

Joint Meeting of
13th Annual Meeting of the Southeastern Bat Diversity Network
10th Annual Meeting of the Northeast Bat Working Group
18th Colloquium on Conservation of Mammals in the Southeastern United States



2008

Holiday Inn and Conference Center, Blacksburg, Virginia 20–22 February 2008

Hosted by
Conservation Management Institute at Virginia Tech
&
Virginia Department of Game and Inland Fisheries



Program Overview

Wednesday 20 February 2008

- 8:00 – 5:00 **Registration**
1:00 – 1:15 **Welcome and Introduction**
1:15 – 1:35 **Summary of SBDN activities**
1:35 – 1:55 **Summary of NEBWG activities**
1:55 – 2:15 **Regional Bat Database**
2:15 – 2:45 **Break**
2:45 – 4:30 **Invited Presentations – Session 1**
4:30 – 6:30 **Dinner on your own**
6:30 – 10:30 **No Host Social at Buffalo Wild Wings, 211 Price’s Fork Rd, Blacksburg**
7:00 – 8:30 **Open Workshop on Use of Genetics in Bat Conservation**

Thursday

- 8:00 – 5:00 **Registration**
8:00 – 9:30 **Invited Presentations – Session 2**
9:30 – 10:00 **Break**
10:00 – 11:30 **Invited Presentations – Session 3**
11:30 – 1:00 **Lunch**
1:00 – 2:00 **NEBWG business meeting**
2:00 – 3:00 **SBDN business meeting**
3:00 – 3:30 **Break**
3:30 – 5:00 **Poster Session**
5:00 – 7:00 **Dinner on your own**
7:00 – 11:00 **Social at Awful Arthur’s Seafood Co, 211 Draper Rd. Blacksburg**
7:30 – 9:00 **Open Workshop on Bats with Fungal Infections**

Friday

- 8:00 – 11:00 **Registration**
8:00 – 9:45 **Oral Presentations – Session 1**
9:45 – 10:15 **Break**
10:15 – 11:45 **Oral Presentations – Session 2**
11:45 – 1:00 **Lunch**
1:00 – 2:45 **Oral Presentations – Session 3**
2:45 – 3:15 **Break**
3:15 – 4:15 **Oral Presentations – Session 4**
4:15 **Awards, announcements, closing remarks**

Detailed Program

Wednesday 20 February 2008

- 9:00 – 11:00 **SBDN Board of Directors Meeting**, Stockholders room
- 8:00 – 5:00 **Registration**
- 1:00 – 1:15 **Welcome and Introduction**, Mike St. Germain – Virginia Tech
- 1:15 – 1:35 **Summary of SBDN activities**, Matina Kalcounis-Rüppell – UNC-G
- 1:35 – 1:55 **Summary of NEBWG activities**, Al Hicks – NYSDEC
- 1:55 – 2:15 **Regional Bat Database**, Susan Loeb – U.S. Forest Service
- 2:15 – 2:45 Break
- 2:45 – 4:30 **Invited Oral Presentations Session 1**, Moderator Eric Britzke
- 2:45 – 3:30 **THE APPLICATION OF GENETIC DATA TO THE STUDY AND MANAGEMENT OF BATS**, Maarten Vonhof – Western Michigan University
- 3:30 – 4:30 **ASSESSING IMPACTS OF WIND ENERGY DEVELOPMENT ON BATS: STATUS, CHALLENGES, AND OPPORTUNITES**, Edward B. Arnett and Tom H. Kunz – Bat Conservation International (EBA), Boston University (THK)
- 4:30 – 6:30 **Dinner on your own**
- 6:30 – 10:30 **No Host Social** at Buffalo Wild Wings, 211 Price's Fork Rd, Blacksburg
- 7:00 – 8:30 **Open Workshop on Use of Genetics in Bat Conservation**

Thursday 21 February 2008

8:00 – 5:00 **Registration**

8:00 – 9:30 **Invited Oral Presentations Session 2**, Moderator Eric Britzke

8:00 – 8:45 **PIT TAGS: RECENT ACTIVITIES IN THE EAST TO DEFINE THEIR POTENTIAL FOR ADDRESSING QUESTIONS OF BAT CONSERVATION**, Alan C. Hicks – New York State Dept Environmental Conservation

8:45 – 9:30 **MULTI-SCALE FACTORS INFLUENCING DETECTION, SITE OCCUPANCY AND RESOURCE USE BY FORAGING BATS**, Sybill Amelon – U.S. Forest Service

9:30 – 10:00 **Break**

10:00 – 11:30 **Invited Oral Presentations Session 3**, Moderator Eric Britzke

10:00 – 10:45 **SPRING INDIANA BAT MIGRATION TELEMETRY**, Cal Butchkoski, John Chenger, Al Hicks, and Rick Reynolds – Pennsylvania Game Commission (CB), Bat Conservation and Management, Inc. (JC), New York Department of Environmental Conservation (AH), Virginia Department of Game and Inland Fisheries (RR)

10:45 – 11:30 **USE OF STABLE ISOTOPE ANALYSIS FOR STUDY OF BAT ECOLOGY IN THE EASTERN UNITED STATES**, Eric R. Britzke, Susan C. Loeb, Maarten J. Vonhof, Chris Romanek, and Keith A. Hobson – Britzke and Associates (ERB), USDA Forest Service (SCL), Western Michigan University (MJV), Savannah River Ecology Laboratory (CR), Environment Canada Canadian Wildlife Service (KAH)

11:30 – 1:00 **Lunch**

1:00 – 2:00 **NEBWG business meeting**

2:00 – 3:00 **SBDN business meeting**

3:00 – 3:30 **Break**

3:30 – 5:00 **Poster Session**

COMPARING GLUE TYPES FOR TRANSMITTER ATTACHMENT ON EASTERN BAT SPECIES

A. L. Albus* and T. C. Carter – *Southern Illinois University of Carbondale (ALA), Ball State University (TCC)*

**DIFFERENCES IN DIVERSITY AND ABUNDANCE OF DIPTERAN FAMILIES
BETWEEN A MANAGED PINE FOREST AND A NATURAL FORESTED WETLAND
ON THE NORTH CAROLINA COASTAL PLAIN**

D. W. Allgood*, J. A. McDonough, M. A. Vindigni, A. D. Morris, M. C. Kalcounis-Rüppell and
D. A. Miller – *University of North Carolina at Greensboro (DWA, JAM, MAV, ADM, MCKR),
Weyerhaeuser Company (DAM)*

**LICHEN AND VEGETATION SURVEYS OF A DISJUNCT POPULATION OF THE
CAROLINA NORTHERN FLYING SQUIRREL
(*GLAUCOMYS SABRINUS COLORATUS*)**

N. D. Allman* and B. Collins – *Western Carolina University*

**A METHOD FOR ESTIMATING THE RELATIVE RANGES
OF BAT DETECTORS**

M. J. Clement* and S. B. Castleberry *University of Georgia*

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

L. M. Gilley* and T. L. Best – *Auburn University*

**EFFECTS OF HABITAT AND CLIMATIC VARIABLES ON AVAILABILITY OF
VOLANT BAT PREY IN VIRGINIA PIEDMONT FORESTS**

R. S. Henderson*, K. M. Womack*, and A. D. Fink – *Longwood University*

**FACTORS IMPACTING EMERGENCE TIME OF LITTLE BROWN BATS (*MYOTIS
LUCIFUGUS*) AT A MATERNITY COLONY IN CENTRAL PA**

A. F. Janicki* and C. A. Iudica – *Susquehanna University*

**A HOT SPOT FOR MAMMALIAN BIODIVERSITY:
MONROE COUNTY, TENNESSEE**

M. L. Kennedy, S. A. Dykes and R. L. Wyatt – *University of Memphis (MLK),
Tennessee Wildlife Resources Agency (SAD and RLW)*

**STRANGERS IN THE NIGHT: TRANSPORTATION PROJECTS
AND ENDANGERED BATS**

B. K. McMurray – *Missouri Department of Transportation*

**RABIES EXPOSURE AND INFECTION,
RELATIVE IMMUNE FUNCTION AND LIFE-HISTORY TRAITS
IN THE BIG BROWN BAT, *EPTESICUS FUSCUS***

M. S. Moore *, F. R. Jackson, B. J. Panasuk, M. T. Mendonça, G. F. McCracken, and T. H. Kunz
– *Boston University (MSM and THK), Centers for Disease Control & Prevention in Atlanta (FRJ
and BJP), Auburn University (MTM), University of Tennessee (GFM)*

OVERVIEW OF THE SOUTHEASTERN BAT DIVERSITY NETWORK

S. T. Murdock – *Malcolm Pirnie, Inc*

**IMPORTANCE OF PINE SNAGS AND OPEN FOREST HABITATS TO ROOSTING
MALE BIG BROWN BATS IN ARKANSAS**

R. W. Perry and R. E. Thill – *USDA Forest Service*

**STABLE ISOTOPES HIGHLIGHT COMPLEXITIES OF MIGRATORY BEHAVIOR
AND POPULATION DYNAMICS
IN BRAZILIAN FREE-TAILED BATS**

J. D. Reichard* and T. H. Kunz – *Boston University*

**ROOST SITE SELECTION BY TWO VESPERTILIONID BATS (*MYOTIS
AUSTRORIPARIUS* AND *CORYNORHINUS RAFINESQUII*) IN A NORTHEAST
LOUISIANA BOTTOMLAND HARDWOOD FOREST**

C. L. Rice and K. M. Tolson – *The University of Louisiana at Monroe*

**COOPERATION & INNOVATIVE TECHNIQUES ACCOMMODATE BOTH BAT
CONSERVATION AND STREAM RESTORATION GOALS**

K. Schultes – *USDA Forest Service*

**MIXED SPECIES SUMMER ROOSTS OF INDIANA BATS (*MYOTIS SODALIS*) AND
LITTLE BROWN BATS (*M. LUCIFUGUS*)**

T. J. Sichmeller*, T. C. Carter, and M. Hohmann – *Ball State University (TJS and TCC),
Engineering Research Development Center–Construction Engineering Research Laboratory
(MH)*

DISTRIBUTION OF SHORT-TAILED SHREWS (*BLARINA*) IN ALABAMA

J. A. White, V. A. Peterson, and A. C. Hodge – *Auburn University*

**BAT ACTIVITY AND INSECT ABUNDANCE ALONG AN ELEVATIONAL GRADIENT
UNDER DIFFERENT WEATHER CONDITIONS**

S. Wolbert*, H. P. Whidden, E. Skirta, and G. Turner – *East Stroudsburg University (S, HPW,
and ES), Pennsylvania Game Commission (GT)*

**ASSESSMENT OF METHYLMERCURY AVAILABILITY TO BATS
IN NEW YORK – 2006**

D. Yates, D. Evers, D. Braun, M. Brown, T. Divoll, J. Loukmas, A. Sauer, N. Schoch and R.
Taylor – *BioDiversity Research Institute (DY, DE, and TD), Texas A&M Trace Element Research
Lab (DB and MB), New York Department of Environmental Conservation (JL), Syracuse
University (AS), Wildlife Conservation Society (NS),
Texas A&M University (RT).*

**POST-CONSTRUCTION MONITORING OF BIRD AND BAT MORTALITY AT THE
LOCUST RIDGE WIND FARM SCHUYLKILL COUNTY, PA**

A. S. Zellner, H. P. Whidden, and G. Turner – *East Stroudsburg University (ASZ and HPW),
Pennsylvania Game Commission (GT)*

5:00 – 7:00 **Dinner on your own**

7:00 – 11:00 **Social** at Awful Arthur's Seafood Co, 211 Draper Rd. Blacksburg

7:30 – 9:00 **Open Workshop on Bats with Fungal Infections**

Friday 22 February 2008

<p>Techniques Session Moderator: Robert Currie</p>
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- 8:00 **AUTOMATED THERMAL INFRARED VIDEOGRAPHIC CENSUS TECHNIQUE FOR BATS IN FLIGHT**, B. M. Sabol, R. E. Melton, and R. R. Currie - *US Army Engineer Research and Development Center (BMS, REM), US Fish and Wildlife Service (RRC)*
- 8:15 **ASSESSING RISK TO BATS FROM WIND FACILITIES USING THE WEIGHT-OF-EVIDENCE APPROACH TO ECOLOGICAL RISK ASSESSMENT**, C. W. Meinke, T. S. Peterson, J. P. Lortie, and S. K. Pelletier - *Stantec Consulting, ME*
- 8:30 **TROPHIC PATTERNS OF AN INSECTIVOROUS BAT COMMUNITY FORATGING OVER URBAN AND PRISTINE STREAMS AS REVEALED BY STABLE ISOTOPE AND FECAL ANALYSIS**. L. A. Shiflet*, and M. C. Kalcounis-Reuppell. *Department of Biology. University of North Carolina at Greensboro. Greensboro, NC 27403*
- 8:45 **STABLE ISOTOPE ANALYSIS OF CLAWS OF SILVER-HAIRED BATS (*LASIONYCTERIS NOCTIVAGANS*) TO DETERMINE MIGRATION DISTANCE TRAVELED THROUGH ALABAMA**, S. Hirt* - *Auburn University*

<p>Bats in the Southeast Session Moderator: Mylea Bayless</p>

- 8:00 **HABITAT ASSOCIATIONS OF BATS ON REDSTONE ARSENAL, MADISON COUNTY, ALABAMA, USING MIST NET SURVEYS**, S. E. Gardner* and T. L. Best - *Auburn University*
- 8:15 **USE OF FOREST EDGES BY BATS IN A MANAGED PINE FOREST IN COASTAL NORTH CAROLINA**, A. D. Morris*, D. A. Miller, and M. C. Kalcounis-Rüppell - *University of North Carolina at Greensboro, Greensboro (ADM and MCKR), Weyerhaeuser Company (DAM)*
- 8:30 **INFLUENCE OF LANDSCAPE AND LOCAL HABITAT VARIABLES ON ACTIVITY OF BATS WITHIN MANAGED FOREST LANDSCAPES IN THE SOUTHEASTERN COASTAL PLAIN**, M. J. Bender*, S. B. Castleberry, D.A. Miller, and T. B. Wigley - *University of Georgia (MJB and SBC), Weyerhaeuser Company (DAM), National Council for Air and Stream Improvement Inc. (TBW)*
- 8:45 **DISTRIBUTION AND HABITAT RELATIONSHIPS OF RAFINESQUE'S BIG-EARED BAT IN THE COASTAL PLAIN OF GEORGIA**, M. J. Clement* and S. B. Castleberry - *University of Georgia*

9:00 **THERMAL ECOLOGY OF EASTERN RED BAT WINTER ROOSTS IN A FORESTED OZARK LANDSCAPE, J. R. Flinn*** and L. W. Robbins - *Missouri State University*

9:00 **ROOSTING AFFINITIES OF RAFINESQUE'S BIG-EARED BAT (*CORYNORHINUS RAFINESQUII*) IN BUILDING ROOSTS IN SOUTHEASTERN VIRGINIA, E. Carpenter*** - *Christopher Newport University*

9:15 **GENETIC SUBDIVISION IN AN ISOLATED POPULATION OF TREE ROOSTING BATS UNDERGOING PERMANENT GROUP FISSION, J. D. Metheny** and M. C. Kalcounis-Rüppell - *University of North Carolina at Greensboro*

9:15 **PATTERNS OF ROOST TREE USE BY *CORYNORHINUS RAFINESQUII* AND *MYOTIS AUSTRORIPARIUS* IN WESTERN TENNESSEE, B. D. Carver, J. Lawson, S. Bell, D. Dickey, K. McInnis and T. McPherson** - *Freed-Hardeman University*

9:30 **APPLICATION OF GENETIC TECHNIQUES FOR DETECTION OF PREY OF FOREST-DWELLING BATS, L. E. Dodd***, L. K. Rieske-Kinney, and M. J. Lacki - *University of Kentucky*

9:30 **INFLUENCE OF WATER SOURCE TYPE ON BAT FORAGING BEHAVIOR IN A MANAGED PINE LANDSCAPE, M. A. Vindigni***, M. C. Kalcounis-Rüppell, and D. A. Miller - *University of North Carolina at Greensboro (MAV and MCKR), Weyerhaeuser Company (DAM)*

9:45 – 10:15 **Break**

Indiana Bats Session
Moderator: Susi von Oettingen

Bat Activity/Habitat Use Session
Moderator: Marcella Kelly

10:15 **EFFECT OF TEMPERATURE AND STANDARD DEVIATION OF TEMPERATURE ON HIBERNACULA SELECTION BY INDIANA BATS (*MYOTIS SODALIS*) IN SOUTHERN ILLINOIS, B. J. Steffen, T. C. Carter,** and G. A. Feldhamer - *BHE Environmental, Inc. (BJS); Ball State University (TCC); Southern Illinois University (GAF)*

10:15 **THE INFLUENCE OF RIDGE TOP HABITAT MANIPULATIONS ON BAT ACTIVITY AND SPECIES COMPOSITION AT A PROPOSED WIND FACILITY IN SOUTH-CENTRAL PENNSYLVANIA, M. R. Schirmacher** and E. B. Arnett - *Bat Conservation International*

- 10:30 **FORAGING AND ROOSTING ECOLOGY OF INDIANA BATS (*MYOTIS SODALIS*) IN NORTH-CENTRAL NEW YORK, J. S. Johnson, S. A. Boyden, T. S. Peterson, and K. S. Watrous - Stantec Consulting, ME**
- 10:30 **BAT SURVEYS AND WIND TURBINES: GOALS AND METHODS, L.W. Robbins and J.R. Flinn - Missouri State University**
- 10:45 **LANDSCAPE CHARACTERISTICS AS THEY RELATED TO ROOST SELECTION OF INDIANA BATS IN THE LOWER HUDSON RIVER VALLEY, D. J. Newman, C. J. Herzog and A. C. Hicks - New York State Department of Environmental Conservation**
- 10:45 **DISTRIBUTION OF BAT ACTIVITY AT MTC-FORT PICKETT, BLACKSTONE, VA, M. J. St. Germain – Conservation Management Institute at Virginia Tech**
- 11:00 **BEHAVIOR AND SUMMER ROOST SELECTION BY FEMALE INDIANA BATS (*MYOTIS SODALIS*) IN NEW JERSEY, M. E. Kitchell* and L. S. Risley – US Fish and Wildlife Service (MEK), William Paterson University (MEK and LSR.)**
- 11:00 **BAT ACTIVITY AND ROOSTING AT FORT DRUM, C. A. Dobony, W. M. Ford, and A. M. Mann - Fort Drum Natural Resources Branch (CAD); USDA Forest Service (WMF); Environmental Solutions and Innovations, Inc., (AMM)**
- 11:15 **INDIANA BAT (*MYOTIS SODALIS*) ACOUSTICAL SURVEY GUIDANCE FOR THE COMMONWEALTH OF KENTUCKY, B. A. Slack, M. P. Armstrong, and E. R. Britzke - Kentucky Department of Fish & Wildlife Resources (BAS), US Fish & Wildlife Service (MPA), Britzke and Associates (ERB)**
- 11:15 **BAT COMMUNITY STRUCTURE AND FORAGING ACTIVITY PATTERNS IN A DYNAMIC LANDSCAPE MOSAIC IN CENTRAL VIRGINIA, K. M. Womack*, A. D. Fink, and S. K. Amelon - Longwood University (KMW and ADF), USDA Forest Service (SKA)**
- 11:30 **SOUTH PENN TUNNEL SPRING AND FALL INDIANA BAT MIGRATION RADIO TELEMETRY 2007, J. Chengler and C. Sanders - Bat Conservation and Management, Inc. (JC), Sanders Environmental Inc. (CS)**
- 11:30 **SUMMER BAT ACTIVITY AT WOODLAND VERNAL POOLS IN THE NORTHERN GREAT LAKES REGION, K. E. Francel - Radford University**

11:45 – 1:00 **Lunch**

Non-bat Mammals Session
Moderator: Joy O'Keefe

- 1:00 **PRELIMINARY ANALYSIS OF PRESCRIBED FIRE IMPACTS ON BURRIS TRACT, JEFFERSON NATIONAL FOREST (BLAND COUNTY, VIRGINIA),** W. T. Munsey*, K. E. Francl, and C. J. Small - *Radford University*
- 1:15 **SMALL MAMMAL ABUNDANCE AND DIVERSITY AT FORT PICKETT, VIRGINIA,** E. D. Wolf - *Virginia Tech*
- 1:45 **EXAMINING THE RELATIONSHIP OF SMALL MAMMAL COMMUNITIES AND HABITAT VARIABLES AT SELU CONSERVANCY, MONTGOMERY COUNTY, VIRGINIA,** A. Helton*, K. E. Francl, and C. J. Small - *Radford University*
- 2:00 **EFFECT OF COARSE WOODY DEBRIS MANIPULATION ON FOREST-FLOOR VERTEBRATE ABUNDANCE IN THE SOUTH CAROLINA COASTAL PLAIN,** J. C. Davis*, S. B. Castleberry, and J. C. Kilgo - *University of Georgia (JCD and SBC), USDA Forest Service (JCK)*
- 2:15 **TRAPPING STUDY OF THE ENDANGERED KEY LARGO COTTON MOUSE: PRELIMINARY TRAPPING SUMMARY,** D. Greene*, M. T. Mengak, S. B. Castleberry – *University of Georgia*
- 2:30 **DOES GLIDING WHEN PREGNANT SELECT FOR LARGER FEMALES? A TEST OF PREDICTIONS IN SOUTHERN FLYING SQUIRRELS,** T. S. Risch and H. B. Fokidis - *Arkansas State University (TSR), Arizona State University, Tempe (HBF)*
- 2:45 – 3:15 Break

Miscellaneous Mammal Session
Moderator: Bree McMurray

- 3:15 **DETERMINE THE RESPONSE OF MIGRATING BATS TO LARGE WATER BODIES: OUR FIRST DIP INTO THIS KIND OF POND,** A. C. Hicks, D. J. Newman, R. A. Holland, C. J. Herzog, M. Twiss, and C. M. Macdonald – *New York State Department of Environmental Conservation ACH, DJN, CJH), Princeton University (RAH), Ontario Ministry of Natural Resources (CMM), Peterborough ON (MT)*
- 3:30 **DISTRIBUTION AND ACTIVITY OF BATS AT LOCAL AND LANDSCAPE SCALES WITHIN A RURAL-URBAN GRADIENT,** J. B. Johnson*, J. E. Gates, and W. M. Ford - *West Virginia University (JBJ), University of Maryland Center for Environmental Science (JEG), USDA Forest Service (WMF)*
- 3:45 **PATTERNS OF ABUNDANCE, SEX RATIOS, AND RECAPTURE OF FOREST BATS DURING SUMMER IN THE OUACHITA MOUNTAINS, ARKANSAS,** R. W. Perry, R. E. Thill, and S. A. Carter - *USDA Forest Service*

4:00 **ONE-OF-A-KIND ARTIFICIAL URBAN BAT CAVE: PLANNING AND DEVELOPMENT**, B. K. McMurray - *Missouri Department of Transportation*

4:15 **Closing Remarks**

2008 MAMMAL COLLOQUIUM

INVITED ORAL PRESENTATION ABSTRACTS

IN ALPHABETICAL ORDER BY FIRST AUTHOR

MULTI-SCALE FACTORS INFLUENCING DETECTION, SITE OCCUPANCY AND RESOURCE USE BY FORAGING BATS

S. K. Amelon. *USDA Forest Service, Northern Research Station, University of Missouri, Columbia, MO 65211*

The ecological importance of bat populations and their susceptibility to decline emphasizes the need for scientifically rigorous yet economically feasible approaches to assessing bat habitat occupancy patterns, and relative abundance at multiple scales over time. Historically, many such studies have not accounted for imperfect detection probability. Because bats are difficult to detect by either capture or acoustic methods, without consideration of detection probability, inference of population trends has been problematic. We applied a maximum likelihood approach to estimate probability of site occupancy using acoustic detection data for ten species of forest bats in the Ozark Region of Missouri. We evaluated a priori hypotheses relative to both probability of detection and site occupancy using an objective model selection criterion (Akaike's Information Criteria, AIC) to rank the candidate models in terms of their ability to explain the empirical data. Estimated species-specific detection probabilities varied among species. We found support for the effects of time, ambient temperature, days since last rain, vegetative clutter, and date on detection probability. Species responded to landscape pattern at different spatial scales (2, 8, and 16 km). Habitat, patch, and landscape characteristics (i.e., terrestrial and aquatic habitat type, composition of non-forest habitat, road density, and interspersions of contrasting habitats) were important covariates in estimates of site occupancy, but these characteristics also varied among species.

ASSESSING IMPACTS OF WIND ENERGY DEVELOPMENT ON BATS: STATUS, CHALLENGES, AND OPPORTUNITIES

E. B. Arnett, and T. H. Kunz. *Bat Conservation International, Austin, TX (EBA); Boston University, Boston, MA (THK)*.

At a time of growing concern over the rising costs and long-term environmental impacts from the use of fossil fuels and nuclear energy, wind energy has become an increasingly important sector of the electrical power industry, largely because it has been promoted as being emission free and is supported by government subsidies and tax credits. However, large numbers of bats are being killed at utility-scale wind energy facilities, especially along forested ridge tops in the eastern United States. These fatalities raise important concerns about cumulative impacts of proposed wind energy development on bat populations. I will discuss our current state of knowledge on patterns of bat fatalities at wind facilities, present findings from ongoing pre-construction surveys for bats at proposed wind energy facilities and studies on the effectiveness of acoustic deterrents, and discuss challenges and opportunities for developing solutions to reduce or eliminate bat fatality at wind facilities.

USE OF STABLE ISOTOPE ANALYSIS FOR STUDY OF BAT ECOLOGY IN THE EASTERN UNITED STATES

E. R. Britzke, S. C. Loeb, M. J. Vonhof, C. Romanek, and K. A. Hobson. *Britzke and Associates, Forrest City, AR 72335 (ERB); USDA Forest Service, Southern Research Station, Clemson University, Clemson, SC 29634 (SCL); Dept. of Biological Sciences, Western Michigan University, Kalamazoo, MI 49008 (MJV); Savannah River Ecology Laboratory, Drawer E Aiken, SC 29808 (CR); Environment Canada Canadian Wildlife Service, Saskatoon, SK, Canada, S7N 0X4 (KAH).*

Information on the ecology of bats has greatly increased in recent years through the use of acoustic detectors, radio-telemetry, and genetics. Although stable isotope analysis has been used widely in the study of birds, it is only now being applied to address questions of bat ecology. Most elements exist in two isotopic forms and the ratio of the two isotopes in the animal generally reflects the ratios of the 2 isotopes in the environment. Several elements can be used in stable isotope analysis including hydrogen, oxygen, sulfur, carbon, and nitrogen. However, these elements differ in their suitability for addressing ecological questions. Ratios of hydrogen isotopes (δD) vary with latitude, thereby making this element very useful in examining migration whereas nitrogen and carbon isotopes are more useful in studying foraging behavior. Choosing a tissue to examine is also important as turnover rates vary from a couple of days (plasma) to a year (hair). Our research has shown that there is a significant relationship between latitude and δD values in the hair of *Lasiurus borealis*, *Myotis lucifugus*, *M. septentrionalis*, and *M. sodalis*, thereby supporting the applicability of this technique to determine migratory patterns of these bats. However, we have also found that there is significant intra- and inter-specific variation in these relationships. Examination of the differences in stable isotope values may provide insight into aspects of the ecology of a species that have gone undetected using other techniques. Information gained on the ecology of bats in the eastern United States through the use of stable isotope analysis will assist in future conservation efforts.

SPRING INDIANA BAT MIGRATION TELEMETRY

C. Butchkoski, J. Chenger, A. Hicks, R. Reynolds. *Pennsylvania Game Commission, 4294 Eberle Road, Petersburg, PA 16669 (CB); Bat Conservation and Management, Inc., 220 Old Stone House Road, Carlisle, PA 17013 (JC); New York Department of Environmental Conservation, 625 Broadway, Albany, NY 1223 (AH)3; Virginia Department of Game and Inland Fisheries, PO Box 996, Verona, VA 24482 (RR).*

Since the year 2000, studies have been conducted in 4 northeast region states to locate Indiana bat (*Myotis sodalis*) summer habitats by radio tagging and following bats as they exit known hibernacula in the spring. Techniques used include ground tracking with specially equipped vehicles, tracking with specially equipped aircraft, and the combination of both techniques. In New York, 6 of the largest hibernacula were studied on 7 occasions. Ninety-eight (75%) of 130 bats tracked were located at least once on a day roost, including 1 bat found with other Indiana bats in a building. All were within 68 km of their hibernacula. In New Jersey, 8 (80%) of 10 bats were successfully tracked from 2 mines resulting in finds of 8 roost sites including 1 building. All were within 27 km of the hibernacula. In Pennsylvania, 4 hibernacula were investigated on 6 occasions, the first 2 being unsuccessful. Of the 40 Pennsylvania bats radio tagged, 15 (37%) were found in 5 summer sites, including 2 roosts in Maryland which were 135 and 148 km from their hibernaculum. A Virginia project attempted to track 13 animals from 2 neighboring caves; all were lost in this first attempt. Distances tracked before Virginia telemetry subjects were lost ranged from 4 to 80 km, suggesting some long-range migration is occurring. As expected, the degree of success depends greatly on the distances bats are traveling from their hibernacula.

PIT TAGS: RECENT ACTIVITIES IN THE EAST TO DEFINE THEIR POTENTIAL FOR ADDRESSING QUESTIONS OF BAT CONSERVATION

A. C. Hicks, *New York State Dept Environmental Conservation, Albany NY*

PIT tags have the potential for addressing many of the questions of bat conservation, biology, and behavior, that were previously impractical or impossible to answer and are beginning to be used for those purposes. However, there are still issues that need to be resolved before they can be applied to their full potential. Passive Integrated Transponders or "PIT" tags are small (8–12 mm x 2mm) electronic microchips. They have no internal power source, and remain dormant until activated by the electromagnetic field of a reader, at which time they transmit a unique alpha numeric code. Appealing characteristics of PIT tags include their small size, permanent function, and their ability to be identified without having to touch the animal. Most importantly, they allow for the automated monitoring of a practically endless number of uniquely marked animals that pass within detection range of the reader. The greatest weaknesses are the short detection range (currently about 15–18 cm), and costs. Pit tags have been recently employed in a variety of studies involving summer colonies of several bat species. However, their most important conservation applications in the east probably lie in broad scale demographic studies conducted where animals are most concentrated, primarily hibernacula. We discuss work that has been conducted to date in the Eastern United States to assess how well this technology can be applied, including questions about mortality and tag retention rates, costs of application, and the detectability of marked animals both when roosting within hibernacula, and when passing through entrances.

THE APPLICATION OF GENETIC DATA TO THE STUDY AND MANAGEMENT OF BATS

M. J. Vonhof, *Dept. of Biological Sciences, Western Michigan University, Kalamazoo, MI 49008*

Genetic data can provide a powerful tool in wildlife ecology and complements behavioral, demographic and spatial data to provide new insights into the biology of bats and other organisms. However, because of the specialized terminology and techniques associated with genetic data, many field biologists and wildlife managers remain unaware of the potential utility of genetic data for informing their own research or management concerns. Here I will attempt to address this knowledge gap and review the potential contributions of molecular methods to the conservation and management of bats. I will first provide a brief overview of genetic terminology and the types of molecular markers commonly used in molecular ecological studies to measure genetic variation. Using data from the literature and my own research, I will then discuss potential applications of genetic data to questions at three different levels of biological organization: 1) individuals, including those on mating or social systems, relatedness, and parentage; 2) populations, including questions about levels of genetic differentiation among populations, the definition of management units, assessing effective population size, and insights into demographic patterns associated with the reduction and expansion of populations; and 3) species, including questions about species relationships and molecular species identification. My goal is to demonstrate that genetic data can inform our understanding of the ecology of the species we study, and provide valuable information for the management and conservation of bat populations.

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ORAL PRESENTATION ABSTRACTS

IN ALPHABETICAL ORDER BY FIRST AUTHOR

INFLUENCE OF LANDSCAPE AND LOCAL HABITAT VARIABLES ON ACTIVITY OF BATS WITHIN MANAGED FOREST LANDSCAPES IN THE SOUTHEASTERN COASTAL PLAIN

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Effective management of forest bat communities requires knowledge of how bats use forested landscapes. Previous research attempting to link foraging activity to landscape level predictors has achieved various levels of success depending upon landscape characteristics. Our objectives were to elucidate landscape-level factors that influence bat foraging activity within managed pine (*Pinus* spp.) landscapes in the southeast and evaluate competing hypotheses relating activity levels to habitat variables. During the summer of 2007, we used Anabat II bat detector systems to conduct acoustic surveys within 3 managed forest landscapes in the Coastal Plain regions of Arkansas, Georgia, and South Carolina. We sampled 84 points for at least 2 nights and calculated mean numbers of call passes recorded/night at each sample point. We used negative binomial count regression to model mean call passes/night and Akaike's Information Criterion adjusted for small samples sizes (AICc) to evaluate a candidate set of models. The best performing models within the candidate set included both local and landscape-level variables. Preliminary analyses suggest that increases in percent canopy cover resulted in decreased activity, while decreases in distances to older stands (> 31 years) increased activity. These preliminary data suggest that forest bats differentially use managed forest landscapes to the coastal plain based on both large and small scale variables.

ROOSTING AFFINITIES OF RAFINESQUE'S BIG-EARED BAT (*CORYNORHINUS RAFINESQUII*) IN BUILDING ROOSTS IN SOUTHEASTERN VIRGINIA

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There is a paucity of information regarding microclimate preferences of *C. rafinesquii*, both region-wide and in Virginia. In southeastern Virginia, all known maternity colonies roost in abandoned buildings. Over the summer, dataloggers were placed in four maternity roosts, one solitary roost, and one building not used as a roost. Temperature was recorded every hour for three months. Mean day & night temperatures, minimum day & night temperature, maximum day & night temperatures, and day & night roost to ambient temperature ratios were calculated and compared within roosts & between roosts. Roost surroundings and the potential for disturbance and predation were also noted. Microclimate results and possible implications will be discussed.

PATTERNS OF ROOST TREE USE BY *CORYNORHINUS RAFINESQUII* AND *MYOTIS AUSTRORIPARIUS* IN WESTERN TENNESSEE

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Rafinesque's big-eared bats (*Corynorhinus rafinesquii*) and southeastern myotis (*Myotis austroriparius*) are uncommon throughout their range and are listed (informally) by the U. S. Fish and Wildlife Service as species of management concern. Much of the decline in numbers of these species can be linked to a loss of bottomland hardwood forests throughout their range, resulting in a loss of natural roost structures in many areas. Very little data exist on use of natural tree roosts of these species. Our study was designed to describe patterns of day roost use by these two species. Bats were captured above water sources or at roost structures. Radio transmitters were attached to adult females of both species to aid in locating new roost structures. Thirty-three roost trees were identified, with most being large hollow water tupelos (*Nyssa aquatica*). Only four roost trees were known to be used by both species. Roost trees were checked twice weekly during the fall of 2007 for the presence of roosting bats. When possible, direct counts or estimates of the number of bats present were made. Roost trees were occupied between 0 and 79 percent of the dates they were checked. An average of forty percent of the roost trees were occupied each day, and frequent roost switching was observed. The average number of bats per roost was 9 for the Rafinesque's big-eared bat and 151 (estimated) per roost for the southeastern myotis. The results of our study suggest that the roost structures in our study area are relatively permanent, but they are likely not widely available across the landscape.

SOUTH PENN TUNNEL SPRING AND FALL INDIANA BAT MIGRATION RADIO TELEMETRY 2007

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The South Penn Tunnel (SPT) was trapped 13 nights in April capturing 735 bats representing 5 species. Thirty-eight Indiana bats (*Myotis sodalis*, "IBATs") were captured including eight female and seven males that were radio-tagged (RT) with transmitters. Of the fifteen RT IBATs, eleven were followed through migration to their summer roosting areas a maximum of 13.3 miles (21.4 kilometers) from the SPT. Migration paths and activity areas observed from dusk to dawn for the life of the transmitters are depicted in 116 individual maps. Males used 13 roost trees of no preference during the project. Females used 25 individual roosts, ten (40%) of which were shagbark hickory. No more than one bat was observed emerging from a male roost tree. Counts at seven of the female's trees were greater than one and ranged up to thirty-seven individuals indicating the presence of a maternity colony. The SPT was trapped 14 nights from September 7th through October 3rd. 1,600 bats representing 6 species were captured including 130 IBATs. Eight female and nine male IBATs were RT in order to observe their fall behaviors and home ranges. Five of the nine RT IBAT males remained in a "staging" area approximately 1 mile (1.6 kilometers) east of the SPT during the monitoring period. Four other males ventured an average of 7.7 miles (12.4 kilometers) straight-line migration. Four of the eight females immediately entered hibernation inside the SPT upon release. The four female bats that remained outside the SPT for a length of time averaged 9.9 miles (15.9 kilometers) straight-line migration to maternity areas discovered in the spring. Thirty roost areas were identified. Migration paths and activity areas observed from dusk to dawn during the monitoring period are depicted in 100 individual maps. Similar to findings from the spring, the male bats tended to forage in home areas closer to the hibernacula and were more likely to end up both roosting and foraging in hilly, forested areas and around low order streams. Females generally picked activity areas in flatter areas and foraged closer to higher order streams in lower slope agricultural terrain.

DISTRIBUTION AND HABITAT RELATIONSHIPS OF RAFINESQUE'S BIG-EARED BAT IN THE COASTAL PLAIN OF GEORGIA

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The distribution of Rafinesque's big-eared bat in the Coastal Plain of Georgia was previously described from only 20 individual records. Furthermore, habitat relationships of the species in the state were virtually

unknown. We examined distribution and habitat relationships of big-eared bats at 3 study sites along 3 major river drainages in the Coastal Plain to identify areas of potential big-eared bat habitat, determine if these areas were occupied, and examine the characteristics of summer roosts. We located roosts through a combination of tree cavity searches along randomly placed transects, *ad hoc* tree cavity searches, and radio tracking of bats captured from roosts or in mist nets. We collected quantitative data on occupied trees and randomly selected apparently unoccupied trees. We located 96 roosts and 565 bats at the 3 study areas combined. We found 68 roosts during transect searches, 6 during *ad hoc* cavity searches, and located 22 roosts by tracking 24 radiotagged bats. Three roosts were located in buildings and 93 in hollow trees. Big-eared bats most often roosted in water tupelo (*Nyssa aquatica*; n=81) or bald cypress (*Taxodium distichum*; n=5) trees. Occupied trees had a larger internal cavity volume than unoccupied trees and roosts selected by females had a significantly larger internal cavity volume than roosts selected by males. All but 3 occupied tree roosts were located in flooded areas of cypress-gum swamps. Bats likely select flooded areas because flooded areas contain more hollow trees, trees with larger cavities, and more tupelo than drier sites. Our results suggest that big-eared bats are likely distributed throughout the Georgia Coastal Plain where suitable habitat exists and that their habitat is more restricted to flooded areas than previously known.

EFFECT OF COARSE WOODY DEBRIS MANIPULATION ON FOREST-FLOOR VERTEBRATE ABUNDANCE IN THE SOUTH CAROLINA COASTAL PLAIN

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Most research assessing the importance of coarse woody debris (CWD) to forest-floor vertebrate communities has been largely observational, lacking adequate experimental control. Additionally, studies focused on the importance of CWD to forest-floor vertebrates in the southeastern Coastal Plain are lacking. In 1997 we initiated a long-term manipulative study investigating the effects of CWD ecosystem function in upland loblolly pine (*Pinus taeda*) stands at the Savannah River Site in the Coastal Plain of South Carolina. Herein, we examine small mammal and herpetofauna abundance among various levels of downed and standing CWD as the CWD approached later stages of decay. Twelve experimental plots representing four treatments in three replicate blocks were sampled. The four treatments were: (1) Removal – all CWD >10 cm in diameter removed, (2) Downed Addition – five-fold increase of downed CWD >10 cm in diameter, (3) Standing Addition/Snag – 10-fold increase in the volume of standing CWD, and (4) Control – CWD volume not affected. The Removal and Control treatments were initiated in 1997 while the Downed Addition and Standing Addition/Snag treatments were implemented in 2001. We sampled plots for 14 consecutive days during each season of 2007. Mean capture numbers for all vertebrates combined, as well as amphibians, reptiles, and rodents separately did not differ among treatments. However, shrew abundance was greater in the Downed Addition (mean=30.7 shrews) than in the Removal treatment (mean=6.7 shrews), suggesting that removal of CWD may be detrimental to soricid communities. Naturally low levels of CWD in the Coastal Plain, due to rapid decomposition, frequent fire, shorter rotations, and smaller trees, may mean that forest-floor vertebrates in this region have not evolved to rely on it as a critical habitat component. Continued sampling will take place through 2008 to further elucidate the importance of CWD to forest-floor vertebrate communities.

BAT ACTIVITY AND ROOSTING AT FORT DRUM

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As part of an Integrated Natural Resource Management Plan, Fort Drum Military Installation began bat surveys in 2003. Acoustical surveys 2003 to 2006 indicated high bat activity throughout, mostly little brown bats. Nine species were recorded, including echolocation indicative of Indiana bats. Presence was

confirmed in 2006 when radio-tagged Indiana bats from adjacent property roosted on site. Installation-wide netting was conducted in 2007 documenting 8 species. Echolocation activity was higher over open ponds and streams than vegetated wetlands and forested streams, with the exception of the northern bat, where the converse was true. Summer (May–August) activity peaked 2 – 3 hours after sunset, whereas activity in September varied throughout the night. Eighteen Indiana bats were captured in the summer of 2007. Nine reproductively active female Indiana bats were radio-tracked to 24 roosts representing 8 tree species. Distance from capture sites to roosts varied (63 m – 3.3 km), as did distances traveled among roosts by individual bats (9 – 900 m). Although roost switching occurred, bats showed high site fidelity to 4 suspected maternity roosting areas within a small part of the installation. Distances between roosting areas ranged from 1.2 – 5.8 km. Mean emergence counts of Indiana bats at roosts were 8.3 bats (range 1 – 44). In the fall of 2007, 3 Indiana bats were radio-tracked over 19 days to 29 roosts representing 5 tree species. Mean fall foraging home range was 576 ha (95% fixed kernel) with foraging activities centered on summer maternity areas.

APPLICATION OF GENETIC TECHNIQUES FOR DETECTION OF PREY OF FOREST-DWELLING BATS

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The use of genetic tools to elucidate trophic linkages has been limited in the field of bat ecology, but has become increasingly commonplace in other ecological disciplines. To compensate for the current lack of resolution in bat diet analysis, we are investigating a genetic approach that will possess greater sensitivity and enhance our ability to identify dietary components relative to traditional morphological identification of prey. If successful, this genetic technique will allow direct linkage of prey species to specific bat species. Bats captured in mist nets (2006–2008) in the Central Appalachians are the source of fecal material. We have successfully extracted DNA in bat fecal samples using commercially-available reagent kits and protocols. Using DNA primers universal for insects, we have successfully amplified insect DNA from this fecal material. Using a web-based basic local alignment and search tool (BLAST), our preliminary fecal samples most closely match existing entries for DNA sequences of Lepidoptera and Diptera. Continued progress will necessitate use of family-specific or species-specific DNA primers. More specific DNA primers will allow direct comparisons of genetic identification with morphological identification at a comparable level of resolution. This approach increases our understanding of trophic linkages in bat ecology, further enhancing stewardship efforts aimed at enhancing bat habitat.

THERMAL ECOLOGY OF EASTERN RED BAT WINTER ROOSTS IN A FORESTED OZARK LANDSCAPE

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The eastern red bat, *Lasiurus borealis*, is a migratory tree roosting species that overwinters in southern Missouri. Due to conservation concerns about winter forestry management practices, i.e. prescribed fires, research was initiated to better understand the winter habitat requirements for this species. Our objectives were to characterize the habitat structure associated with winter roosts and describe the temperature gradient available in the landscape to explore relationships between roost choice and temperature. We identified 101 roost locations for 33 radio-tagged red bats and recorded habitat variables around roost and random sites. Dataloggers were used to record temperature profiles at roost and non-roost sites. Bats roosted in trees and under the leaf litter on the forest floor. Both tree (N = 52) and leaf litter (N = 49) roosts were found on south facing slopes that were higher in elevation and steeper than random locations. When encountered in trees, bats were primarily on the south side of young oaks with persistent dead leaves that were smaller in DBH (mean = 13.7 cm) and height (mean = 9.1 m) when compared to random trees. Leaf litter roost sites were characterized by deeper leaf litter and greater percent leaf cover on the ground. Results from the temperature dataloggers suggest: 1) High-elevation, southern-facing areas have warmer

temperatures than any other area monitored, 2) The south side of trees is warmer than the north side, and 3) Leaf litter on the forest floor provides a microclimate that buffers extreme ambient temperatures. In terms of energy savings, the choice to roost in leaf-litter versus in trees may equate to the difference between life and death for eastern red bats during periods of subfreezing temperatures. Such knowledge of bat roosting strategies may be used to modify forest management practices that are more conducive to red bat winter survival.

SUMMER BAT ACTIVITY AT WOODLAND VERNAL POOLS IN THE NORTHERN GREAT LAKES REGION

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Woodland vernal pools in the northern Great Lakes region, limited in this study to northern Wisconsin and Michigan's Upper Peninsula, are potentially important sites for bat feeding and drinking. In order to determine the influence of pool size, hydroperiod, and structural complexity on relative bat activity, I surveyed pools (17 in 2004, subset of 8 in 2005 and 2006) at approximately two-week intervals throughout summer months, documenting bat species use with mist nets and AnaBat II echolocation recording systems. In 189 mist net-nights over three summers, I captured 114 individuals and identified 21591 AnaBat call sequences. Little brown bats (*Myotis lucifugus*) dominated the captures (75.4%) and AnaBat call sequences (83.3% of all identified call sequences). Northern myotis (*M. septentrionalis*) were less common (19.3% of captures, 6.4% of identified call sequences) but ubiquitous across pools. Four additional species (*Lasiurus borealis*, *Lasiurus cinereus*, *Eptesicus fuscus*, *Lasionycteris noctivagans*) were more commonly documented at larger pools. Across all years, relative bat activity (as estimated by call sequences per night) was significantly influenced by pool size (more activity at small and large pools than medium pools) and covaried with the proportion of water remaining in the pool. My study emphasizes the utility of pools of all sizes to bats, as larger-bodied bats preferentially use larger pools, while smaller-bodied *Myotis* spp. are capable of foraging at pools of all sizes. Relative activity of all species was secondarily driven by pool hydroperiod, as the number of bat call sequences per night decreased as the amount of open water declined.

HABITAT ASSOCIATIONS OF BATS ON REDSTONE ARSENAL, MADISON COUNTY, ALABAMA, USING MIST NET SURVEYS

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Recently, there has been increased investigation of the ecology of forest-dwelling bats, but limited information is known about their foraging ecology. Our objective was to determine habitat associations for species of bats that are foraging on Redstone Arsenal using data obtained by capturing bats in mist nets. These data were compared to land cover types from the National Land Cover Database at 3 spatial scales and analyzed using MANOVA and bivariate correlations. Results indicated that *Myotis grisescens* is associated with deciduous forest, *Eptesicus fuscus* is associated with mixed forest and evergreen forest, and *Perimyotis subflavus* is associated with wetlands. This study provides preliminary data for use in creating management plans for foraging habitat among southeastern species of bats. Methods used in this study may provide a time-effective and cost-efficient method of collecting and analyzing habitat data.

TRAPPING STUDY OF THE ENDANGERED KEY LARGO COTTON MOUSE: PRELIMINARY TRAPPING SUMMARY

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The Key Largo cotton mouse (*Peromyscus gossypinus allapaticola*) is an endemic, insular subspecies of the cotton mouse (*P. gossypinus*) found only on Key Largo, Florida. The Key Largo cotton mouse was listed as endangered in 1984, primarily in response to habitat loss and fragmentation from development. Although Key Largo cotton mouse populations appear relatively stable in suitable habitat, the current population status is unknown. The most recent quantitative density estimate for the Key Largo cotton mouse in 1988 was 21.2 individuals/ha across all habitats (851 ha). Previous estimates used large grids, long trapping periods, and high capture probabilities. Obtaining such data at a large scale is practically impossible for routine population monitoring due to limitations in budgets and personnel. The goal of this study was to develop a standardized methodology for reliably assessing Key Largo cotton mouse population trends given the economic and personnel constraints of the agencies conducting the field work. To achieve this goal, we evaluated a sampling method that has potential to provide a reliable and efficient monitoring of long-term trends in Key Largo cotton mouse populations. We live-trapped 3 times in 2007 using a 7 x 7 grid arrangement over 4 consecutive nights. We collected 558 individuals with 1541 total captures; a 66:34 M:F ratio. Population abundance will be estimated using capture data from the 3 sessions using Pollack's Robust Design. Analysis will include using Program Mark to determine to most efficient combination of trapping grids and trapping effort for future population estimation.

EXAMINING THE RELATIONSHIP OF SMALL MAMMAL COMMUNITIES AND HABITAT VARIABLES AT SELU CONSERVANCY, MONTGOMERY COUNTY, VIRGINIA

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In order to determine if small mammal communities were influenced by macro- and microhabitat variables, particularly invasive plant species measures, we surveyed 23 locations on Radford University's Selu Conservancy tract (156 ha) in Montgomery Co., Virginia. Using a combination of tomahawks, Sherman live traps, and snap traps (11,592 trapnights), we captured 361 unique individuals (plus 64 recaptures; 3.6% trap success) of 10 species (3.1% trap success). At each location, *Peromyscus leucopus* dominated in number of captures (76.9% of all captures). Linear and logistic stepwise regressions of mammal capture measures and 15 habitat variables revealed that invasive species measures significantly influenced our total capture success and four of the six most commonly captured mammals. Sites with a greater percent cover of *Rosa multiflora* (an invasive shrub) had greater overall capture success (likely driven by a similar positive trend with *Peromyscus leucopus*), and a lower likelihood of capturing eastern chipmunks (*Tamias striatus*). We were more likely to capture opossums (*Didelphis virginiana*) and less likely to capture eastern chipmunks and raccoons (*Procyon lotor*) at sites with a higher density of honeysuckle (*Lonicera* spp.). Other habitat variables (soil moisture, downed log density, tree density, canopy cover) affected capture success or presence/absence on a species-specific basis. We suggest that invasive plant species' presence, relative dominance, or structural qualities can positively or negatively affect small mammal communities, the extent and direction likely depending upon species-specific habitat needs.

DETERMINING THE RESPONSE OF MIGRATING BATS TO LARGE WATER BODIES: OUR FIRST DIP INTO THIS KIND OF POND

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Wildlife managers and regulators are increasingly being forced to make decisions regarding the placement of wind facilities without a clear understanding of the risks they present to migrating tree bats. This is especially true in the high wind areas associated with the Great Lakes, and other large water bodies. This project was an initial effort to determine how fall migrating bats respond both to the barrier presented by large water bodies, and to land forms that could reduce the size of those barriers. The study was conducted on Long Point, a peninsula on the north shore of Lake Erie, which shortens the open water distances to the south shore from 68 km to as little as 37 km. Between August 30 and September 1, 2007 we released and

radio tracked 13 silver-haired bats (*Lasionycteris noctivagans*), and one hoary bat (*Lasiurus cinereus*), from the base of Long Point. The results were clearly biased by both the methodologies, and by their implementation, and may not represent normal bat movements. Of the 12 we could track, 1 animal clearly crossed the lake without taking advantage of the peninsula, while 4 others were last detected heading towards the peninsula tip. Seven others apparently returned to the mainland. To our knowledge this, and a concurrent project in Pennsylvania that was conducted over land, were the first large scale attempts to track migrating tree bats. We discuss the problems that affected our results, and how to avoid them in the future.

**STABLE ISOTOPE ANALYSIS OF CLAWS OF SILVER-HAIRED BATS
(*LASIONYCTERIS NOCTIVAGANS*) TO DETERMINE
MIGRATION DISTANCE TRAVELED THROUGH ALABAMA**

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We caught 21 silver-haired bats (*Lasionycteris noctivagans*) and used oxygen and hydrogen signatures in their claws to estimate their nearest probable migratory location. We mist netted for five consecutive weekends starting the 28th of September, 2007 in Jackson County, Alabama in two locations. Silver-haired bats as well as two hoary bats (*Lasiurus cinereus*) and two big brown bats (*Eptesicus fuscus*) were preserved as museum specimens and then claws were removed, cleaned with a 2:1 methanol: chloroform solution, and dried in a 40° C drying oven. Claws were then prepared and sent to the Cornell University stable isotope laboratory. The average value of the claws for silver-haired bats was δD -87.07 with a standard deviation of 14.67 and a $\delta^{18}O$ value of 10.42 with a standard deviation of 1.57. We then used GIS stable isotope maps from Bowen et al. 2005 and Meehan et al. 2004 to determine the nearest probable location for both average and independent values.

FORAGING AND ROOSTING ECOLOGY OF INDIANA BATS (*MYOTIS SODALIS*) IN NORTH-CENTRAL NEW YORK

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Few data exist on foraging and roosting ecology of Indiana bats (*Myotis sodalis*) in the northeastern United States. Our primary objective was to characterize summer foraging and roosting habitats in north-central New York using radiotelemetry. Five male and 12 female Indiana bats were captured and fitted with radiotransmitters between May and August 2007. Bats were tracked to their day-roosts each day, and nighttime locations were triangulated from sunset to approximately midnight on 2–4 evenings. Fourteen Indiana bats were tracked to 38 unique day-roosts. Transmitter malfunction and denied land-access prevented three bats from being tracked regularly. Nineteen snag- and stand-level habitat measurements were taken at day-roosts and compared to measurements from 25 randomly located snags. Four measurements differed significantly ($P < 0.05$) between roosts and random snags. Day-roosts were taller and extended further above the surrounding canopy than random snags, and were located in stands with higher basal area of snags ≥ 10 cm dbh, as well as basal area of snags ≥ 25 cm dbh. A landscape-level analysis is currently underway. At least 20 telemetry locations were obtained for four males and eight females; data from these bats were used to generate home range estimates and nighttime habitat use. Male home range estimates ranged from 48.2–234.0 ha ($\bar{x} = 120.2 \pm 44.1$ ha) and female estimates ranged from 35.3–1651.8 ha ($\bar{x} = 452.3 \pm 186.2$ ha). Second-order habitat analysis showed bats established home ranges closer to forest stands and farthest from open water and wetlands. Third-order habitat analysis showed estimated locations within home ranges were closest to forest stands and farthest from fields and agricultural areas. These data highlight the importance of consideration of spatial scales in foraging studies and the importance of snag density to roosting habitat.

DISTRIBUTION AND ACTIVITY OF BATS AT LOCAL AND LANDSCAPE SCALES WITHIN A RURAL-URBAN GRADIENT

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Bat population declines have been attributed to a variety of human actions including hibernacula and maternity roost disturbance, environmental degradation from contaminants and land use changes. In particular, disturbances such as deforestation followed by urbanization can cause bat distributions to shift according to these local- and landscape-scale changes. However, natural factors such as proximity to hibernacula also may impact bat distributions of cavernicolous species more than the effects of human-induced changes to the landscape. We examined the relationship between urbanization and extent of forest cover on bat activity levels and species composition in the National Park Service, National Capital Region (NCR) Parks. We inventoried bats within 11 NCR Parks in Maryland, Virginia, West Virginia, and Washington, D.C. during 2003–2005, using mist nets and acoustical detectors. We captured 383 bats and identified 6,380 echolocation passes representing 6 species: big brown bats (*Eptesicus fuscus*), eastern red bats (*Lasiurus borealis*), hoary bats (*L. cinereus*), little brown myotis (*Myotis lucifugus*), northern myotis (*M. septentrionalis*), and eastern pipistrelles (*Pipistrellus subflavus*). Overall bat activity and species-specific activity was affected to a greater extent by forest fragmentation than by urbanization. Big brown bats were the most ubiquitous and probably the most abundant species in NCR Parks, particularly in forested, urban parks. Little brown myotis and northern myotis were more common in forested, rural parks in the mountainous landscapes of the Ridge and Valley and Blue Ridge than to the east in the Piedmont and Coastal Plain. Northern myotis, and to a lesser extent, little brown myotis, were uncommon in less forested urban parks, reflecting the lesser amount of forest cover and/or the consequence of distance to hibernacula. Retention of larger residual forest tracts will be beneficial to most bat species as urbanization continues to expand in the NCR Parks region.

BEHAVIOR AND SUMMER ROOST SELECTION BY FEMALE INDIANA BATS (*MYOTIS SODALIS*) IN NEW JERSEY

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Many studies have examined the summer roosting ecology of the federally endangered Indiana bat (*Myotis sodalis*), yet few have occurred in the northeast where populations have increased significantly over the last 40 years. This study's primary goal was to identify and characterize roosts selected by reproductively active females in and around Great Swamp NWR (Basking Ridge, NJ), and to observe behavior such as colony size, roost fidelity and animal movements. Transmitters were placed on 24 female Indiana bats between 2006 and 2007: 3 early season non-reproductive, 3 pregnant, 12 lactating and 6 post-lactating. Bats were tracked until transmitters fell off or until the signal went undetected in the study area for 4 days. The characteristics of roost trees and their surrounding habitat (0.1 ha) were measured, and emergence counts were conducted at all 2007 trees containing transmitted bats. Seventy-four roost trees of 8 species were identified, the most common being American elm, red maple, shagbark hickory and pin oak. Fifty of 74 roosts were dead (67.6%); 10 (13.5%) were declining; and 14 (18.9%) were alive. The average dbh of roost trees was 41.3cm (\pm 1.87 se), and the average height was 19.5m (\pm 0.90 se); the amount of bark remaining, bark exfoliating and canopy closure were highly variable. Two-thirds of plots contained less than 30% shrub coverage and had few saplings. Roost switching occurred on average once every 1.79 days, and the average distance between consecutive roosts was 649m (\pm 144.5 se.) Peak emergence counts at 4 primary trees were 252, 164, 52 and 55 bats, which may indicate population size in as many as 4 colonies. This study indicates that roost selection by Indiana bats in NJ is similar to previous studies; yet low roost fidelity here raises questions about fidelity in habitats with abundant suitable roosts.

ONE-OF-A-KIND ARTIFICIAL URBAN BAT CAVE: PLANNING AND DEVELOPMENT

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The opportunity to create artificial bat habitat in the city of St. Louis, Missouri may become a reality over the next 18 months. The Missouri Department of Transportation (MoDOT) is leading an effort to promote the development of a cold chamber, or an urban bat cave, in Forest Park under Interstate 64/Highway 40 inside St. Louis city limits. Combined with the current plan to upgrade I64/40 through the Forest Park area, an existing pedestrian underpass will be closed and a new pedestrian walkway constructed in a different location. A proposal was brought to MoDOT to consider leaving the existing structure, which is basically a box culvert that conveys people instead of water, in place and converting it to bat habitat. The idea to develop what is being termed the "Bat Tunnel" was suggested to the MoDOT endangered species biologists in the late spring of 2007. In the fall of 2007 this idea started taking shape and gaining momentum. The prospect of recycling an old transportation feature into a new bat habitat is drawing a lot of attention from natural resource partners. This project has a lot of potential from an urban environmental stewardship and educational outreach standpoint. Currently, we are organizing meetings with stakeholders to determine the eventual Steward of this project and to finalize design plans for creating the Bat Tunnel. This has been a lesson in developing partnerships between natural resource groups and a transportation agency for the benefit of bats and outreach education.

ASSESSING RISK TO BATS FROM WIND FACILITIES USING THE WEIGHT-OF-EVIDENCE APPROACH TO ECOLOGICAL RISK ASSESSMENT

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Acoustic monitoring and mist-netting surveys are commonly recommended by federal and state agencies to assess potential risk to bat communities from wind energy development during the pre-construction phase. However, to date no published studies have linked pre-construction results with post-construction fatalities. Despite guidance documents developed by regulatory agencies and scientists to date, there exist

no reliable methods to extrapolate findings from these commonly used pre-construction surveys to accurately assess risk. Consequently, regulators charged with the responsibility of making permitting decisions regarding land management have to rely on sources of information that have inherent uncertainty. In light of these challenges, we demonstrate how a weight-of-evidence (WOE) approach to conducting an ecological risk assessment can provide a framework for systematic analysis and standardized documentation that stakeholders can use to support informed judgments about the likelihood of risk. We present a hypothetical case study that used the WOE method to simultaneously evaluate multiple lines of evidence pertaining to a specific population of bats. Data used in the assessment were derived from literature review and site-specific acoustic, mist-netting, hibernacula, and habitat surveys. Professional judgment, scientific knowledge, and technical expertise were used to evaluate strengths and weaknesses of each assessment method and to assign a level of confidence to each assessment of risk. The level of concurrence among risk assessments for each method was then used to evaluate whether the overall evidence indicated a risk of harm to bats. In this manner, the WOE evaluation procedure integrated disparate assessment methods into a cohesive framework that facilitates interpretation of the results. We demonstrate how the WOE procedure can be used to promote transparency that can facilitate collaboration among wind developers, regulators, and scientists to better understand the potential impacts posed to bats by wind facilities.

GENETIC SUBDIVISION IN AN ISOLATED POPULATION OF TREE-ROOSTING BATS UNDERGOING PERMANENT GROUP FISSION

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In Cypress Hills Interprovincial Park, Saskatchewan, tree-roosting big brown bats (*Eptesicus fuscus*) exhibit fission-fusion roosting behavior. During long-term studies, bats have been monitored with radio-telemetry and with antennas placed around cavity openings which detect transponder codes. Four non-overlapping roosting areas were identified (RA1-RA4) that each have a resident colony of adult female bats. About 30 bats are resident to RA1 and return to RA1 within and between seasons. These bats switch roost trees and potentially roost-mates about every two days. In RA1, roosting associations between pairs of *E. fuscus* are nonrandom and not based on genetic relationships. During 2004-2006, a subset of females previously resident to RA1 permanently moved to RA4. Here we take advantage of recent permanent group fission to determine if genetic relationships influence roost area selection in female tree-roosting *E. fuscus*. First, we determined the kin composition of newly formed colonies (RA1* & RA4). Second, we compared genetic subdivision among established and newly formed colonies. Genetic relationships and genetic subdivision were inferred from nine microsatellite loci and from a segment of the mitochondrial DNA control region. We found that bats in RA4 had higher average relatedness than expected ($r = 0.024$, $p < 0.05$), while average relatedness in RA1* was low ($r = -0.065$). We found that bats belonging to matrilineages with high average relatedness generally all moved to RA4 while bats belonging to less closely related matrilineages were split between RA1* and RA4. We observed no nuclear genetic subdivision. Maternal genetic subdivision was observed between RA1* and RA2 ($\Phi_{st} = 0.097$), RA4 and RA2 ($\Phi_{st} = 0.384$), and RA1 and RA2 ($\Phi_{st} = 0.145$). These results suggest that individuals move to new roost areas preferentially with kin, which is surprising given that daily roosting preferences within one roost area are not associated with genetic relationships.

USE OF FOREST EDGES BY BATS IN A MANAGED PINE FOREST IN COASTAL NORTH CAROLINA

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Insectivorous bats are primary components of the nocturnal pine forest food web in the southeastern US. Our objective was to investigate foraging behavior of bats within an intensively managed pine landscape in coastal North Carolina. The intensively managed pine forest landscape is characterized by a mosaic-patterning of forest patches and the resulting forest edges. We sampled bat activity, bat foraging activity, and insect distribution in four structurally distinct forest types (young open-canopy pine, pre-thinned pine, thinned pine, and unmanaged forest) and along forest edges during the summers of 2006 and 2007. At each sampling site, from dusk until dawn, we recorded echolocation calls of bats using two Pettersson D240X bat detectors (one heterodyne mode and one time-expanded mode) with digital recorders. At each site, we indexed the insect community using passive malaise insect traps. Mist netting was used to capture bats and obtain reference echolocation calls. We used regression models to describe bat foraging behavior using forest stand types, forest edges, and insect distribution as predictors. Forest edges and stand types were more useful predictors of bat activity than the distributions of insects. We found a species-specific edge effect on bat foraging behavior. Edges provide important foraging habitat for six aerial-foraging bat species, whereas stand interiors are more important to clutter-tolerant *Myotis* species. Since bat species have different foraging strategies, a diversity of stand types and forest edges may provide suitable foraging habitat for the assemblage of bat species in the North Carolina coastal plain.

PRELIMINARY ANALYSIS OF PRESCRIBED FIRE IMPACTS ON BURRIS TRACT, JEFFERSON NATIONAL FOREST (BLAND COUNTY, VIRGINIA)

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In an effort to begin a long-term study on the impacts of prescribed fire on plant and animal communities on the Jefferson National Forest, we surveyed the 97-ha Burris Tract (Bland County, Virginia) in summer 2007. Using a combination of tomahawks, Sherman live traps, and snap traps (5040 trapnights) at 10 sites (Sites 1–5 burned in March 2007, Sites 6–10 burned 2002–2004), we captured 133 individuals (2.6% trap success) of seven species. At each location, *Peromyscus leucopus* was the most commonly captured species (*Peromyscus* spp.: 82% of all captures), but *Blarina brevicauda* also was present at 9 of 10 sites. An examination of mammal capture measures and 14 habitat structural measures revealed few, if any, species-specific trends. When comparing recently burned sites to older burn sites, the only variable that differed significantly between the groups was soil moisture, which was higher at the older burn sites. Unique animal captures (golden mice [*Ochrotomys nuttali*], two species of jumping mice) and unexpected vegetative finds (American chestnut [*Castanea dentata*], eight invasive plant species) also will be discussed. Additional species-specific vegetative trends and projected long-term fire effects will be presented in light of recent analyses.

LANDSCAPE CHARACTERISTICS AS THEY RELATED TO ROOST SELECTION OF INDIANA BATS IN THE LOWER HUDSON RIVER VALLEY

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Due to development pressure in the Lower Hudson River Valley there is an immediate need to determine the essential landscape characteristics used by the endangered Indiana bat on its summer range. Our goals were to identify what if any landscape level factors influence the location of maternity colonies in the

Lower Hudson River Valley. Ninety-six roost tree locations from three seasons of spring tracking (42 different bats) were used along with easily accessible GIS layers. These GIS layers included: elevation, land cover, water resources including regulatory wetlands, transportation (roads), and aerial photography. At the broad landscape level (100 km circular buffer from the Williams Lake Mine complex) we compared the elevation of the known roost to random points on the landscape and determined that roosts were significantly lower in elevation than random points ($p < 0.01$) with the highest known roost being 276 meter above sea level (306m is highest known roost in the state). Minimum convex polygons were created around two clusters of known roost trees ($n > 35$) and land cover was compared between the roost polygons and the area surrounding the polygons with little difference found. A more focused analysis of the roost trees east of the Hudson River was conducted with no significant differences found between random points and known roost when looking at distance to roads, distance to water resources, or number of buildings within 400 meters, although roost tended to be closer to water resources and have fewer buildings within 400 meters. Generalizations that can be made from this work is that Indiana bats from the Williams Lake Mine complex summer in areas below ~300m, away from urban centers, and within 350 meters of a water resource. Future studies should look at land cover within home ranges and use finer scale land cover maps.

PATTERNS OF ABUNDANCE, SEX RATIOS, AND RECAPTURE OF FOREST BATS DURING SUMMER IN THE OUACHITA MOUNTAINS, ARKANSAS

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We quantified weekly relative abundance and sex ratios and determined recapture rates for 8 species of bat during 7 years of extensive mist netting in a forested landscape to provide insight on large-scale patterns in abundance. These data have implications for seasonal distributions, migration, site fidelity, and demography. Red bats, evening bats, northern long-eared bats, and eastern pipistrelles showed a distinct peak in abundance in early-mid August. Red bats were the most abundant species captured (79% of total captures) and overall abundance was up to 35 times greater in August and September than the rest of summer. Big brown bats were the least often captured species. Relative abundance of hoary bats showed peaks in early and late summer, but were relatively low in mid summer. Silver-haired bats were abundant in early summer, present in late summer, but were absent during mid summer. Sex ratios of red bats were skewed toward males in early and late summer, but were dominated by females in mid summer. Sex ratios of red bats, pipistrelles, and hoary bats were similar (approximately 65% male), and sex ratios of evening bats, Seminole bats, and big brown bats were almost exclusively male. Capture rates of northern long-eared bats were mostly (55%) female. Evening bats were the most often recaptured bats (13% recapture rate), and recapture rate for all species combined was 4.2%. We recaptured some individual red bats, Seminole bats, pipistrelles, northern long-eared bats, and evening bats in multiple years, suggesting they are either year-round residents or return to the same areas each summer. Our results demonstrate that both relative abundance and sex ratios of forest bats derived via mist netting are contingent on the period of summer in which surveys are conducted and surveys conducted during a portion of the summer may not represent abundance of a species throughout summer.

DOES GLIDING WHEN PREGNANT SELECT FOR LARGER FEMALES? A TEST OF PREDICTIONS IN SOUTHERN FLYING SQUIRRELS

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Gliding imposes unique constraints on the interaction of body mass and structural size, particular with reference to minimizing wing loading. Females of gliding animals are especially susceptible to increases in wing loading during pregnancy or gravidity, and selection may favour increased structural size to compensate for this added mass. We tested whether pregnancy in female southern flying squirrels (*Glaucomys volans*) resulted in similar wing loading to males, and whether females with less wing loading

bore heavier litters, than heavily loaded females. Males always had greater wing-loads than females, however the slope of the linear relationship between planar surface area and body mass was similar between pregnant females and males. Contrary to our prediction, females with greater wing loading had heavier litters than those with lower wing loading. Intersexual comparisons suggest female flying squirrels may optimise their litter mass to minimize wing loading during pregnancy. As females with greater wing loading bore heavier litters this suggests reproductive output may be constrained by other ecological factors. More research may reveal a trade-off between wing loading and reproductive output in species with unique locomotory modes.

BAT SURVEYS AND WIND TURBINES: GOALS AND METHODS

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Previous and on-going preconstruction surveys have focused on overall and species group bat activity at meteorological towers or at locations where individual turbines will be constructed. These studies have correlated activity with height, weather, and season. The goal has been to determine if these data can be correlated with mortality once the turbines are active. However, studies have also shown that the species composition and relative abundance of the species killed at these turbine sites may not correlate with the preconstruction data. Some species seem more susceptible while other species known to be present seldom, if ever are represented in the mortality data. Overall mortality data from across North America indicate that geographic location and habitat variables may contribute to overall and species specific mortality estimates. We suggest that preconstruction surveys include total activity and activity of individual species relative to habitat variables, weather variables, and season. Preconstruction survey data from locations in Missouri where Indiana bats are of concern will be presented.

AUTOMATED THERMAL INFRARED VIDEOGRAPHIC CENSUS TECHNIQUE FOR BATS IN FLIGHT

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To improve accuracy of census data to evaluate gray bat population trends, we have developed a thermal infrared videographic technique, involving automated digital image processing, to detect, track, and count bats in flight. Initial testing and validation of the technique was performed by recording evening emergences of several thousand Southeastern bats (*Myotis austroriparius*) from local abandoned cisterns. Subsequently, more rigorous testing was performed at gray bat (*Myotis grisescens*) maternity caves throughout the southeastern US. The automated counts were compared with simultaneous counts generated by qualified human observers at numerous caves – some containing in excess of several hundred thousand bats. During this test series we also compared thermal imagers with several low-cost camera types, including light-intensifiers and near-infrared illuminated camcorders. We subsequently finalized development of this methodology including recommending specified hardware, freezing software development, preparing user manuals, and developing training classes. In this presentation we review the procedure, summarize results of development efforts, and describe the final system and its use.

THE INFLUENCE OF RIDGE TOP HABITAT MANIPULATIONS ON BAT ACTIVITY AND SPECIES COMPOSITION AT A PROPOSED WIND FACILITY IN SOUTH-CENTRAL PENNSYLVANIA

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As part of ongoing research at a proposed wind facility in south-central Pennsylvania, we examined bat activity and species composition at sites before and after the manipulation of a forested ridge top. Our objective was to determine if habitat manipulation at this wind facility would affect bat activity and

species-specific habitat use. We surveyed our sites using Anabat II bat detectors sampling at 1.5m, 22m, and/or 44m for two years prior to and one year after the habitat manipulation. Preliminary results suggest a significant increase in bat activity. Habitat changes that may have contributed to increase bat activity include the creation of forest gaps, linear features such as roads, and temporary water sources as part of the construction of the 23 turbine wind facility. This study may give insight into the hypothesis that habitat manipulation associated with forested ridge tops in the central Appalachian may contribute to the high fatality rates of bats at wind facilities in this region.

TROPHIC PATTERNS OF AN INSECTIVOROUS BAT COMMUNITY FORAGING OVER URBAN AND PRISTINE STREAMS AS REVEALED BY STABLE ISOTOPE AND FECAL ANALYSIS

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The North Buffalo Creek wastewater treatment plant (WWTP) has a demonstrated impact on basal stream components and the foraging activity of common bat species in the watershed. I examined trophic patterns of common bat species upstream and downstream of the WWTP and in the relatively pristine Uwharrie National Forest. I used stable isotopes and fecal analysis to examine trophic positions and diets of bat species at these sites. Bat species in the Uwharrie National Forest had distinct $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ signals whereas these isotope signals converged among bat species along North Buffalo Creek. Fecal analysis showed that in the Uwharrie National Forest diets of bats differed among the species whereas diets were similar along North Buffalo Creek. Bi-plots of $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ for bats and insects support fecal analyses. In the Piedmont of North Carolina, the unique trophic roles of particular bat species are lost along North Buffalo Creek.

INDIANA BAT (*MYOTIS SODALIS*) ACOUSTICAL SURVEY GUIDANCE FOR THE COMMONWEALTH OF KENTUCKY

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In recent years, the Kentucky Field Office (KFO) of the U.S. Fish and Wildlife Service (USFWS) has reviewed hundreds of Indiana Bat summer and winter survey results for development projects and other activities in Kentucky. In reviewing these survey results, it became evident the survey guidance could be improved three ways: improve the accuracy of the survey data and results; use improved survey methodologies and technologies; and provide survey protocols for potential hibernacula. During the review of survey data and results, some results were determined to be insufficient, invalid, or of poor quality due to a variety of factors. It became apparent that consistent, statewide guidance on how, where, and when to conduct Indiana bat summer and winter habitat surveys was needed and that the guidance should be sufficiently detailed to control these types of data collection or survey errors. It is also well documented that Indiana bats, even when known to be present, are difficult to capture using currently accepted mist netting survey techniques. In response to this limitation, the KFO and KDFWR developed acoustical sampling survey guidance. Based on recent studies which have tested the efficacy of both methods, the combination of mist netting and acoustical sampling has shown to be the most effective means of determining bat species composition in an area.

DISTRIBUTION OF BAT ACTIVITY AT MTC-FORT PICKETT, BLACKSTONE, VA

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Bat activity was assessed at MTC Fort Pickett using Anabat II CF ZCAIM acoustical detectors and supplemented with captures by mist nets and harp traps to determine habitat use patterns. Physiognomic habitat types (6) were stratified and passively sampled (n=87) from 15 May – 15 September 2006 & 2007.

A standardized Acoustical Activity Index (AI) was used for all acoustical monitoring, resulting in a percent of total activity. I recorded 11 species and captured 7. The species recorded, from highest to lowest AI, were as follows: *Lasiurus intermedius* (northern yellow bat) 0% captures, 27.4% AI, was most likely to occur over open wetlands and within developed areas and least likely in areas with no apparent flyway; *Perimyotis subflavus* (eastern pipistrelle) 13.9% captures, 16.3% AI, occurred over open water and least likely where there was no flyway; *Myotis lucifugus* (little brown myotis) 1.4% captures, 13.6% AI, mostly over open water and within developed areas and least likely where there was no flyway; *Lasiurus borealis* (eastern red bat) 33.3% captures, 11.5% AI, predominantly over open water and within developed areas; *Nycticeius humeralis* (evening bat), 5.6% captures, 10.6% AI, mostly over open water and within developed areas; *Myotis septentrionalis* (northern myotis) 8.3% captures, 10.2% AI, with most detections occurred over open water; *Eptesicus fuscus* (big brown bat) 36.1% captures, 5.0% AI, mostly along roadways and open regions within developed areas; *Corynorhinus species* (big-eared bat Virginia & Rafenesquii), 0% captures, 0.8% AI, within open regions of developed areas; *Lasiurus cinereus* (hoary bat) 1.4% captures, 0.01% AI; *Lasionycteris noctivagans* (silver-haired bat) 0% captures, 0.01% AI, along stream corridors. This species migrates and most activity recorded was during the winter months (not discussed). In addition, calls believed to be representative of *Myotis sodalis* (Indiana myotis), 4.5% AI, were recorded mostly over open wetlands, but individuals were never captured. Because of call overlap with other *Myotis* species this identification is still under investigation.

EFFECT OF TEMPERATURE AND STANDARD DEVIATION OF TEMPERATURE ON HIBERNACULA SELECTION BY INDIANA BATS (*MYOTIS SODALIS*) IN SOUTHERN ILLINOIS

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Southern Illinois is home to a series of abandoned silica mines. Seven of these mines are used as hibernacula by a combined 40,000+ federally endangered Indiana bats. From 2003–2006, 35 Hobo H8 ProSeries Dataloggers were deployed in 16 different mines and were set to record temperature and relative humidity every four hours. Of these loggers, 14 were placed near hibernating clusters of Indiana bats, and 21 were placed in locations where there were no Indiana bats. Temperature data was then averaged for three separate time periods: winter (December – February); spring (March – April); and fall (October – November). Additionally, the standard deviation was also calculated for the above periods. The data are very complex and interpretation is challenging. Many of the data loggers were deployed over multiple years, and some of the natural variation in long-term weather patterns is reflected in the standard deviations, and even the average temperatures. However, the data does illustrate three things. One, temperatures were lower and more stable at locations where hibernating Indiana bats were found. Two, Indiana bats can, and do, successfully hibernate at temperatures outside of the ideal 3–6°C temperature range. And third, Indiana bats seem to be able to withstand a greater amount of temperature variability during the hibernation period than previously thought. It appears as if the bats are choosing either ideal temperatures that are somewhat variable or warmer but stable temperatures. If a hibernaculum is within the ideal temperature range, then some temperature variability is tolerable. Conversely, if temperatures are very stable, then perhaps temperatures that are outside of the “ideal” range will allow for successful hibernation.

INFLUENCE OF WATER SOURCE TYPE ON BAT FORAGING BEHAVIOR IN A MANAGED PINE LANDSCAPE

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Bats forage over large, calm, open water presumably because of high insect abundance, decreased flight obstacles, and low echolocation interference. Southeastern pine plantations are economically important and

responsible for 60% of the United States timber production. Heliponds and manmade drainage ditches are a primary landscape feature of plantations in coastal North Carolina. We determined how different water sources bat foraging behavior in an intensively managed loblolly pine forest and an adjacent natural forested wetland in eastern North Carolina. We used mist nets, remote acoustic sampling (full spectrum Pettersson D240x detectors), and passive insect traps (Emergence and Malaise) to collect data on bat community structure, foraging activity, diet, and insect community structure through the night. We analyzed echolocation call sequences to determine bat species presence and foraging activity. We identified all insects to Order. We sampled at 5 heliponds, 10 interior ditches, 15 edge ditches, and 4 natural wetland sites. Natural wetlands and heliponds supported a greater abundance of total insects than ditches. All bat species were recorded at all water sources. *Myotis* spp. were predominant over interior ditches, while other species were predominant over heliponds. Total bat activity was greatest at heliponds and lowest at natural wetlands. The proportion of time bats spent foraging was greater at natural forested wetlands and heliponds as compared to ditches. Results suggest that bat abundance and activity varies by species with water source type and insect abundance. Heliponds were suggested to be an important source of water and insect prey for bats within this landscape.

SMALL MAMMAL ABUNDANCE AND DIVERSITY AT FORT PICKETT, VIRGINIA

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Military training lands are typically comprised of a variety of habitat types that, in addition to providing a diverse training environment, also provides a diverse environment for a host of wildlife species. Small mammals often make up the dominant component of the animal biomass of an area, and so are important components of terrestrial ecosystems. We used a combination of box traps and pitfall traps to sample small mammal populations in deciduous forested areas, coniferous forested areas, and non-forested/grassland habitat types on Fort Pickett Maneuver Training Center in southeastern Virginia in a preliminary effort to document small mammal populations on the installation. We captured 459 individuals representing 12 species during the course of 6700 trap nights overall. We examine species richness, diversity, and relative abundance by season and by habitat type. Some areas of the installation are subjected to frequent fires as the result of the live rounds and artillery used during training so we also looked at characteristics of the small mammal populations that occur in these areas as compared to those that occur in areas of lower fire disturbance.

BAT COMMUNITY STRUCTURE AND FORAGING ACTIVITY PATTERNS IN A DYNAMIC LANDSCAPE MOSAIC IN CENTRAL VIRGINIA

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Forests of the southeastern U.S. are changing rapidly in species composition and extent of forest cover due to increasing conversion to pine (*Pinus* sp.) plantations, intensifying management practices, and expanding urbanization and sprawl. Questions related to the impacts of these changes on wildlife species are of great conservation interest and management relevance. Highly mobile species with large home ranges and complex habitat requirements, such as bats, may be especially vulnerable to increasing human modification of landscapes. However, the impacts of such modifications on bat species are poorly understood. We sought to evaluate bat community structure and foraging activity in regenerating managed pine and mixed hardwood systems in the central Virginia Piedmont. We conducted this research in the Appomattox–Buckingham State Forest in June–August 2006 and May–August 2007. We sampled sites in both hardwood and managed pine systems across a range of ages and management strategies. In each site we established a sampling array consisting of a bat detector and an associated insect sampling location. We assessed bat activity (1800 to 0700 hours) with Anabat II bat detector systems, calculated mean bat passes per hour, and identified calls to genus or species. We collected and analyzed insect samples and assessed vegetation attributes using standard procedures. To understand factors affecting bat activity, we used an Information

Theoretic approach to evaluate support for a suite of *a priori* models that included measures of habitat attributes, climate conditions, and prey availability. In this on-going work, our goals are to understand bat activity patterns and habitat use in actively managed forest landscapes and to provide data to inform conservation and management decisions.

2008 MAMMAL COLLOQUIUM

POSTER SESSION ABSTRACTS

IN ALPHABETICAL ORDER BY FIRST AUTHOR

COMPARING GLUE TYPES FOR TRANSMITTER ATTACHMENT ON EASTERN BAT SPECIES

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Radio transmitters are a valuable tool used in bat studies around the world species. Though there are varying methods for attaching the transmitters, a common method is to glue the transmitter between the scapula with a surgical adhesive. However in the last year or so the manufacturer of the most popular surgical adhesive (Skinbond) has changed its formulation. The new formula behaves significantly different and some researchers are less than pleased with its performance. Our objective is to evaluate the currently available surgical adhesives to determine their performance for attaching radio transmitters to bats. The three glues tested include the original formula of Skinbond and the new formula of Skinbond as well as Torbot brand adhesive. In the field, we placed transmitters on three species of *Myotis* found in southern Indiana and northern Kentucky. We placed transmitters on them using the three different types of glue. We documented the length of time each transmitter stayed on the bats as determined by how many days we were able to follow them. Additionally in the lab, we tested the application and drying characteristics and holding strength of each glue. Data from the field portion of the study suggest that the old Skinbond is the best, however the new Skinbond and Torbot were comparable in transmitter retention time. Lab tests suggest that the new formula of Skinbond has the strongest holding ability. While old Skinbond has the longest working time and retains its stickiness for the greatest period of time.

DIFFERENCES IN DIVERSITY AND ABUNDANCE OF DIPTERAN FAMILIES BETWEEN A MANAGED PINE FOREST AND A NATURAL FORESTED WETLAND ON THE NORTH CAROLINA COASTAL PLAIN

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Research is currently underway to determine the effects of intensive pine management on bat foraging behavior in the North Carolina coastal plain. A major component of this project involves capturing insects to evaluate differences in abundance and diversity of bat prey items between a managed pine forest and a natural forested wetland. Insects from both habitats captured in the summers of 2006 and 2007 have been initially identified to Order and counted. Over 70 percent of insects captured belonged to the Order Diptera (flies). The Diptera are currently being identified to Family to assess the differences in abundance and diversity of Dipteran Families between the two habitat types. Upon completion of keying all Dipteran insects to Family, paired statistical approaches will be used to examine differences in Family level abundance and diversity between the two habitat types. Preliminary analyses suggest a significantly higher abundance of Dipteran Families Tipulidae (crane flies), Psychodidae (moth flies), Ceratopogonidae (biting midges), Dolichopodidae (long-legged flies), Ephydriidae (shore flies), and Muscidae (no common name) at the natural forested wetland. Tipulids have been shown to be a dietary component for some bats, so changes in Dipteran community structure due to pine management may affect bat foraging behavior.

LICHEN AND VEGETATION SURVEYS OF A DISJUNCT POPULATION OF THE CAROLINA NORTHERN FLYING SQUIRREL (*GLAUCOMYS SABRINUS COLORATUS*)

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Disjunct populations of the federally-endangered Carolina northern flying squirrel, *Glaucomys sabrinus coloratus* (Sciuridae), occur in the southern Appalachians, Black Hills, southern Rocky Mountains, and Sierra Nevada. One population occurs within hemlock-northern hardwoods forests along the Cherohala Skyway in western North Carolina. Our objective was to survey vegetation and lichen composition of points where Carolina northern flying squirrels have been tracked by radio telemetry or captured in traps. Vegetation was surveyed around den sites recorded for two squirrels in summer 2006, at random points 50m away from recorded sites, and at any point where a Carolina northern flying squirrel was captured in a trap. A nested plot design was established in which tree species composition and size (dbh) were recorded in 10 x 10 plots; sapling species, sapling height, herb species composition, and shrub species composition were recorded in a 5 x 5 m plot; and percent cover of each herbaceous species and canopy cover were recorded in 1 x 1 m plots in each corner of the largest plot. Lichens were surveyed at intervals throughout the areas of known den sites. Results of these surveys will reveal information about the habitat, including potential foraging habitat, of the disjunct Carolina northern flying squirrel population.

A METHOD FOR ESTIMATING THE RELATIVE RANGES OF BAT DETECTORS

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One limitation of bat detector studies is that an indeterminate space is surveyed. Size of bat detector detection cones vary under different recording circumstances and among bat species with different call intensities. As a result, comparisons of bat activity across species, habitats, or bat detectors are confounded by the unknown detector range. We developed a method to calculate the range of detection cones using two aligned bat detectors. The distribution of detections between the two detectors is entered into an algorithm to produce an estimate of the detector range. We tested the method, using both computer simulations and a field experiment. The computer simulations demonstrated that, given sufficient data, this method can precisely calculate the range of detection cones, if the detection probability equals 1. When the detection probability varies with the distance to the detector, the detector does not have a simple "range," but rather a series of distances and probabilities. In this case, the range estimate is less precise, but still valuable because the range of each bat detector can be used to make relative comparisons to other bat detectors in other recording circumstances (i.e. different bat species, habitat structure, etc). The field experiment confirmed the ability to estimate the relative range of detectors under field conditions. Although limited by variable detection probability across detection distance, the method is useful for making relative comparisons among detectors and is an advancement over current methods.

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

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Since the discovery of bats having the ability to emit ultrasonic calls in 1938, relatively little research has assessed the extent of this behavior in other mammalian taxa. For example, it is currently known that bats, cetaceans, and shrews use ultrasound for echolocation, and several species of myomorph rodents and one sciuriform use ultrasound for communication. We describe the first known use of ultrasonic calls in two species of gliding mammals: *Glaucomys sabrinus* and *G. volans*. Ultrasonic calls from captive *G. sabrinus* and *G. volans* were recorded in a laboratory using Pettersson D 240x ultrasound detectors and iRiver mp3 players. Sonobat software was used to spectrographically analyze calls. Four motifs of ultrasonic vocalizations were identified for *G. sabrinus* and nine for *G. volans*. Results suggest species-specific

differences among calls and high levels of stereotypy within species for some syllables within motifs. Such findings may be useful in discriminating species with use of acoustic surveys in areas where both occur.

EFFECTS OF HABITAT AND CLIMATIC VARIABLES ON AVAILABILITY OF VOLANT BAT PREY IN VIRGINIA PIEDMONT FORESTS

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Recent research in the United Kingdom found significant differences in bat use of organic and conventional agricultural land. The elucidated link between vegetation management, insect communities, and bat foraging activity also could apply to managed timber lands, a potential link that we investigated in pine and mixed hardwood stands managed and maintained under various regimes. In the summers of 2006 and 2007, we conducted research in the Appomattox–Buckingham State Forest of central Virginia in pine and hardwood sites at various stages of succession. In each site we established a sampling array consisting of a bat detector and an associated universal black light trap. For insect samples, we determined dry biomass and identified to order those individuals that were within a predicted prey size range, as determined with published data. We used Anabat II detector systems to assess bat activity and later determined species richness. As in the UK project, we found positive associations of bat activity and insect abundance, though in contrast our more intensively managed sites had greater insect biomass. This raises interesting questions about the roles of these young sites, particularly plantations, as foraging sites for bats, and results of this on–going work will provide relevant information to managers interested in non–game use of these areas.

FACTORS IMPACTING EMERGENCE TIME OF LITTLE BROWN BATS (*MYOTIS LUCIFUGUS*) AT A MATERNITY COLONY IN CENTRAL PA

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The foraging strategy of little brown bats (*Myotis lucifugus*) is based on the trade–off between predation risk and competition from birds with the availability of prey and variations in energetic demands. Emergence time is the time at dusk that an individual bat leaves its' roost to forage for the night. If bats emerge late, they miss foraging opportunities at a time of peak prey abundance. However, early emergence increases exposure to predators and increases competition with birds. Depending on an individual bat's energetic needs, they will emerge as soon as the benefits outweigh the risks. Little brown bats were trapped using mist nets and harp traps at maternity colony in a two–story barn in Selinsgrove, Pennsylvania. Standard data (sex, age, weight, forearm, and PIT tag or band numbers), along with weather information (temperature, relative humidity, barometric pressure, and light levels) were recorded for 15 trap nights. Data analyses suggest that several factors impact the emergence time of little brown bats, such as sex, age, and body mass. Skinny bats, or bats with a smaller body mass, emerged earlier during the emergence period probably because of their low body reserves. Juvenile bats emerged later than adults probably because they have not perfected their flying skills or echolocation yet.

A HOT SPOT FOR MAMMALIAN BIODIVERSITY: MONROE COUNTY, TENNESSEE

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Based on high species richness in the county and a high percentage of the taxa listed for protection in Tennessee (at the federal and state levels) known in the area, we recognize Monroe Co., Tennessee, as a local hot spot for mammalian biodiversity in the Southern Appalachians. Future planning relating to management and conservation of mammals in the Southern Appalachians should acknowledge this local species richness and plans should be developed to monitor the status of mammalian biodiversity in the area.

STRANGERS IN THE NIGHT: TRANSPORTATION PROJECTS AND ENDANGERED BATS

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The Endangered Species Act is one of many federal acts and regulations that the Missouri Department of Transportation (MoDOT) must consider in the assessment of impacts from transportation improvement projects. Of the 34 federally listed species that may occur in the state, the one that MoDOT gives consideration to on the greatest number of projects is the Indiana bat (*Myotis sodalis*). Aside from several hibernacula, the entire state is in the summer breeding range for this species. Removal of forest for a MoDOT construction project requires consultation with the United State Fish and Wildlife Service (USFWS). One such project in southeastern Missouri will require the removal of over 650 acres of mature forest from public and private land in Wayne County. This includes removal of approximately 55 acres from a protected area on the Mark Twain National Forest, set aside for suitable roosting and foraging habitat for a known maternity colony. Because of this impact, MoDOT and the Federal Highway administration entered into formal consultation with USFWS in October 2006. The Biological Opinion has been issued, with minimization and conservation measures. Over the next five years, MoDOT will mitigate for the loss of over 200 potentially suitable acres of roost habitat with some innovative partnering ideas.

RABIES EXPOSURE AND INFECTION, RELATIVE IMMUNE FUNCTION AND LIFE–HISTORY TRAITS IN THE BIG BROWN BAT, *EPTESICUS FUSCUS*

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This study aimed to characterize immune responses in the big brown bat, *Eptesicus fuscus*, and how variation in immune function may relate to population differences, life–history traits and pathogen exposure, specifically to the rabies virus. Bats were captured from ten barns located in New Hampshire and Massachusetts. A bactericidal assay and the phytohemagglutinin (PHA) challenge were used to test the innate and cell–mediated adaptive immune responses respectively. The rapid fluorescent focus inhibition test (RFFIT) was used to measure rabies virus–neutralizing antibodies (VNA). Infection status was determined using nested RT–PCR and sequencing. Among females, bactericidal ability of blood was significantly related to colony and reproductive stage. Specifically, postlactating bats showed greater bacterial killing compared to lactating bats. PHA index was significantly related to date and year. Significant differences were observed between production of VNA, reproductive stage, date and year. Pregnant and lactating individuals were more likely to exhibit elevated production of VNA compared to postlactating individuals. 3.2% of female bats captured in 2005 and 19% captured in 2006 were considered recently exposed to the rabies virus. Three bats were actively shedding rabies viral particles between 2005, 2006 and 2007. Results suggest that reproductive status, colony site, season and differences between years may influence the ability of bats to respond immunologically. Moreover, pregnant and lactating individuals, which exhibit increased gregarious behavior compared to bats in other reproductive stages, appear to be more susceptible to pathogen exposure.

OVERVIEW OF THE SOUTHEASTERN BAT DIVERSITY NETWORK

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The Southeastern Bat Diversity Network (SBDN) was established in 1995 at the North American Symposium on Bat Research. Bat biologists, land managers and others interested in the conservation of bats that occur in the southeastern United States constitute the membership. The SBDN was formed to facilitate communication within the region, identify priorities and needs specific to the southeastern United States and develop and implement programs that address regional bat conservation needs. The SBDN is

directed by a President, President-elect, Secretary, Treasurer, and a 10 member Board of Directors. Sixteen states are included within the SBDN's region. Since its founding in 1995 the SBDN has evolved to support numerous important programs and initiatives. These include a Bat Conservation Director position. In 2005 the North Carolina Wildlife Resources Commission partnered with SBDN to support a staff position to facilitate bat conservation efforts in the Southeastern United States. Other efforts include sponsorship of an annual on-the-ground Bat Blitz. A Bat Blitz is a coordinated, intensive survey designed to sample the bat community in a particular area. SBDN, in cooperation with the Northeast Bat Working Group supports the Bat Database, designed as a data repository for use by bat research scientists in the eastern United States. Other efforts include, but are not limited to, an annual meeting in conjunction with the Colloquium on Conservation of Mammals in the Southeastern United States, Student Travel Awards for students involved in bat research, and Lifetime Achievement Awards; given to those who have made significant lifetime contributions to bat conservation and research.

IMPORTANCE OF PINE SNAGS AND OPEN FOREST HABITATS TO ROOSTING MALE BIG BROWN BATS IN ARKANSAS

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Although the big brown bat (*Eptesicus fuscus*) has been widely studied, information on tree-roosting in forests by males is rare and little information is available on tree roosting in the southeastern United States. Our objectives were to characterize diurnal summer roosts, primarily for male big brown bats, and to determine relationships between forest structure and roost selection. We quantified 25 male roosts located via radiotelemetry, and describe an additional 9 maternity roosts for females. All roosts for both sexes were in shortleaf pine (*Pinus echinata*) snags, and 82% of roost snags were 15–25 cm diameter at breast height (dbh). Most (94%) roosts for both sexes were under loose bark. A logistic regression model differentiating male roost sites from random locations indicated males were more likely to roost in recently thinned, open-forest conditions (less canopy cover, more cut stumps, fewer understory stems) that contained abundant overstory pines ≥ 25 cm dbh and abundant snags. Males roosted primarily (84%) in stands that had recently undergone partial harvesting. Maintaining a supply of pine snags 15–25 cm dbh in relatively open forest habitats, including areas undergoing partial harvest would likely provide suitable roosting habitat for male big brown bats in the Ouachita Mountains.

STABLE ISOTOPES HIGHLIGHT COMPLEXITIES OF MIGRATORY BEHAVIOR AND POPULATION DYNAMICS IN BRAZILIAN FREE-TAILED BATS

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Despite extensive efforts to characterize seasonal behavior of Brazilian free-tailed bats (*Tadarida brasiliensis*), comprehensive descriptions of migratory patterns and timing remain unclear. Low recapture success of banded individuals, wide ranging flight, and the large effective population size for this species all contribute to the concealment of broad patterns across their geographic range. Stable isotopes of hydrogen (δD_h) in the hair from bats provide a potential tool for identifying the direction and phenology of movements between roosts and fidelity to seasonal ranges of this species. Hair was collected from Brazilian free-tailed bats at four roosts in south-central Texas that were used by maternity colonies during summer and stop-over roosts for migrants in spring and autumn. Although an offset of 25‰ is the expected difference between precipitation (δD_p) and hair, δD_h values in bat hair collected at locations where annual molt occurred differed from the estimated δD_p values by only $6.5 \pm 3.7\%$ (mean \pm standard error). δD_h values indicate significant fractionation between adults, $\delta D_h = -14.5\%$, and juveniles, -25.7% ($p=0.01$, $d.f.=10$). Also, significantly greater variance in δD_h of fall colonies compared to summer colonies indicates mixing of individuals from disparate summer ranges during migration and more cohesive groups during the maternity period. This greater variance corresponds with periods of fluctuating colony sizes in autumn. These data support previously published hypotheses for putative migratory routes and population structure

for this species, but underscore the need for broader sampling of individuals and improved estimates for geographic distributions of δD_h and other stable isotopes in bats.

ROOST SITE SELECTION BY TWO VESPERTILIONID BATS (*MYOTIS AUSTRORIPARIUS* AND *CORYNORHINUS RAFINESQUII*) IN A NORTHEAST LOUISIANA BOTTOMLAND HARDWOOD FOREST

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Myotis austroriparius (southeastern myotis) and *Corynorhinus rafinesquii* (Rafinesque's big-eared bat) are listed federally as "species of concern" throughout their range of the southeastern United States. A paucity of information exists on either species, but both are known to roost in water tupelo (*Nyssa aquatica*) and bald cypress (*Taxodium distichum*) cavities. Fifty-nine potential roost sites located in cavities of water tupelo, cypress, persimmon (*Diospyros virginiana*), water oak (*Quercus nigra*) and willow oak (*Quercus phellos*) were identified within a 1700 m stream bed in the Upper Ouachita NWR. Cavities have been monitored since 24 May 2007. Forty-one cavity searches revealed that thirty-four cavities (water tupelo and cypress)(58%) have been utilized as roosts for one or both species. *C. rafinesquii* inhabited thirty-three cavities (water tupelo and cypress)(56%) and switched roosts frequently. Fourteen trees were occupied >50% of the time by this species. *M. austroriparius* established more permanent roosts in only six cavities (water tupelo)(10%). On occasion, *M. austroriparius* and *C. rafinesquii* were found sharing roost sites in five cavities. Site characteristics have been obtained for all trees in an attempt to determine roost site preferences for both species. Additionally, mist nets are being used to survey bat species within the study site. Since 2 March 2007, 112 individuals consisting of four species (*M. austroriparius*, *C. rafinesquii*, *Eptesicus fuscus*, and *Lasiurus borealis*) have been captured. Data were collected on gender, weight, forearm length, reproductive status, and age of all bats. Ambient temperature and time of capture for each individual were recorded.

COOPERATION & INNOVATIVE TECHNIQUES ACCOMMODATE BOTH BAT CONSERVATION AND STREAM RESTORATION GOALS

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Coal mining, both underground and surface stripmining, were once prevalent activities across southeast Ohio, especially before laws were enacted to govern such actions. Serious effects to the landscape have resulted, including acidified streams laden with dissolved metals and sediment. Ecosystem restoration activities on the Wayne National Forest (NF) have several goals, one of which is aimed at improving water quality while also addressing safety issues and wildlife habitat potential. Acid mine drainage source-control projects (i.e., backfilling mine portals and subsidences) sometimes conflict with the maintenance of underground habitat for bats. Closing holes can eliminate suitable bat habitat, or entomb animals if work proceeds during bat-critical periods. However, cooperation and innovative ideas can lead to projects that meet multiple resource goals. Several projects were initiated on the Wayne NF that incorporated stream restoration or safety measures, and that accommodated bat-use of the sites. Techniques included stream diversions past open mine holes, bat-friendly gates, vent pipes for air flow maintenance, and simple habitat enhancements (e.g., creation of road ruts). Pre- and post-project fall swarming surveys for bats help track the success of these measures to conserve bat habitat. Preliminary data suggest that bats continue to use the modified openings after projects were completed, and, in some cases, bat-use has increased. Goals for ecosystem restoration, safety, and wildlife conservation are not mutually exclusive. Case studies from the Wayne NF suggest innovative and sometimes low-cost techniques can be used to protect bat habitat while still meeting restoration and safety goals. Collaboration and cooperation at all levels are required. Pre- and post-project monitoring are essential to determine effects of designs, if any, on bats. Successes and failures must be documented and shared between resource professionals.

MIXED SPECIES SUMMER ROOSTS OF INDIANA BATS (*MYOTIS SODALIS*) AND LITTLE BROWN BATS (*M. LUCIFUGUS*)

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During the summer, both female Indiana bats (*Myotis sodalis*) and little brown bats (*M. lucifugus*) form maternity colonies. Indiana bats have relatively low fidelity to their roost trees, and frequently switch roosts. However, little brown bats show very high fidelity to one roost often using it for the length of the summer season. Over the course of three summer field seasons, Indiana bats and little brown bats were captured and fitted with radio transmitters. In 2005, one Indiana bat and one little brown bat were tracked to the same roost tree on three different days. In 2006, two separate trees were found that contained both roosting Indiana bats and little brown bats. In the summer of 2007, while both species were captured we did not observe both bat species in the same roost trees. With these findings it is important to consider that when an Indiana bat roost tree is found that all individuals in that colony may not be Indiana bats. Doing emergence counts is a good practice for finding the general amount of bats in a roost, but when there are multiple species in the same roost the numbers may be erroneous if mixed species roosting is not considered.

DISTRIBUTION OF SHORT-TAILED SHREWS (*BLARINA*) IN ALABAMA

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Two species of short-tailed shrews, the southern short-tailed shrew (*Blarina carolinensis*) and northern short-tailed shrew (*B. brevicauda*), occur in the southeastern United States. However in Alabama, only limited distribution records exist for both *B. brevicauda* and *B. carolinensis*, particularly in the northern part of the state. Thus, to clarify distributions of short-tailed shrews in Alabama, we examined skulls of *Blarina* obtained from museum collections and from discarded bottles found along roadsides. We used 4 cranial measurements to classify individuals; condylobasal length, cranial breadth, interorbital breadth, and maxillary breadth. Morphometric analysis of skulls revealed 3 distinct forms of *Blarina* in Alabama. *B. carolinensis* occurs throughout most of the state, and the larger *B. brevicauda* inhabits the Piedmont Upland region of east-central Alabama where *B. carolinensis* does not occur. In northern Alabama, the Tennessee River seems to serve as a barrier separating *B. carolinensis* from a population of intermediate-sized *Blarina* north of the river. This population may represent a smaller form of *B. brevicauda*, a larger form of *B. carolinensis*, or a distinct species. Genetic analysis may elucidate the taxonomic relationship of this population to other populations of short-tailed shrews in Alabama and adjacent states.

BAT ACTIVITY AND INSECT ABUNDANCE ALONG AN ELEVATIONAL GRADIENT UNDER DIFFERENT WEATHER CONDITIONS

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A major source of alternative energy is wind power, and while wind farms do provide an alternative form of energy, there is concern over their impacts on birds and bats. To better understand the role of temperature and elevation in bat mortality associated with wind farms, we sampled bat activity and insect abundance along an elevational gradient at 3 study areas in northeastern Pennsylvania. At each study area, bat activity was sampled with an AR125 acoustic detection system (Binary Acoustic Technology) and insect abundance was sampled using an insect black light trap (BioQuip #2851A Light Trap) at elevations 1100', 1500', and 1900'. Each study area was sampled once a week for 30 weeks. Temperature data were obtained from a Hobo data logger permanently installed at each of the 9 sampling sites. During 30 weeks of

sampling, we recorded over 67,000 total bat passes and collected over 70,000 insects. There were 14 nights when temperature inversions occurred, these temperature inversions were predominately at the Hickory Run site. With this preliminary analysis we found some suggestion that temperature inversions lead to increased bat activity along ridge tops. We are currently working on a weighted multiple regression analysis to assess the effects of temperature and prey availability on bat activity.

ASSESSMENT OF METHYLMERCURY AVAILABILITY TO BATS IN NEW YORK – 2006

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More than half of the species of bats in the U.S. can be characterized as foraging over water for emergent insects. There have been very few investigations measuring the exposure of mercury (Hg) to bats. Because of factors that relate to the bat's natural history and vulnerability to anthropogenic stressors, over half of the species in the United States are listed as endangered and threatened or are under consideration for listing. Bats comprise about one-quarter of the mammalian species and constitute a substantial portion of the mammalian biological diversity in the United States. We present findings from a pilot effort to evaluate Hg exposure in multiple bat species from New York State. We sampled blood and fur from 96 bats at eight sites in New York State. Samples were analyzed for total Hg (>95% Hg in fur is MeHg). We found that 16% and 5% of the bats sampled had fur Hg concentrations that exceeded the lowest observed effects levels in dosed mice (i.e., 10.8 ug/g, fw) and furbearers (i.e., 20.0 ug/g, fw), respectively. This study demonstrates the potential risk of anthropogenic releases of Hg in the air sheds and watersheds of New York State for bats and parallels risks found in diurnal invertivores – songbirds.

POST-CONSTRUCTION MONITORING OF BIRD AND BAT MORTALITY AT THE LOCUST RIDGE WIND FARM SCHUYLKILL COUNTY, PA

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The proliferation of wind farms along ridges of the Appalachians has raised concerns about bird and bat mortality resulting from collisions with wind turbines. Locust Ridge Wind Farm is a 13-turbine, utility-scale wind facility in Schuylkill County, PA, which went online in December 2006. To assess the scope, species composition, and seasonal patterns of bat mortality at this facility, we conducted daily searches from 1 May to 18 November 2007 on 12 of the 13 turbines at Locust Ridge. Our search plots were 120 meters by 120 meters, centered on each turbine, with transects every 6 meters. The results of this full-season daily effort are generally consistent with previous studies at similar facilities. Bat mortality was greatest during the late summer and early fall, and red, hoary, and silver-haired bats were the most impacted species. We found an overall low mortality rate for birds. These results illustrate the need for continued research in this expanding industry.