

Muncie, Indiana 47306-0440

20TH COLLOQUIUM ON THE CONSERVATION OF MAMMALS
IN THE SOUTHEASTERN UNITED STATES
19 February 2010, Asheville, NC

ABSTRACTS

(*denotes a student in awards competition)

ONLY ABSTRACTS WITH PERMISSION FROM AUTHOR(S) ARE POSTED

**THE INDIRECT EFFECTS OF PRESCRIBED FIRE ON BATS IN THE
HIGH PINE ECOSYSTEM**

D.W. Armitage*, and H.K. Ober. *Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, FL 32611*

The historical exclusion of fire from the longleaf pine-wiregrass (high pine) ecosystem has resulted in a tremendous net loss of this important habitat. Prescribed fire has become the status-quo for maintenance of these systems, and its restorative effects on tree, shrub, and ground-layer plant communities are well-documented. Our goal was to elucidate which factor, the physical structure of the stand or its insect prey base was the most influential predictor of bat activity (mean no. calls night⁻¹) and whether either of these factors was impacted by the periodicity of prescribed fire. We conducted a two-year echolocation-monitoring study of bats in xeric longleaf pine-wiregrass habitats representing three categories of fire periodicity: 0-1 years, 3-5 years, and > 8 years. We found significant differences in tree, shrub, and ground-layer characteristics among each of these categories. We did not detect fire-treatment effects for most orders of nocturnal insects. However, lepidopteran biomass was greatest at sites with the longest time between burns and was positively associated with fire-dependent deciduous tree and shrub densities. Overall bat activity above the canopy was equal among burn treatments and was not associated with any stand, insect, or landscape variables. Bat activity below the canopy was significantly lower in stands burned > 8 years ago than in either of the other treatments and was positively associated with height of canopy closure (a fire-dependent variable). Species-specific activity patterns confirmed ecomorphological predictions, with small, clutter-adapted species replacing larger species below the canopy at sites with >8 year burn frequencies. These results suggest that the prescribed fire regime is an important indirect determinant in structuring the communities of bats that forage in the understories of high pine ecosystems.

**K-NEAREST-NEIGHBOR CLASSIFICATION TO IDENTIFY BAT CALLS;
PERFORMANCE WITH A SUITE OF COASTAL PLAIN FOREST SPECIES AND
COMPARISON TO DISCRIMINANT FUNCTION ANALYSIS.**

Michael J. Bender*, Steven B. Castleberry, Darren A. Miller, and T. Bently Wigley.
Daniel B. Warnell *School of Forestry and Natural Resources, University of Georgia (MJB and SBC); Weyerhaeuser Company (DAM); National Council for Air and Stream Improvement, Inc. (TBW).*

The primary purpose of many acoustic surveys is to monitor and determine presence of free-flying bats. A critical step in this process is accurate identification of species based on echolocation calls. Many quantitative approaches to identification have been used, but discriminant function analysis (DFA) is a relatively accurate and commonly used method. K-nearest-neighbor analysis (KNN) is an alternative classifier that is relatively simple, widely available, and free from restrictive assumptions. Our objectives were to test performance of KNN as a quantitative method to classify bat calls and compare accuracy rates to those produced by

DFA. KNN achieved an 82.50 percent overall accuracy rate which was 9.91 and 7.63 percentage points higher than linear and quadratic DFA rates, respectively. Our results indicate that KNN analysis should be given strong consideration when the primary objective is identification of unknown bat calls.

MITIGATING ROAD IMPACTS TO WILDLIFE IN NORTH CAROLINA

A. M. Burroughs, *North Carolina Department of Transportation, Raleigh, NC 27604.*

Roads result in road kill, reduced wildlife habitat, and increased habitat fragmentation. Rare species like the Florida panther (*Puma concolor coryi*) can be affected by individual loss and mass-migrating species can become imperiled when roads cross migration routes, yet research indicates that road kill typically does not impact healthy populations. While roads destroy habitat, unless the habitat is rare, the effect is generally not severe. Habitat fragmentation however, is a serious threat to wildlife. Physical and audio barriers associated with roads can inhibit wide-ranging species like black bears (*Ursus americanus*) from reaching food and reproductive resources or can simply divide populations, leaving smaller populations more prone to extinction. Efforts to reduce road impacts are categorized as broad based planning, modifying human behavior and/or modifying animal behavior. Deer crossing signs are the most commonly employed driver modification tool, but signs have proven to be vastly ineffective. Efforts to modify animal behavior with wildlife crossings and fences have been more successful but require careful planning and (frequently) large monetary expenditures. Structural details (location, design, and frequency of installations) greatly affect the performance of wildlife crossings. In North Carolina several structures have been installed specifically targeting black bear, red wolves (*Canis rufus*) and white-tailed deer (*Odocoileus virginianus*). Crossings under US 64 in Washington County have been the focus of the first large scale pre- and post-construction wildlife crossing study in the US. The efficacy of the crossings at reducing fragmentation of black bear habitat will require more research. Some unintended negative impacts to other species were detected and can be mitigated for in future wildlife crossing designs. While animal behavior modification can help reduce fragmentation, the most efficient and effective mitigation is early planning which avoids and/or minimizes impacts by considering important ecological linkages during transportation planning.

DO EDGES ACT AS CONDUITS OR FILTERS FOR FORAGING BATS?

K.M. Briones*, M.M. Marshall, D.A. Miller, J.A. Homyack, and M.C. Kalcounis-Ruppell. *Biology, University of North Carolina at Greensboro, NC, 27402 (KMB, MMM and MCKR); Weyerhaeuser Company, Columbus, MS 39701 (DAM); Weyerhaeuser Company, Vanceboro, NC 28586 (JAH).*

Research on managed forest landscapes in the southeastern U.S. has shown that six bat species (*Lasiurus borealis*, *L. cinereus*, *Eptesicus fuscus*, *Nycticeius humeralis*, *Tadarida brasiliensis*, and *Perimyotis subflavus*) have substantially higher activity along hard forest edges (older forested stands adjacent to young open-canopy stands) than in forest interiors, consistent with studies that show high bat species richness and abundance along hard forest edges. Hard edges may create a semi-permeable barrier to movements of bats into the forest, causing an accumulation of bat activity along edges (a filtering effect). Alternatively, forest edges may improve connectivity between foraging areas (a conduit effect), or serve as both a filter and a conduit. To investigate this, we used a microphone array and thermal imagery during summer

2009, along hard forest edges, to examine how individual bats use edges and to test the hypotheses that edges act as filters (fly perpendicular to edge) and/or conduits (fly parallel to edge). We used a 4-channel microphone array (Avisoft USG) to determine position of the incoming echolocation call, relative to the edge, based on time of arrival of the call at each microphone in the array. In addition, we used a thermal imaging camera (Photon 320; Flir/Core by Indigo) with the microphone array to visualize individual bat flight at the edge. We sampled 10 different edge sites, each for 3 continuous nights, within a managed forest landscape owned and managed by Weyerhaeuser Company in eastern North Carolina. To date, we have analyzed a subset of the data from five of the edges. More bats flew parallel to the edge than perpendicular or in an alternate direction, suggesting that the edge acts as a conduit for bats in this landscape. In the future we will analyze the thermal imagery data to confirm our microphone array results and identify echolocation calls to examine species-specific use of edges as conduits or filters.

ECOLOGY OF *MYOTIS LUCIFUGUS* IN THE SOUTHEAST: COMPARISONS WITH THE NORTHEAST

Eric R. Britzke, U. S. Army Engineer Research and Development Center, Vicksburg, MS 39180

Like many other common bat species, the ecology of little brown bats (*Myotis lucifugus*) is poorly understood. Existing data is largely from extensive banding efforts at caves prior to the 1970s. In the southeastern United States, little brown bats occur over a wide area, but constitute a small percentage of the bats captured during summer or observed in hibernacula surveys. In summer, most roosts have been found in human structures (barns, old buildings, bridges, etc.), while some tree roosts have been located. Little browns typically forage over streams, particularly on stretches of calm water where they can forage on newly emerging insects. In winter, little browns are often present in the same hibernacula as Indiana bats (*Myotis sodalis*), but are normally less abundant than Indiana bats. Information on little brown bats in the northeast will be provided for comparison. With White-nose Syndrome affecting little brown bats, there is an imminent need to gather basic information on the ecology of little browns to inform future conservation efforts before these bats disappear from the landscape.

ROOST COMMUNICATION IN THE INDIANA BAT, *MYOTIS SODALIS*

Caroline M. Byrne*, Dylan A. Horvath, Joy M. O'Keefe. *Binghamton University, NY 13903 (CMB and DAH); USDA Forest Service, Southern Research Station, Clemson, SC 29634 (JMO).*

In a pilot study, vocalizations of the Indiana bat, *Myotis sodalis*, were recorded at communal summer roosts. The goal was to capture social calls, differentiated from echolocation calls by their solely communicative function. Echolocation calls were eliminated with the use of known samples from *M. sodalis*. We used an Anabat bat detector and CF ZCAIM to record calls at known roosts from 15 minutes pre-emergence to 5 minutes post-emergence. Recorded calls were analyzed in AnalookW and compared to parameters given in Pfalzer and Kusch 2003, who describe four general types of call based on corresponding behaviors. Calls were recorded at 1 roost in June-July 2008 and 6 roosts in June-July 2009; there were 45 call files, containing a total of 138 pulses. The preliminary results show calls recorded at the *M. sodalis* roosts fit the general parameters of the mother to juvenile isolation or directional call type (frequency modulated with a curved structure, single pulses with a duration of 5-58ms or double pulses). If social calls of North American bats are found to exhibit species-specific characteristics similar to those found in Europe by Pfalzer and Kusch(2003), social calls could become a noninvasive research method,

done along side existing research. If researchers are vectors in the spread of White Nose Syndrome, acoustic surveys could be a viable alternate to survey methods that require handling bats. Further research is needed to determine species-specific characteristics, and the period in which the recordings are made should be extended to include pre-juvenile and mating periods.

NICHE BREADTH, FORAGING PLASTICITY AND CONSERVATION RISK OF *MYOTIS LEIBII*, *M. LUCIFICUGUS*, AND *M. SEPTENTRIONALIS*

Aaron J. Corcoran, Joseph M. Szewczak. *Wake Forest University, Winston Salem, NC, 27106;*
Humboldt State University, Arcata, CA, 95521

An animal's behavioral plasticity is one of many factors that can determine its extinction risk in a changing environment. In bats, dietary breadth is indeed related to extinction risk. Microchiropteran bats use echolocation to detect and locate prey. The structure and variation of a bat species' echolocation repertoire can tell us much about its habitat selection and foraging flexibility. Echolocation structure has also been shown to reflect niche differentiation for bats in the genus *Myotis*. For the purposes of understanding the factors contributing to the conservation status of three bat species (*M. leibii*, *M. lucifugus*, and *M. septentrionalis*), I report on what is known of the dietary variation and echolocation repertoires of these species. All three species are known to use multiple foraging strategies, including aerial hawking and gleaning off of substrates. They all also forage widely on over eight orders of insects and spiders, and are typically considered generalist foragers. These myotines frequently eat soft-bodied insects, including lepidoptera. This is particularly true for *M. septentrionalis* and *M. leibii*. *M. lucifugus* has the broadest repertoire of echolocation call structure, including calls suited for foraging in open and forest interior. *M. septentrionalis* and *M. leibii* calls show less variation and reflect foraging only in forest interior. Out of the three species, *M. septentrionalis* echolocation structure appears the best suited for gleaning and foraging in cluttered environments. In summary, the three species are all generalist foragers that eat many soft bodied insects. Echolocation structure reflects a greater degree of niche partitioning than does diet of these bats, with *M. lucifugus* employing the greatest breadth of echolocation call structure. Concordantly, *M. septentrionalis* and *M. leibii* may be more at greater conservation risk due to their specialized foraging within forest interior.

CONSERVATION OF A LARGE CARNIVORE: THE RED WOLF

J. A. Dellinger* and T. L. Best. Department of Biological Sciences, Auburn University, Auburn University, AL 36830 (JAD and TLB).

Re-introduction and conservation of large carnivores is heavily associated with the western United States. However, a re-introduction and conservation effort centered on a large carnivore, the red wolf (*Canis rufus*), has been underway for the past 23 years in the southeastern United States. To date the effort has been labeled a success. The single wild population, occurring on the Albemarle Peninsula in northeastern North Carolina, has reached carrying capacity for the current recovery area and shows an ability to co-exist alongside humans. The success of this effort can be attributed to the multifaceted approach that the United States Fish and Wildlife Service- Red Wolf Recovery Project (USFWS-RWRP) took to re-introduce and conserve the red wolf. By using science, technology and politics, the USFWS-RWRP has allowed local people to develop a better attitude and working relationship with a once feared and persecuted animal. The USFWS-RWRP anticipates this effort will be duplicated elsewhere within the historic range of

the red wolf in the near future. However, much remains to be learned about the red wolf and how it interacts with other animals and its environment. Nevertheless, this effort serves as an example and reminder that large carnivores and human interests can co-exist.

NEITHER RAIN NOR SLEET NOR GLOOM OF NIGHT: STUBBORN BRIDGE ROOSTING HABITS OF BIG BROWN BATS (*EPTESICUS FUSCUS*)

M. E. Frazer and M. R. Miller, *NC Department of Transportation, Raleigh, NC, 27603-1598*

Although big brown bats (*Eptesicus fuscus*) probably favor large hollow trees and rock crevices as day roosts, they are commonly observed roosting in a variety of man-made structures, such as concrete bridges. Bats roosting in large bridges may enjoy thermal benefits from sunlight-warmed concrete and reduced exposure to predators, but bridge-roosting bats still have to contend with weather. We monitored big brown bats roosting in three bridges in western and central North Carolina to determine roosting habits. Bats day-roosted in guardrail crevices and in bridge deck expansion joints despite the lack of overhead cover and their proximity to traffic noise and exhaust, while night roosting occurred underneath bridge decks. During rain events, instead of moving to a well-used night roost below the bridge, a maternity colony of 50-100 individuals remained in a bridge deck expansion joint despite exposure to the elements. Other observations include winter roosting by big browns under bridge decks and opportunistic use of bat boxes mounted on a bridge that had been intended for eastern small-footed bats (*Myotis leibii*). Since they could not fit into the narrow slots of the bat boxes, big browns simply wedged themselves between the bat box and the side of the bridge. These observations demonstrate big browns' versatility in adapting to a variety of roost types and weather conditions. The ability to use a wide range of roosts in summer should benefit resource managers seeking to create or improve big brown summer roosting habitat, although care must be taken not to do this at the expense of less common species. This adaptability may also help big brown bats when contending with white-nose syndrome (*Geomyces destructans*) in winter.

TEMPORAL ROOSTING PATTERNS AND POPULATION DYNAMICS OF TWO BRIDGE POPULATIONS OF EASTERN SMALL-FOOTED BATS (*MYOTIS LEIBII*)

M. E. Frazer and J. M. O'Keefe. *NC Department of Transportation, Raleigh, NC, 27699-1598 (MEF); USDA Forest Service, Southern Research Station, Clemson, SC, 29634 (JMO)*

Bats often use bridges as day or night roosts to supplement or replace natural roost sites. The eastern small-footed bat (*Myotis leibii*) is a tiny (4–6 g) bat that typically roosts in natural rock crevices, but they have also been found roosting in the crevice-like expansion joints of concrete bridges. The objectives of our study were to identify temporal roosting patterns and to measure population dynamics in two bridge populations of eastern small-footed bats in western North Carolina, where this species is considered vulnerable. At the Fontana bridge (elevation ~500 m), bats were first banded in 2000 and were monitored in the bridge ≥ 3 times per year from March–November 2004–2009. At the Stratton Meadows bridge (elevation ~1400 m), bats were first banded in 2004 and were monitored in the bridge ≥ 1 times per year from May–June 2007–2009. The warmer Fontana bridge is primarily used by adult females ($n \geq 22$), but male and juvenile small-footed bats and male little brown bats (*M. lucifugus*) are sometimes observed. The Stratton Meadows bridge is used by ≥ 36 bachelor male and ≥ 7 female small-footed bats, as well as the occasional male little brown bat. Although numbers of bats using the bridges varies by day, eastern small-footed bats show fidelity to both bridges; one female has used Fontana bridge for

≥7 years and several males have used Stratton Meadows bridge for ≥5 years. Relatively large populations and long-term fidelity indicate that both bridges provide important roosting habitat for eastern small-footed bats.

CHARACTERIZATION OF ULTRASONIC CALLS IN TWO SPECIES OF GLIDING MAMMALS: *GLAUCOMYS SABRINUS* AND *G. VOLANS*

L. M. Gilley* and T. L. Best. *Department of Biological Sciences, 331 Funchess Hall, Auburn University, AL 36830*

Ultrasonic calls in lab mice (*Mus musculus*) and rats (*Rattus norvegicus*) has long been studied in the biomedical field. Outside of biomedical research, the study of ultrasound in mammals has largely focused on echolocation in bats and odontocete whales. More recent works have described complex ultrasonic signals being used for communication in several myomorph species and one sciurumorph. However, very little is known about the extent to which ultrasonic signaling is used in mammals, and even less is known about function. We describe the first known ultrasonic calls in two species of gliding mammals: northern flying squirrels (*Glaucomys sabrinus*) and southern flying squirrels (*G. volans*). Ultrasonic calls from captive *G. sabrinus* and *G. volans* were recorded and analyzed. We identified and characterized four common call-types of ultrasonic vocalizations for northern and southern flying squirrels. Results show high levels of stereotypy for certain call parameters within species, and discriminant function analysis correctly classified seven of the eight common call-types at ≥ 85%. The high degree of stereotypy observed in these calls suggests that acoustic surveys may be a viable tool for documenting and monitoring the presence of sensitive species of flying squirrels in North America. Furthermore, a better understanding of the acoustic repertoire in mammals will provide insight into behaviors associated with both conspecific and heterospecific interactions.

DETERMINATION OF CALVING INTERVAL AND PREGNANCY RATE OF BOWHEAD WHALES (*BALAENA MYSTICETUS*) VIA ANALYSIS OF STABLE ISOTOPES AND TRACE ELEMENTS IN BALEEN

Samuel Hirt* *331 Funchess Hall Auburn University, Alabama 36849*

Bowhead whales (*Balaena mysticetus*) are a long-lived species that inhabit the Arctic and sub-Arctic waters, but despite being extensively studied for that past 30+ years, little is known about their reproductive life histories. Baleen from tip to tip can be up to 20 years old and contains a history of individual whales. The objectives of my research are to:

- 1) Determine calving interval of bowhead whales by examining trace elements in baleen
- 2) Analyze trace elements in baleen to estimate parameters of life history such as age at weaning, the relationship between age and length at sexual maturity, duration of gestation, and elements that may be limiting in pregnancy
- 3) Analyze trace elements in baleen over time to see if these levels have changed over time

To study these questions I will analyze sections of baleen collected from Eskimo subsistence hunted bowhead whales from the past 20+ years. I will first compare concentrations of elements in the most recently grown portion of baleen between pregnant females and non-pregnant individuals to understand which elements are significantly different during pregnancy. I will then section baleen and analyze the oscillation of ratios of stable isotopes to create a “timeline” for individual whale baleen sections. I will section the baleen and extract trace elements that were significant in the first experiment to determine reproductive state and fecundity throughout the

growth of the baleen. Finally, I will investigate concentrations of elements in baleen to assess changes in the population over time. My research will help us understand the potential for population increase in this stock of whales and their response to the changing arctic environment. I will present preliminary results from analysis of baleen from 3 whales that show varying concentrations of trace elements.

THE SBDN/NEBWG BAT CAPTURE DATABASE: CURRENT STATUS AND FUTURE USES

Heather Irwin, Susan Loeb, and Eric Britzke, *Department of Forestry and Natural Resources, Clemson University, Clemson, SC; USDA Forest Service, Southern Research Station, Clemson, SC; Eric Britzke, U.S. Army Engineer Research and Development Center, Vicksburg, MS.*

Regular monitoring of bat populations is needed to assess the impacts of threats to bats such as climate change, wind turbines and White-nose Syndrome. Researchers have been collecting bat capture data for many years and combining that data into an organized database is important in monitoring bats populations. The Southeastern Bat Diversity Network and the Northeast Bat Working Group (SBDN/NEBWG) Bat Capture Database is just such an example. The database is similar to databases currently used by some State agencies and houses bat data from researchers throughout the eastern US. Currently the database ranges from 1999 to the present and covers data from Arkansas, Georgia, Illinois, Indiana, Kentucky, Maine, Missouri, North Carolina, New York, Ohio, South Carolina, Tennessee, and Virginia. The database can be used to document band recoveries. Further, relationships are established to facilitate efficient management of information in order to ascertain any patterns in variables such as species, location, and habitat. These patterns can then be compared to known threats to bat populations to establish possible cause and effect such as species distribution and capture frequency from 1999-2009. Extensive range maps as well as ones specific to certain species of bats can also be produced given the significant amount of data from a wide range of sources. Tables and reports can be generated to summarize the number of bats captured in each county each year. While the database will be maintained by members of the SBDN/NEBWG Database committee, it will be possible for contributors who have research and management needs to request specific queries. One of the biggest advantages of having such a database is the accessibility of data to researchers. Sharing knowledge leads to cohesive studies and ultimately improves overall research and management.

BAT COMMUNITY STRUCTURE WITHIN RIPARIAN AREAS OF NORTHWESTERN GEORGIA

J. B. Johnson^{*}, W. M. Ford, J. W. Edwards, and M. A. Menzel. *Division of Forestry and Natural Resources, West Virginia University, Morgantown, WV 26506 (JBJ and JWE); US Army Engineer Research and Development Center, Vicksburg, MS 39180 (WMF); Federal Bureau of Investigation, Kansas City, MO 64105 (MAM)*

Although it is well known that bats commonly forage in riparian areas, which provide water resources and insect concentrations, the role that the physical structure of riparian areas plays in influencing local bat communities is less certain. In 2000–2002, we used acoustic monitoring to determine bat species presence at 338 riparian sites in northwestern Georgia, USA. We used a 2-dimensional nonmetric multidimensional scaling (NMDS) ordination to assess how separations among species were partially associated with riparian conditions. Our NMDS analysis found some degree of habitat partitioning among bat species occurring in northwestern Georgia and was

dictated in part by riparian condition. *Myotis grisescens* and *M. septentrionalis* were associated with low-elevation lotic waterways, whereas *M. lucifugus*, *Lasiurus borealis*, and *Eptesicus fuscus* were associated with high-elevation lentic waterways with sparse canopy cover. However, riparian conditions had weak relations with NMDS axes, possibly resulting in coincidental associations in some cases. Regression tree analysis indicated that higher bat species richness was associated with apparently uncommon small, high-elevation waterways with sparse canopy cover as well as larger streams and rivers that had wetlands adjacent to them. Including high-elevation waterways with existing management recommendations for endangered gray *Myotis* foraging areas (large, low-elevation streams and rivers) will be the most effective conservation strategy to benefit the most bat species in northwestern Georgia and probably elsewhere in the southern Appalachians.

OCCUPANCY RATE AND DETECTION PROBABILITY OF THE CAROLINA NORTHERN FLYING SQUIRREL IN NORTH CAROLINA

C. A. Kelly and W. M. Ford. North Carolina Wildlife Resources Commission, 1751 Varsity Drive, Raleigh, NC 27606 (CAK); U.S. Army Engineer Research and Development Center, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199 (WMF)

Preliminary analysis of the Carolina northern flying squirrel (*Glaucomys sabrinus coloratus*) dataset from the Appalachian Mountains in North Carolina from 1996-present has shown that annual nest box surveys have been plagued by low capture/recapture rates and tag loss. Accordingly, we explored the utility of transitioning from quantifying population abundance to monitoring habitat occupancy over time. We used 74 nest box transects located among seven recovery areas to develop capture histories. With a multiple-season occupancy model in PRESENCE, we estimated occupancy rate (ψ), extinction rate (ϵ), and detection probability (p). We assumed that colonization did not occur between populations inhabiting isolated massifs. In addition to the null model, we modeled these metrics using two covariates: habitat quality ranking with occupancy and detection, and proportional patch size with extinction. We considered red spruce (*Picea rubens*)-Fraser fir (*Abies fraseri*) and northern hardwood-red spruce habitats to be higher quality, whereas pure northern hardwoods or red spruce-red oak (*Quercus rubra*) forests were lower quality. Our best-approximating model was $\psi(\cdot), \epsilon(\cdot), p(\text{habitat})$. Occupancy remained constant ($\psi = 0.51 \pm 0.046$), whereas detection probability varied by habitat quality. Detection was greater in higher quality habitat ($p = 0.75 \pm 0.047$) than in lower quality habitat ($p = 0.63 \pm 0.029$). Our $\psi(\text{habitat}), \epsilon(\cdot), p(\text{habitat})$ model also received strong support. Patch size was not a supported covariate for extinction. We believe constant occupancy reflects the close proximity and heterogeneous mixing of all high-elevation forest types over relatively small areas in North Carolina. This contrasts with the Virginia northern flying squirrel (*G. s. fuscus*) where far larger landscape patches of northern hardwoods and spruce-northern hardwoods resulted in differences in occupancy but not detection. Simulations indicate that monitoring ≥ 30 nest box transects will be necessary to detect changing trends statewide in occupancy by Carolina northern flying squirrels.

CAROLINA NORTHERN FLYING SQUIRRELS USE WOOD POLES TO GLIDE ACROSS A ROAD BARRIER IN THE UNICOI MOUNTAINS, NORTH CAROLINA.

Chris Kelly, *North Carolina Wildlife Resources Commission, 32 Amber Lane, Asheville, NC 28803*

Radio telemetry monitoring of the endangered Carolina northern flying squirrel has documented that the Cherohala Skyway, a scenic byway traversing habitat in Graham County, North Carolina, is a barrier to dispersal. The width of the pavement, shoulders, cut bank, and fill slope exceeds the gliding ability of the northern flying squirrel, effectively bisecting the Unicoi Mountains population. Both short and long-term conservation measures were developed to reconnect and improve habitat. Wood utility poles, serving as artificial trees, were posted adjacent to the road shoulder to narrow the width of the canopy gap until trees mature. A total of six poles, modified with horizontal launch beams and escape shelters, were erected in pairs set opposite each other in three locations along the Skyway in June 2008. Evaluation of the crossing structures began in March 2009 and included infrared camera monitoring, nest box surveys, and experimental releases of radio-collared flying squirrels onto poles on the opposite side of the road from the capture site. Three still images, six videos, and two captures from an escape shelter have documented Carolina northern flying squirrel on four of the six poles. Three videos have documented flying squirrels using the poles to cross the road. Six of eight recordings were taken on nights with low visibility due to fog or moon phase, suggesting predator avoidance. We have demonstrated that flying squirrels are using the poles to glide across the road, will den in the escape shelters, are using dens on both sides of the road, and can cross heading downslope or upslope. Camera monitoring will continue to evaluate the potential threat from barred owls. Long-term conservation measures are underway to protect maturing trees along the road banks, treat hemlocks for hemlock wooly adelgid, and plant suitable conifers in the surrounding forest to supplant dying hemlocks.

SMALL MAMMAL USE OF NATIVE WARM-SEASON AND EXOTIC COOL-SEASON GRASS FIELDS

R.L. Klimstra* and C.E. Moorman. *College of Natural Resources, Fisheries and Wildlife Sciences Program, North Carolina State University, Raleigh, NC 27607*

Grassland-dependent songbirds and small mammals have suffered population declines throughout the United States, mostly from habitat loss. Converting exotic cool-season grass (ecsg) pastures to native warm-season grass (nwsg) fields may improve habitat quality for wildlife while still allowing forage production for cattle. In 2009 and 2010, we compared small mammal populations among 5 nwsg, 4 ecsg, and 4 wildlife fields (i.e., nwsg and forbs planted specifically for wildlife), located in the western piedmont of North Carolina. We captured small mammals using Sherman live traps during spring and summer on the 13 privately owned fields, all of which are enrolled in the Cooperative Upland Restoration and Enhancement (CURE) program. We expected fields containing nwsg to harbor higher densities of small mammals than ecsg fields. In 2009, small mammal captures differed among the three field types ($p=0.002$). We captured more small mammals in wildlife fields ($\bar{x}=50.3\pm 10.0/1000$ trap nights) than in ecsg ($\bar{x}=4.5\pm 2.9/1000$ trap nights) and nwsg ($\bar{x}=20.6\pm 4.0/1000$ trap nights) fields. Although captures were higher in nwsg fields, capture numbers did not differ significantly from ecsg fields. Based on preliminary data, ecsg and nwsg forage fields do not provide the same habitat quality as the diverse plant communities in wildlife fields.

EVALUATION OF EXPERIMENTAL CROSSING STRUCTURES FOR THE CAROLINA NORTHERN FLYING SQUIRREL IN GRAHAM COUNTY, NC

Andrew Lawrence*, Chris Kelly. *North Carolina State University, 110 Brooks Avenue, Raleigh, NC, 27607; North Carolina Wildlife Resources Commission, 1751 Varsity Drive, Raleigh, NC 27606.*

The Cherohala Skyway in the Unicoi Mountains of Graham County, North Carolina, acts as a dispersal barrier bisecting an isolated population of the endangered Carolina northern flying squirrel (*Glaucomys sabrinus coloratus*). In June of 2008, six modified utility poles, intended to function as launch points for dispersing squirrels, were installed in treeless areas along the Skyway, narrowing the gap between forest edges. Evaluation of flying squirrels' use of the poles involved radio-telemetry, experimental release of flying squirrels onto poles, camera monitoring, and nest box captures. While telemetry and capture could document that a flying squirrel had relocated to the opposite side of the road, camera monitoring was needed to determine if flying squirrels used the poles to leap across. Since March of 2009, the poles have been monitored with DLC Covert Scoutguard trail cameras. The cameras are triggered by an infrared sensor aimed down a horizontal launch beam, and feature an infrared flash that goes undetected by flying squirrels or predators. The squirrel's ability to leap across the road from the top of a pole was first confirmed during an experimental release of a radio-collared squirrel. The telemetry readings correspond with time-stamped images showing the squirrel perched at the end of the launch beam. Subsequent video monitoring provided further evidence that flying squirrels are actively exploring the poles and using them to cross the road. Five videos show flying squirrels gliding across the road from the launch beam, crossing in both the upslope and downslope direction, and using at least one pole in each of the three crossing corridors. Given the remoteness of the study site and nocturnal habits of the flying squirrel, passive monitoring with infrared cameras has proven to be an effective way to document use of the poles for dispersal across the road barrier.

EFFECTS OF DIET QUALITY ON THE ACTIVITY PATTERNS AND GUT MORPHOLOGY OF THE WHITE-FOOTED MOUSE, *PEROMYSCUS LEUCOPUS*

K. E. Lucia* and J. A. Cranford. *Department of Zoology, Center for Animal Behavior, Miami University, Oxford, OH 45056 (KEL); Department of Biology, Virginia Polytechnic Institute and State University, Blacksburg, VA 24060 (JAC)*

Habitat fragmentation and other changes to habitat can alter biodiversity and diet quality for small mammals. To evaluate the effects of decreased diet quality, white-footed mice (*Peromyscus leucopus*) were maintained in the laboratory on two diets. The first diet was comparable to standard lab chow and was comprised of 5% nonnutritive fiber. The second diet had a level of 35% nonnutritive fiber, replacing a large portion of the glucose in the diet. Feeding times, activity levels and patterns were monitored. Additionally, morphological data from the gastrointestinal tract of mice on 35% fiber diet were gathered and compared with mice on rodent chow. Mice on 35% fiber diet did not exhibit a significant change in activity intensity during the dark cycle, but did display a significant increase in activity during the light cycle marked by a 2-hour anticipation of onset of darkness. The anticipation of darkness was driven by hunger as indicated by a significant increase in feeding activity during the 4 hours prior to darkness. Significant morphological changes also occurred at 35% fiber diet, mostly to the hindgut, which is indicative of a response to diet quality and not simply an increase in the quantity of food consumed. Bimodal activity patterns were observed in mice on 35% fiber diet, characterized by

two peaks in activity during the dark cycle. The first peak was higher in intensity than the second. These changes demonstrate that morphological changes to the gastrointestinal tract can allow for normal activity levels to be maintained even on a lower quality diet. However, the hunger-driven anticipation of darkness may increase predation risk for this nocturnal rodent.

IMPACTS OF MANAGING LOBLOLLY PINE PLANTATIONS FOR BIOFUELS PRODUCTION ON RODENT ABUNDANCE, DISTRIBUTION, AND DEMOGRAPHICS

M. M. Marshall*, M.C. Kalcounis-Rüppell, D.A. Miller, J.A. Homyack, *Biology Department, University of North Carolina at Greensboro, Greensboro, NC 27402-6170 (MMM and MCKR); Weyerhaeuser Company, P.O. Box 2288, Columbus, MS 39701 (DAM); Weyerhaeuser Company, 1785 Weyerhaeuser Road, Vanceboro, NC 28586 (JAH)*

To help meet demands for renewable sources of energy for transportation fuels, Weyerhaeuser Company is investigating intercropped switchgrass (*Panicum virgatum* L.) within intensively managed loblolly pine (*Pinus taeda*) stands as a biofuels crop. Changes to understory composition and structure may affect ecologically important rodent communities. Therefore, we surveyed rodent populations using mark-recapture techniques to determine their responses to switchgrass intercropping. We captured rodents on experimental plots within newly established pine plantations subjected to five different intercropping treatments (pine with woody biomass in place, pine with woody biomass removed, pine and switchgrass with woody biomass in place, pine and switchgrass with woody biomass removed, and switchgrass only with woody biomass removed). We trapped each plot for 24 nights from July-December 2009, resulting in 1,832 rodent captures during 13,428 trap nights. We captured *Peromyscus leucopus* (n=390 tagged individuals), *Mus musculus* (n=278 tagged individuals), *Sigmodon hispidus* (n=149 tagged individuals), and *Reithrodontomys humulis* (n=12 tagged individuals). Preliminary examination of the effect of intercropping treatment on the number of individuals and total captures revealed that only *Mus musculus* was influenced by treatment type (number of individuals: $c^2=11.01$, d.f.=4, $p=0.03$; total captures: $c^2=13.55$, 4 d.f.=4, $p<0.01$), with more *Mus musculus* in treatments containing switchgrass. Ongoing analyses will be discussed.

STATUS OF THE ALLEGHENY WOODRAT (*NEOTOMA MAGISTER*) IN VIRGINIA BLUE RIDGE MOUNTAINS

T. Menken*, M. T. Mengak, and S. B. Castleberry. *D.B. Warnell School of Forestry & Natural Resources, University of Georgia, Athens, GA 30602*

The Allegheny woodrat is one of the 24 identified species in the Virginia Comprehensive Wildlife Conservation Strategy (CWCS) and is defined as having a moderate conservation need. Allegheny woodrats occupy isolated rocky habitat and share habitat with other CWCS mammalian species of conservation need including rock voles and spotted skunks. The species is known to be declining or is extirpated from several states within its range. Woodrats are no longer present at previously occupied sites in Maryland, Indiana, Pennsylvania, and West Virginia. Because their status in Virginia is thought to be declining, we surveyed 57 previously known or newly discovered sites along Virginia's Blue Ridge Mountains using traps and remote cameras to determine the current status. Sites were trapped 2-4 nights and cameras operated similarly. We detected (capture or camera) woodrats at 70% (N=40) of the sites. Of 34 sites trapped between 1990 and 2000, 62% (N=21) were occupied in 2009. Although site occupancy appears to have declined over the past 10 years, occupancy of rocky habitats by woodrats can be

ephemeral and may function within a metapopulation framework with sites experiencing local extirpations and subsequent recolonizations.

COMPARISON OF INDIANA BAT (*MYOTIS SODALIS*) MATERNITY COLONY HOME RANGES AMONG THREE SITES

Melanie L. Michaels* and Timothy C. Carter, *Ball State University, Muncie, Indiana 47306-0440*

The Indiana bat (*Myotis sodalis*) is currently listed as an endangered species by US Fish and Wildlife Service with populations that only recently began to rebound. The objective of this study was to examine the foraging home range for female Indiana bats living in both Southern Illinois and East-Central Indiana. Two-station telemetry was used to triangulate the signal from bats fitted with radio transmitters to determine home range. Foraging points were determined using Locate III and overlaid onto habitat maps using ArcMap® GIS. Both minimum convex polygon and adaptive kernel methods were used to determine home range size. This multi-site analysis of female Indiana bat foraging home ranges will give wildlife managers a better understanding of how much foraging area female Indiana bats require to be successful.

MITOCHONDRIAL DNA VARIATION IN THE EASTERN FOX SQUIRREL (*SCIURUS NIGER*)

Nancy D. Moncrief and Ronald A. Van Den Bussche. *Virginia Museum of Natural History, Martinsville, VA 24112, and Department of Zoology, Oklahoma State University, Stillwater, OK 74078.*

The eastern fox squirrel (*Sciurus niger*) occurs naturally over most of eastern North America. This species displays striking patterns of geographic variation in size and coat color. These patterns of morphologic variation are consistent with a hypothesis of southward range contraction and isolation in two refugia (in Texas and Florida) during the Last Glacial Maximum, followed by northward range expansion after the glaciers receded. Similar hypotheses have been proposed to explain the patterns in phylogeographic structure exhibited by many plants and animals in eastern North America. As part of a more comprehensive study of geographic variation in *Sciurus niger*, we analyzed a 402 bp segment of the cytochrome b (cyt b) mtDNA gene in populations throughout the species' range. Despite the broad geographic sampling in our study, there was no phylogeographic structure in our data. Unique haplotypes differed from high-frequency haplotypes by only one or two base pairs, producing a star-like phylogeny of haplotypes. Bootstrap analysis of neighbor-joining trees revealed a lack of phylogeographic structure among haplotypes. Variation within populations and within the species as a whole was characterized by high haplotype diversity and low nucleotide diversity. Taken together, our data indicate that the eastern fox squirrel underwent a rapid range expansion and rapid morphological divergence within the past 20,000 years.

REVIEW OF THE ECOLOGY OF EASTERN SMALL-FOOTED BATS (*MYOTIS LEIBII*) IN THE SOUTHEASTERN UNITED STATES

Moosman, Paul R., Jr., Jacques P. Veilleux, M. Erin Hawes, & Timothy J. Brust; *Department of Biology, Virginia Military Institute, Lexington, VA 24450 (PRM, MEH & TJB); Department of Biology, Franklin Pierce University, Rindge, NH 03461 (JPV)*

The eastern small footed bat (*Myotis leibii*) is one of the least studied species of bats in the southeastern U.S. Distribution during the non-hibernation period likely is restricted to areas with exposed rock outcrops, including cliff faces and talus slopes, although, colonies have occurred in expansion joints of bridges in the Southeast and in talus-like rip rap of dams in the Northeast. Limited data suggest maternity sites may be associated with south-facing slopes. Males have been documented in a greater variety of roosting habitats, including shaded outcrops and buildings. During summer, most *M. leibii* have been captured < 600m from roosts and radio-telemetry suggests they forage within a 2.5 km radius of their roosts, making captures unlikely unless suitable habitats are intentionally targeted. Most encounters with *M. leibii* have been during winter surveys, typically in the coldest parts of hibernacula, including under rocks, in crevices, and on walls near entrances. Duration of hibernation appears shorter than that of most co-occurring species of bats in eastern North America, suggesting *M. leibii* may have greater cold tolerance. White-nose Syndrome (WNS) is causing ongoing declines in *M. leibii* populations in the Northeast. Whether the unique winter ecology of *M. leibii* will affect mortality rates from WNS in the Southeast remains unknown. However, ecology of *M. leibii* makes it difficult to monitor populations with traditional hibernacula surveys. Efforts are needed to identify summer roost sites to 1) provide alternative means to detect population declines, and 2) improve knowledge of their ecology.

EFFECTS OF SUPPLEMENTAL FEEDING, MAMMALIAN PREDATOR EXCLUSION, AND PRESCRIBED FIRE ON TWO SPECIES OF *PEROMYSCUS* MICE IN A LONGLEAF PINE ECOSYSTEM

G. Morris,* L.M. Conner, M.K. Oli. *Joseph W. Jones Ecological Research Center, Newton, GA 39870 (GM and LMC); Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, FL 32611 (GM and MKO).*

Predation and availability of food resources impact population dynamics of prey species such as small mammals. Ample food resources may cause increases in abundance and may be associated with behavioral responses such as changes in space use or aggression. Predation may affect populations through the direct removal of individuals and through sub-lethal mechanisms; for example, individuals may restrict movement to minimize predation risk. This may limit access to food and reproductive opportunities. *Peromyscus* mice have been observed to exhibit a positive response to prescribed fire but mechanisms behind this response are poorly understood. Fire-caused changes in food resources and cover, which may increase risk of predation, may be important. The objective of this study was to experimentally examine how supplemental feeding, mammalian predator exclusion, and prescribed fire, individually and in combination, affect survival of oldfield (*Peromyscus polionotus*) and cotton mice (*P. gossypinus*). Oldfield mice showed a positive response to mammalian predator exclusion, but no response to feeding or fire treatments alone or in combination with other treatments. Cotton mice had no strong response to any treatment individually, but showed an interactive response to the predation and fire treatments. Specifically, survival in predator exclusion grids increased following prescribed fire while fire had no effect on survival in predator access grids. Further examination determined that

this increased post-fire survival occurred only on feeding grids; survival in all other study areas was similar before and after burning.

TOWARDS A BETTER UNDERSTANDING OF THE ECOLOGY OF *MYOTIS LEIBII*, *MYOTIS LUCIFUGUS*, AND *MYOTIS SEPTENTRIONALIS*

J. M. O’Keefe and M. C. Kalcounis-Rueppell. *USDA Forest Service, Southern Research Station, Clemson, SC, 29634 (JMO), University of North Carolina at Greensboro, Greensboro, NC 27402 (MCKR)*

Hundreds of thousands of *Myotis* bats in the northeastern U.S. have died due to White-nose Syndrome and biologists have predicted that some *Myotis* species may be extirpated in the northeast. White-nose Syndrome also threatens populations of cave-associated bats in the Southeast, including five species of cave-wintering *Myotis*. Historically, more attention and funding have gone towards the study of the endangered *M. grisescens* and *M. sodalis*, but few data are available to guide conservation and recovery of three more common cave wintering *Myotis* species (*M. leibii*, *M. lucifugus*, and *M. septentrionalis*). Until recently, *M. leibii* was considered vulnerable across its range, but *M. lucifugus* and *M. septentrionalis* were considered secure. However, White-nose Syndrome has the potential to be dire for populations of these three species in the Southeast. Summarizing data on summer roosting and foraging habitat requirements and winter roosting ecology for *M. leibii*, *M. lucifugus*, and *M. septentrionalis* is necessary for informing policy and management decisions and will give us a better understanding of the potential impacts of White-nose Syndrome on these species. Further, some of the information that we have for these species in the Southeast is in the gray literature and it is important that these data be combined with published findings. Finally, we hope that summarizing what is known about *M. leibii*, *M. lucifugus*, and *M. septentrionalis* in the Southeast will allow us to identify critical gaps in our knowledge.

SNAG POPULATION DYNAMICS RELATIVE TO INDIANA BAT ROOST HABITAT SELECTION IN THE SOUTHERN APPALACHIAN MOUNTAINS

Joy M. O’Keefe, Heather L. Stewart, and Susan C. Loeb. *USDA Forest Service, Southern Research Station, Clemson, SC 29634*

Little information exists about the roost ecology of Indiana bats (*Myotis sodalis*) at the southern extent of their range. From 1999–2009, biologists have gathered data on roosts in the southern Appalachians, where Indiana bats primarily use beetle-killed yellow pines, but occasionally roost in white pine or hemlock snags. Multiple studies in the region have shown that Indiana bats selectively roost under sloughing bark in tall, low decay conifers that receive greater solar exposure than random trees. In fall 2009, we measured snag characteristics in the Cherokee and Nantahala National Forests and the Great Smoky Mountains National Park in NC and TN. We located mature stands with a conifer component, searched stands for dense snag patches, and measured ≥ 40 snags in variable size plots on lower, middle, and upper slopes. For snags ≥ 18.4 cm dbh, we recorded species or genus, height, dbh, and overall decay status (1–4). To evaluate decay, we recorded branch state (e.g., size and number), bark tightness, percent remaining bark, and surface wood hardness. We measured 1063 snags in 23 plots; 75.3% were yellow pine, 12.2% were white pine, 6.4% were hemlock, and 6.1% were hardwoods. Hemlock snags were taller and less decayed than known roosts (mainly yellow pines), while yellow and white pine snags were shorter and more decayed than known roosts ($P < 0.0001$). Known roosts and yellow pines had

25–28% bark remaining, while white pines and hemlocks had significantly more bark remaining (58–96%). Although yellow pine snags are abundant in pine-hardwood forests, most will soon be too decayed to be suitable for roosting and recruitment of yellow pine snags is very low. In the near future, white pines with $\geq 30\%$ bark and hemlocks recently killed by adelgids may be significant roost structures for Indiana bats in the southern Appalachians.

ECOLOGY OF *MYOTIS SEPTENTRIONALIS* IN THE SOUTHEASTERN U.S.

R. W. Perry and D. A. Saugey. *Southern Research Station, Forest Service, United States Department of Agriculture, Hot Springs, AR (RWP), Ouachita National Forest, Forest Service, United States Department of Agriculture, Jessieville, AR (DAS)*

The northern long-eared bat (*Myotis septentrionalis*) is primarily distributed east of the Rocky Mountains in the northern U.S and Canada. Often considered rare in the southeastern U.S., it may be locally common, particularly where upland forested conditions occur. Caves and mines are often used as winter hibernacula, where males and females roost alone or in small mixed groups (generally <30 individuals). Within these hibernacula, cooler locations are often selected where one or more individuals may occupy cracks or crevices. Temperature, air flow, humidity, and disturbance periodicity affect use of hibernacula. However, studies on winter selection of hibernacula and microclimate associations are often conflicting and additional research is warranted. The rarity of mines and caves in areas where these bats are common implies other features may be used as hibernacula, but common use of other types of hibernacula is currently unknown. Recent studies have contributed a wealth of information on summer roosting. During summer, both sexes roost beneath loose bark or in cavities of live trees or snags; males and non-reproductive females roost alone, whereas reproducing females often roost in small colonies (10-70 individuals). Reproductive females tend to select mature trees (>20 cm diameter) that are tall and in relatively open forests with reduced canopy coverage and less structural clutter. Males often roost in small (<10 cm) understory trees and in shady, relatively dense forests. In general, long-eared bats are flexible in selection of tree species during summer and appear to have regional preferences based on availability of tree species and historical disturbance in an area. Long-eared bats often return to the same hibernacula each year during fall and to the same forest areas to roost and forage during summer. Nevertheless, spatial relationships between hibernacula and summer use areas are unknown. This bat's habit of roosting in small numbers, in inaccessible portions of caves and mines, and foraging beneath the canopy in relative dense forests may all contribute to underestimated abundance in portions of its range.