2nd JOINT MEETING
NORTHEASTERN BAT WORKING GROUP,
MIDWEST BAT WORKING GROUP (3rd annual),
SOUTHEASTERN BAT DIVERSITY NETWORK (16th annual), and
21st COLLOQUIUM ON THE CONSERVATION OF MAMMALS
IN THE EASTERN UNITED STATES

Louisville, Kentucky
February 23rd - 25th, 2011

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Vendors

Wednesday – Friday
All vendors are located in Salon A

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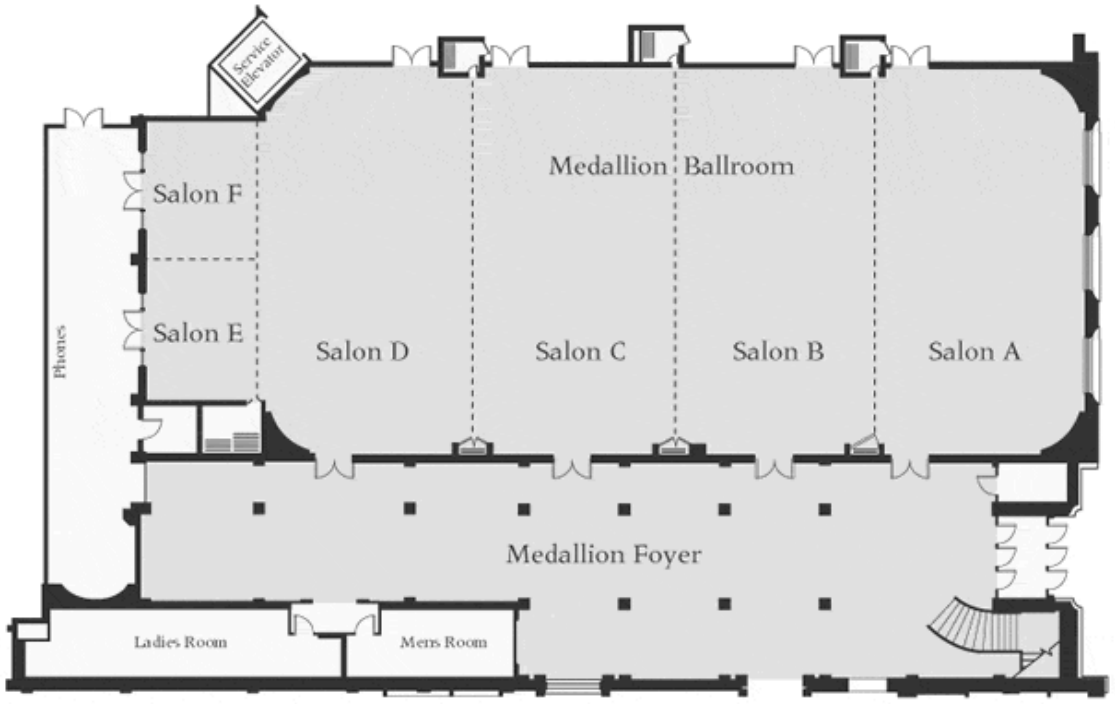

Locations of Events

Vendors ..... Salon A
White-nose Syndrome Symposium ..... Salon C/D
Bat Techniques Workshop ..... Salon C/D
Wind and Bat Symposium ..... Salon C/D
Oral Presentations ..... Salon C & D
Posters ..... Salon B

CONFERENCE SCHEDULE OVERVIEW

Wednesday, 23 February
The Joint Bat Working Group Meeting

8:00 AM	5:00 PM	Registration Open	Medallion Foyer
8:00 AM	9:00 AM	Continental Breakfast	Medallion Foyer
9:00 AM	9:15 AM	Welcome and Introductions	Salon C/D
9:15 AM	12:30 PM	WNS Symposium	Salon C/D
12:30 PM	2:00 PM	Lunch on your own	
2:00 PM	5:30 PM	Bat Techniques Workshop	Salon C/D
5:30 PM	7:00 PM	Dinner on your own	
7:00 PM	10:00 PM	Social KDFWR (sponsor)	The Rathskeller

Thursday, 24 February
The Joint Bat Working Group Meeting

8:00 AM	5:00 PM	Registration Open	Medallion Foyer
7:00 AM	8:00 AM	Continental Breakfast	Medallion Foyer
8:00 AM	9:00 AM	NEBWG Business Meeting	Salon C/D
9:00 AM	10:00 AM	MWBWG Business Meeting	Salon C/D
10:30 AM	12:00 PM	SBDN Business Meeting	Salon C/D
12:00 PM	1:30 PM	Lunch on your own	
1:30 PM	5:00 PM	Wind and Bats Symposium	Salon C/D
5:00 PM	7:00 PM	Dinner on your own	
7:00 PM	10:00 PM	Poster Session, Social, and SBDN Auction	

Friday, 25 February
Colloquium on the Conservation of Mammals in the Eastern US

8:00 AM	12:00 PM	Registration Open	Medallion Foyer
8:00 AM	9:00 AM	Continental Breakfast	Medallion Foyer
9:00 AM	10:15 AM	Session 1(Methodology, Human Dimensions)	Salon C & D
10:45 AM	12:00 PM	Session 2 (WNS, Surveys/Inventories)..	Salon C & D
12:00 PM	1:30 PM	Lunch on your own	
1:30 PM	3:00 PM	Session 2 (Habitat, Ecology)	Salon C & D
3:30 PM	4:00 PM	Session 3 (Toxins)	Salon C/D
4:15 PM	4:45 PM	Awards, Farewell.....	Salon C/D

WHITE-NOSE SYNDROME SYMPOSIUM SCHEDULE

Wednesday, 23 February
All talks will be presented in Salon C/D

9:15 - 10:30	**WNS SUMMARY AND OVERVIEW OF PREVIOUS AND CURRENT RESEARCH**
10:30 – 10:45	**BREAK**
10:45 – 11:15	**POTENTIAL REGULATORY IMPACTS OF WNS INDUCED DECLINES**
11:15 – 11:45	**STATE AND FEDERAL AGENCY PERSPECTIVES**
11:45 – 12:30	**THE NATIONAL PLAN AND YOU**

BAT TECHNIQUES WORKSHOP SCHEDULE

Wednesday, 23 February
All talks will be presented in Salon C/D

2:00 **HISTORY OF BANDING, REASONS WHEN AND WHEN NOT TO BAND – WHAT WE HOPE TO GET AND HOW SHOULD WE RECORD DATA AND STORE DATA**

James Kiser

From 1932 to 1972 the Federal Government issued approximately 1.5 million bands to scientists during its official Bat Banding Program. However, a moratorium on banding was issued in 1972. However, by the mid 2000's many States (KY, NY, VT, NH, PA, OH, WV) started issuing bands to researchers and consultants to use on bats captured in mist nets and harp traps outside of sensitive areas (hibernacula and maternity sites). The purpose of this presentation is to provide a history of bat banding, introduce audience to types of bands used today, describe how, where, and when to use bands, provide examples of how data can be used, and illustrate proper data management strategies.

2:20 **PIT TAGGING: WHAT IT IS, HOW IT WORKS, LIMITATIONS, APPLICATIONS, AND HOW AND WHEN TO MONITOR**

Nate Fuller

Information gathered though the use of subcutaneously implanted passive integrated transponders (PIT tags) in bats has been invaluable in determining nightly time budgets, roost fidelity, and as an alternative to wing bands, which can cause significant damage to flight membranes. However, there are

drawbacks associated with the use of PIT tags. Subcutaneous injections of PIT tags into free-ranging animals come with inherent risks such as disease transmission and infection, and may be detrimental to survival if performed poorly. This talk will cover the basics of PIT tagging and will include discussions of necessary equipment, injection protocols, appropriate applications, and the costs and benefits associated with the use of PIT tags.

2:40 **TRANSMITTERS: METHODS FOR APPLICATION, WHAT GLUES ARE AVAILABLE AND HOW THEY PERFORM AND BMPS**

Tim Carter

Radio transmitters are among the most common tools used by biologists when working with bats. However, many transmitters are not attached correctly. Attachment technique and the type of adhesive can dramatically affect transmitter retention and resulting data acquisition. This talk will focus on attachment technique and also the types of adhesives available.

2:55 **AERIAL AND GROUND TELEMETRY – CONSIDERATIONS AND REQUIREMENTS FOR SUCCESS**

Mark Gumbert and Piper Roby

Understanding bat and transmitter size limitations, habitat needs, activity patterns, and focus of a study are all important for research design when considering the use of radio-telemetry. Other considerations should also include personal experience, available budget, and equipment needs to ensure a successful project. Suggested equipment and techniques used in radio-tracking bats from the ground and from the air will be discussed. Efficient tracking requires patience, understanding of bat behavior, and experience, and this workshop will get you started thinking about how to plan your tracking project.

3:20 **INTRODUCTION OF NEW ACOUSTIC MONITORING SYSTEM**

Eric Britzke

3:40 – 4:00 **BREAK**

4:00 **WNS DECON PROTOCOLS: DISCUSSION OF NEW DEVELOPMENTS AND ADDRESSING ISSUES OF SUMMER DECON THAT ARE A LITTLE MORE AMBIGUOUS**

Hazel Barton

This talk will provide a synopsis of what has been done in regard to decontamination of equipment, including chemicals and protocols, as well as work that is being geared toward bat-research specific problems. There will also be a short discussion of treating bats *in situ* and the obstacles to finding a field-ready solution for bats.

4:30 **TISSUE AND HAIR SAMPLING: WHY COLLECT THESE SAMPLES,**

WHAT CAN YOU DO WITH THEM, HOW TO STORE AND SHIP THEM

Amy Russel and Kim Briones

Samples from hair and tissues (including wing, buccal, and fecal samples) are an integral part to many ecological and evolutionary studies. Modern analyses of diet, energy flow, social structure, and migration depend in large part on inferences taken from such samples. Furthermore, as white-nose syndrome continues to sweep through North America, samples collected now in both affected and unaffected areas may prove to be essential for either identifying possibly resistant populations or predicting directions of disease spread via wildlife vectors. We will review best practices in sampling techniques for tissues used in stable isotope and genetic analyses, and provide a short primer regarding the types of questions that can be addressed with such samples.

4:50 **COLLECTING WNS SAMPLES: WHEN AND HOW TO COLLECT, WHAT TO COLLECT AND HOW MUCH, HOW TO PACKAGE AND WHERE TO SEND AND OTHER ISSUES**

Kevin Keel

We will review the techniques for collecting the best samples to detect Geomyces destructans given the conditions presented to the field biologist. The different types of samples will be discussed as well as their applicability for the various assays currently available to us, including PCR, culture and histopathology. We will discuss how to interpret the results of such assays and what their limitations are. Information for the labs currently testing for WNS will be provided, as well as how to submit samples to them.

5:10 **DETECTION OF G.D. IN THE LAB: HOW THIS PROCESS WORKS AND WHAT PRECAUTIONS MUST BE TAKEN**

Karen Moffett

Learn to identify the distinctive *G. destructans* conidia under the microscope, the process of culturing the fungus, and the protocols necessary to safely handle this pathogen.

WIND AND BAT SYMPOSIUM SCHEDULE

Thursday, 24 February
All talks will be presented in Salon C/D

1:30 **BATS AND WIND: KNOWN KNOWNS AND KNOWN UNKNOWNS**

Cris D. Hein, Michael R. Schirmacher, and Edward B. Arnett. *Bat Conservation International, Austin, TX 7874*

In the US, bats and wind energy-related issues gained prominence in 2003, when 1,400–4,000 fatalities were estimated at the Mountaineer Wind Energy Center, WV. In subsequent years, numerous studies investigating pre-construction activity and post-construction fatality have provided valuable information regarding spatial (location and altitude) and temporal (nightly and seasonal) patterns of bats at proposed and existing wind energy facilities. Unfortunately, synthesizing these data to predict the timing and magnitude of fatalities remains problematic. Furthermore, our understanding of basic bat behavior (e.g., are bats attracted to turbines?) and the cumulative impacts of wind development on bat populations is lacking. Despite our limited knowledge, endeavors to reduce bat fatalities, through the use of acoustic deterrents and operational curtailment, appear promising. To further optimize these mitigation efforts (i.e., minimizing bat fatalities while maximizing wind energy production) we must resolve existing data gaps through robust and innovative research. We will summarize the current state of knowledge with respect to patterns of bat activity and fatality, discuss theories of bat/turbine interactions, identify data gaps, and suggest ideas for future studies.

1:50 **CURRENT UNDERSTANDING OF BAT ACTIVITY AND MORTALITY PATTERNS IN THE NORTHEASTERN UNITED STATES**

Kristen Watrous, Trevor Peterson. *Stantec Consulting, Burlington, VT (KW) and Topsham, ME (TP)*

Initial concern regarding impacts to wildlife from wind facilities focused primarily on birds. However, several high profile bat mortality events at wind facilities on forested ridges of the Appalachian Mountains raised concerns about the impacts to bats; since then a large number of pre-construction and post-construction studies have been conducted in the Northeast, aimed at documenting bat activity and mortality through a variety of survey methods. Impacts in the northeastern United States have been found to be highly variable, ranging from a few fatalities observed during studies in northern Maine to estimates of thousands along the Appalachian range. We review current mortality rates across the Northeast region, patterns of mortality in relation to species composition and weather conditions, and turbine curtailment strategies used to mitigate these effects. We comment on efforts to link pre-construction and post-construction bat survey data, and discuss the issue of estimating unobserved mortality when observed mortality is low. Finally, we discuss the implications of these findings in predicting and monitoring impacts to bats, particularly in light of White Nose Syndrome

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2:10 **BAT AND WIND INTERACTIONS IN THE SOUTHEASTERN UNITED STATES: POTENTIAL NEW CHALLENGES AND USING THE PAST TO PREDICT THE FUTURE**

E. Allison Costello and Christine Sutter. *Pandion Systems, Inc. Gainesville, FL 32609*

Currently, only three states (Arkansas, Tennessee, and West Virginia) in the southeastern region of the United States boast active wind energy facilities. From these three states, bat mortality at active wind energy facilities in West Virginia and Tennessee has been among the highest reported in the country. While the potential for wind energy generation is currently not as widespread in the southeastern region as in other regions of the United States, economic drivers and technology innovations are changing this with wind energy facility prospecting increasing across the southeast both on shore and off shore. Most off shore wind would occur in the shallow waters near the coast. With wind energy facility development likely to grow in the southeastern United States in the near future, there will be greater exposure of endangered species, new species potentially exposed to wind turbines that were not previously, and new seasonal patterns of activity and potentially mortality. Using what we have learned about bat and wind turbine interactions from other regions of the country can we predict risk to endangered species and these novel southeastern species? We will present the principle risk factors to consider, development of preconstruction and postconstruction studies necessary to assess an manage risk, how the extended active season is predicted to affect mortality, and identify the current knowledge gaps.

2:30 **A SUMMARY OF BAT STUDIES AND FATALITIES FROM WIND-ENERGY FACILITIES IN THE UNITED STATES WITH AN EMPHASIS ON THE MIDWEST AND NORTHEAST**

Jeffery Gruver, Kimberly Bay, Matt Kesterke, Wally Erickson, Kevin Murray, and Michelle Ritzert. *Western EcoSystems Technology (WEST), Inc., Laramie, WY (JG), Cheyenne, WY (KB, MK, WE), Bloomington, IN (KM, MR)*

The purpose of the presentation is to use publically available reports to provide a summary of studies and fatalities of bats at wind-energy facilities in the United States, with a focus on the Midwest and Northeast. Wind energy facilities are currently installed in 36 states within the United States. These existing facilities account for 36,303 megawatts (MW) of installed wind power generation and there are another 6,022 MW of wind energy currently under construction in the U.S.

Most new wind-energy facilities in the U.S. are required to conduct formal fatality monitoring following completion of construction, and surveys have occurred at some sites during the first year of commercial operations. Typically at least 1 year of post-construction mortality monitoring will occur, though additional monitoring is possible , for example by permit condition, voluntary agreement, or where the first years' monitoring suggests extraordinary fatality levels.

WEST has compiled data from 40+ publicly available post-construction reports from wind-energy facilities across the country from 1996 through early 2009. The data compiled includes general study information, including; county, state,

dominant habitat, survey frequency, dates, number of turbines at site and number of turbines searched, and other similar attributes. When possible, we have also compiled actual fatality specific information, including; species, date the fatality was found, turbine/location of the fatality, and as much conditional information that was provided. We will present seasonal and temporal patterns of fatalities from United States wind energy facilities, along with regional comparisons and patterns. We will also summarize results of pre- and post-construction activity surveys for comparison.

2:50 **Q&A for 4 presenters**

3:00-3:30 **BREAK**

3:30 **CURRENT UNDERSTANDING OF ACTIVITY PATTERNS, MONITORING EFFORTS, AND POTENTIAL RISKS FOR BATS IN THE OFFSHORE AND NEARSHORE ENVIRONMENT OF THE NORTHEASTERN UNITED STATES**

Steve Pelletier, Sarah Boyden, Trevor Peterson, Kristen Watrous. *Stantec Consulting, Topsham, ME (SP, SB, TP); Stantec Consulting, South Burlington, VT (KW)*

Development of land-based wind energy projects in the northeast has led to a large number of recent studies documenting bat presence and seasonal activity through a variety of survey methods. Increasing interest in offshore wind energy by the industry in the northeastern United States has initiated similar efforts in coastal and offshore environments. Although logistical challenges have limited the number and scope of studies of bat behavior and patterns in the offshore marine environment, growing interest in understanding patterns of bat behavior and movement in this environment has led to several innovative monitoring efforts. We review the current understanding of offshore bat activity patterns from historic maritime records to ongoing offshore monitoring efforts, discuss relevant findings from existing offshore wind developments in Europe, and summarize logistical challenges associated with monitoring bats effectively in the offshore environment. We also discuss the implications of these findings in predicting and monitoring potential direct and indirect impacts of offshore wind energy development

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3:50 **WIND AND WINGS IN MISSOURI: WHAT CAN WE DO WITH WHAT WE KNOW?**

Lynn W. Robbins and Shannon E. Romeling. *Dept. of Biology, Missouri State University, Springfield, MO 65897*

Historically (> 10 ybp) surveys were used to determine presence or probable absence of endangered species at a site prior to habitat disturbance, and if present, avoidance or mitigation was required based on a short-term probability of Take. The proliferation of wind energy facilities within the ranges of one or more endangered bat species has resulted in the continuous and long-term probability of Take during normal operations. This requires a Habitat Conservation Plan (HCP) and the included Incidental Take Permit (ITP) under the guidelines of the Endangered Species Act (ESA). Issuance of an ITP under the ESA is a federal

action subject to compliance with the National Environmental Policy Act. The HCP outlines specific conservation measures associated with either the avoidance and/or minimization of the expected Take, or mitigation for the impact of Take that cannot be avoided and/or minimized. This is done on a case by case basis. The biological information needed to obtain this ITP cannot be obtained using the traditional survey methods. Rather than a detailed discussion of methodologies, we will delineate the requirements for the issuance of an ITP when there is a probability of Take involving the endangered Indiana bat. These include, but are not limited to a discussion of why the species was included, analyses of the impacts the project may have on this species, minimization and/or mitigation of these impacts, and the establishment of a Take number. This Take must not appreciably reduce the likelihood of the survival and recovery of the species in the wild. Therefore, it is necessary to estimate the size of the population that will be impacted, on the local, migratory, and Recovery Unit levels. Once the facility is operational, the short term and long term results of the mitigation and adaptive management must be provided to the USFWS.

4:10 **BATS AND WIND ENERGY IN PENNSYLVANIA: VOLUNTARY COOPERATIVE AGREEMENT SURVEY RESULTS AND IMPLICATIONS**

Catherine D. Haffner, Tracey M. Librandi Mumma. *Pennsylvania Game Commission, Bureau of Wildlife Habitat Management, Pennsylvania Game Commission, 2001 Elmerton Avenue, Harrisburg, PA 17110*

The Pennsylvania Game Commission, under its jurisdiction from Title 34 (Game and Wildlife Code), has the authority to manage and preserve wildlife in the Commonwealth. The Pennsylvania Alternative Energy Portfolio Standards Act, signed in 2004, requires that 18% of electricity sold to retail customers come from renewable energy sources within 15 years. The wind power industry has competed for a substantial portion of Pennsylvania's alternative energy market. To further understand, avoid, and minimize potential impacts to wildlife and its habitat from wind energy development, the Game Commission worked collaboratively with the wind industry to develop a Voluntary Wind Energy Cooperative Agreement (Cooperative Agreement) in 2007. For three years, the Cooperative Agreement has enabled the collection of pre- and post-construction survey data to evaluate the potential and actual impacts from wind turbines in Pennsylvania.

Pre- and post-construction survey results will be presented as well as how these data are used to determine how best to avoid and minimize impacts to bats from wind energy development. Research on methods to minimize bat mortality at wind facilities has shown promise, however implementation of such minimization methods is challenging. The cumulative impacts to bats from wind energy development and other threats, principally White Nose Syndrome, have elevated the Game Commission's concern for all Pennsylvania bat species. The Pennsylvania Game Commission has and continues to work with wind energy Cooperators to avoid and minimize impacts to these species to the greatest extent practicable. However, additional research on bat population ecology, efficacy of bat deterrents at multiple wind sites, and the economic and ecological viability of curtailment at multiple wind sites would greatly enhance our ability to protect imperiled species

from wind energy development.

4:30 **MITIGATION OPTIONS FOR REDUCING BAT FATALITIES AT UTILITY-SCALE WIND ENERGY FACILITIES**

Edward B. Arnett, Michael R. Schirmacher, Manuela M. P. Huso and Cris D. Hein. *Bat Conservation International, Austin, TX 78746 (EBA, MRS, CDH); Department of Forest Ecosystems and Society, Oregon State University, Corvallis, OR 97331 (MMPH).*

Unexpectedly high numbers of bat fatalities have been reported 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 particularly for species already impacted by White-nose Syndrome. We will discuss the results of mitigation options that reduce bat fatalities at wind energy facilities. Operational curtailment studies indicate that bat fatalities can be reduced from 44–93% during selected high risk periods of the year and with marginal power losses (0.3–1% of total annual output). In 2009, our research using acoustic deterrents demonstrated a 20–53% reduction in bat fatalities compared to those without deterrents. Research and development of acoustic deterrents continued in 2010 and we will present the second-year results from a field test comparing fatalities at turbines with and without deterrents. Given the magnitude and extent of bat fatalities worldwide, the conservation implications of our research findings on solutions to bat fatality are critically important.

4:50 **Q&A for 4 presenters**

CONTRIBUTED ORAL PRESENTATION SCHEDULE

Friday 25, February

All talks will be presented in Salon C and Salon D

	Salon C	Salon D
	Methodology	**Human Dimensions**
9:00	**THE INFLUENCE OF MOUSE (PEROMYSCUS SP.) SCENT ON SHERMAN LIVE-TRAP CAPTURE SUCCESS** Stephanie A. Rutan (pg 17)	**IMPACTS OF DIFFERENT FOREST TREE-HARVEST METHODS ON POPULATIONS AND DIETS OF INSECTIVOROUS FOREST BATS.** M.K. Caylor (pg 19)
9:15	**A FORENSIC PATHOLOGY APPROACH TO DIAGNOSING BAT MORTALITY AT WIND FARMS** Katherine E. Rollins (pg 17)	**COMPARING PRE- AND POST-CONSTRUCTION BAT ACTIVITY TO BAT FATALITY RATES AT A WISCONSIN WIND PROJECT** Jeffery Gruver (pg 20)
9:30	**EFFICIENT REPEATABLE APPROACH TO QUANTITATIVE IDENTIFICATION OF BAT ECHOLOCATION CALLS** C. Ryan Allen (pg 18)	**BAT USE OF FOREST STANDS IN RESPONSE TO SILVICULTURAL TREATMENTS IN THE DANIEL BOONE NATIONAL FOREST** Ryan A. Slack (pg 20)
9:45	**A NON-INVASIVE ACOUSTIC MONITORING TECHNIQUE FOR WHITE-NOSE SYNDROME SURVEILLANCE** Michael R. Schirmacher (pg 18)	**EFFECTS OF INTERCROPPING SWITCHGRASS AND LOBLOLLY PINE ON THE DIET AND TROPHIC POSITION OF PEROMYSCUS LEUCOPUS.** Kim M. Briones (pg 21)
10:00	**EFFECTIVENESS OF USING A BAT HAT REFLECTOR PLATE OR PVC TUBE IN PRECONSTRUCTION ACOUSTIC SURVEYS TO ACCESS BAT ACTIVITY AND SPECIES COMPOSITION** Benjamin T. Hale (pg 19)	**THE USE OF BRIDGE EXPANSION JOINTS AS MATERNITY ROOSTS BY MYOTIS LEIBII (EASTERN SMALL-FOOTED BAT) IN WEST VIRGINIA** Gary W. Libby (pg 22)
10:15-10:45	**BREAK**	

	Salon C	Salon D
	White-nose Syndrome	**Surveys/Inventories**
10:45	**IDENTIFICATION OF INTEGUMENTARY DEGRADING PROTEASES IN GEOMYCES DESTRUCTANS BY PEPTIDE MASS FINGERPRINTING** Evan Lacy Pannkuk (pg 22)	**USE OF ACOUSTIC BAT DATA TO CHARACTERIZE LARGE-SCALE MIGRATION PATTERNS FOR LONG-DISTANCE MIGRATORY BAT SPECIES IN THE NORTHEASTERN U.S.** Trevor Peterson (pg 25)
11:00	**DEMOGRAPHIC AND BIOMETRIC CHANGES IN MYOTIS LUCIFUGUS WITH THE ONSET OF WNS IN VIRGINIA: PRELIMINARY RESULTS** Richard J. Reynolds (pg 23)	**ACOUSTIC SURVEY OF OFFSHORE BAT ACTIVITY AND MIGRATION IN THE GULF OF MAINE** Sarah Boyden (pg 25)
11:15	**ZERO-INFLATED COUNT MODELS FOR IMPERFECTLY DETECTED INVASIONS: IMPLICATIONS FOR WHITE NOSE SYNDROME SURVEILLANCE** Thomas E. Ingersoll (pg 23)	**A SURVEY OF THE MAMMALS AT RUSSELL CAVE NATIONAL MONUMENT** A. Christopher Grow (pg 26)
11:30	**EVALUATING CHANGES IN BAT ACTIVITY AND SPECIES COMPOSITION FROM WHITE NOSE SYNDROME AT FIXED ACOUSTIC MONITORING LOCATIONS IN VERMONT** Kristen Watrous (pg 24)	**RESULTS OF A LARGE SCALE MIST-NETTING SURVEY OF THE PINE CREEK GORGE AREA, TIOGA AND POTTER COUNTIES, PENNSYLVANIA** James A. Hart (pg 26)
11:45	**CAPTURE AND REPRODUCTIVE TRENDS OF SUMMER BAT COMMUNITIES IN WEST VIRGINIA: ASSESSING THE IMPACT OF WHITE NOSE SYNDROME** Karen E. Francl (pg 24)	**SEVENTEEN YEARS OF BAT HIBERNACULA MONITORING IN WISCONSIN** Joseph Senulis (pg 27)
12:00-1:30	**LUNCH**	

	Salon C	Salon D
	Habitat	**Ecology**
1:30	**LANDSCAPE METRICS OF INDIANA BAT (Myotis sodalis) HABITAT IN CENTRAL NEW YORK** Michael S. Fishman (pg 27)	**OBSERVATIONS OF GOLDEN MOUSE (OCHROTOMYS NUTTALLI) VISITATION OF SWAINSON'S WARBLER (LYMNOTHLYPIS SWAINSONII) NESTS** Lisa J. Gatens (pg 30)
1:45	**HABITAT ASSOCIATION OF FORAGING BATS ON GEORGIA'S BARRIER ISLANDS** Elizabeth L. Oxford (pg 28)	**SOCIAL NETWORKS OF RAFINESQUE'S BIG-EARED BAT (CORYNORHINUS RAFINESQUII) IN KENTUCKY** Joseph S. Johnson (pg 31)
2:00	**HABITAT AND POPULATION FEATURES OF THE VIRGINIA OPOSSUM (DIDELPHIS VIRGINIANA) IN WESTERN TENNESSEE** D. M. Wolcott (pg 28)	**SELECTION OF ROOSTS BY MALE EASTERN SMALL-FOOTED BATS (MYOTIS LEIBII) IN NEW HAMPSHIRE: IMPORTANCE OF TEMPERATURE AND SIZE OF CREVICES** Timothy J. Brust (pg 31)
2:15	**ROOST SITE DENSITIES NEEDED BY INDIANA BAT (MYOTIS SODALIS) MATERNITY COLONIES** Abigail Schultz (pg 29)	**VARIATION IN THE ECHOLOCATION CALLS OF THE EASTERN RED BAT AND THE IMPLICATIONS FOR SPECIES IDENTIFICATION** Kevin L. Murray (pg 32)
2:30	**WINTER ROOST SELECTION AND ACTIVITY PATTERNS BY BATS IN A CYPRESS-GUM SWAMP IN GEORGIA** Matthew J. Clement (pg 29)	**SPRING MIGRATION OF FEMALE INDIANA BATS (MYOTIS SODALIS) FROM CAVES IN EASTERN TENNESSEE** Mark W. Gumbert (pg 32)
2:45	**SUMMER ROOSTING HABITAT SELECTION OF THE NORTHERN YELLOW BAT (LASIURUS INTERMEDIUS) ON SAPELO ISLAND, GEORGIA** Laci S. Coleman (pg 30)	**ECOLOGICAL CORRELATES OF DIETARY VARIATION IN THE WIDESPREAD INSECTIVOROUS BATS EPTESICUS FUSCUS AND MYOTIS LUCIFUGUS** Paul R. Moosman, Jr (pg 33)
3:00-3:30	**BREAK**	
	Genetics/Toxins (Salon C/D)	
3:30	**POPULATION GENETIC STRUCTURE SUPPORTS FEMALE ROOST PHILOPATRY IN LITTLE BROWN BATS (*MYOTIS LUCIFUGUS)*** Michael D. Dixon (pg 33)	
3:45	**IS CONSERVATION GENETICS A WASTE OF TIME? A POWER ANALYSIS OF GENETIC POPULATION MONITORING** Amy L. Russell (pg 34)	
4:00	**ASSESSMENT OF MERCURY ACCUMULATION IN BAT TISSUES IN THE NORTHEASTERN UNITED STATES** David E. Yates (pg 34)	

CONTRIBUTED ORAL PRESENTATION ABSTRACTS

Listed in order of presentation time

Methodology

THE INFLUENCE OF MOUSE (*PEROMYSCUS* SP.) SCENT ON SHERMAN LIVE-TRAP CAPTURE SUCCESS

Stephanie A. Rutan and Dr. Tim C. Carter. *Biology Department, Ball State University, Muncie, IN 47306 (SAR, TCC)*

Sherman live-traps have been extensively used in small mammal research. Investigators have noticed that capture success varies depending on both bait and scent of previous captures (Boonstra and Krebs 1976; Mazdzer, Capone, and Drickamer 1976; Drickamer 1984). Traps that have previously captured small mammals tend to have higher capture numbers than traps that have been cleaned or never captured animals before (Boonstra and Krebs 1976; Gurnell and Little 1992). However, it is still unclear if clean traps can be inoculated with the scent of other mice to increase trap success, while reducing the likelihood of contracting diseases associated with rodent excreta found in dirty traps. In this study, small mammals were captured using Sherman live-traps to determine if a lab collected mouse scent placed in clean traps would attract animals in the same way as dirty traps that have caught animals in the past. Scent from wild male and female *Peromyscus* were collected on shredded paper towel in lab cages that was later placed in the back of clean Sherman traps to serve as "experimental" traps. Brand new Sherman traps or traps disinfected with detergent were used as "clean" traps, and "dirty" traps were used that have captured animals before. One of each trap type was placed together in woodland habitats to offer small mammals a choice as to which trap type to enter on any given night. Significantly more animals were caught in dirty traps than clean, however, capture numbers between dirty and experimental taps were not significantly different, indicating that mouse scent in clean traps can be used to attract small mammals in a similar way as dirty traps. Further research could illuminate even stronger connections between the uses of fresh mouse scent to capture small mammals to reduce the likelihood of contracting certain zoonotic diseases.

A FORENSIC PATHOLOGY APPROACH TO DIAGNOSING BAT MORTALITY AT WIND FARMS

Katherine E. Rollins, David K. Meyerholz, Greg D. Johnson, Angelo P. Capparella, and Sabine S. Loew. *Illinois State University, Normal, IL 61790; University of Iowa, Iowa City, IA 52242; Western EcoSystems Technology Inc., Cheyenne, WY 82001; Illinois State University, Normal, IL 61790; Illinois State University, Normal, IL 61790.*

Although wind farms are generally considered an environmentally friendly method of energy production, many are associated with the death of relatively large quantities of migrating bats. Barotrauma is a phenomenon in which pressure changes cause tissue damage to air-containing structures (e.g., lungs, ears) and was proposed to be the primary cause of bat mortality at wind farms based on lung changes. Using mice as a model organism, we examined lung tissue to determine its utility as a marker of barotrauma fatality. We found that routine freezing of mice carcasses and post mortem decomposition, for as short a time period as a few hours after death, produced artifactual lung changes that mimicked lesions of edema and hemorrhage seen in bats at wind farms and claimed to be diagnostic of pulmonary barotrauma. If these tissue artifacts can be unambiguously excluded, the presence of traumatic injuries (e.g., bone fractures) in addition to lung hemorrhage should routinely default the forensic cause of death to blunt force trauma.

Importantly, the lack of detectable external injuries at gross examination does not completely rule out blunt force trauma as a cause of lung hemorrhage. Collision with moving wind turbine blades, being the most parsimonious hypothesis for bat mortality at wind farms, should be initially diagnosed under all circumstances where it cannot be unequivocally excluded as cause of death.

EFFICIENT REPEATABLE APPROACH TO QUANTITATIVE IDENTIFICATION OF BAT ECHOLOCATION CALLS

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Since the inception of bat detectors, researchers have attempted to identify bats based on their echolocation calls. The excepted method of identification is to qualitatively compare the calls to a known library. Identification is subject to the individual tasked with interpretation, making it difficult to be represented as repeatable science. Additionally, manually traversing thousands of call files is time prohibitive. Our goal was to produce a program capable of emulating the qualitative analysis of an experienced researcher. The program, currently named Bat Call Identification (BCID), interacts with AnalookW to filter noise and extract call parameters. Using a known call library, collected over 10+ years from eight states by several universities using light tags, hand releases, and passive monitoring where only a single species was present, extracted parameters are compared to quantitative ranges for parameters produced by species known to exist in the region. Individual chirps are then assigned a species and the dominate species present in the sequence is the predicted value. If no species dominates, a value of unknown is assigned. BCID analyzes approximately 2580 calls/min. The following accuracy rates were obtained: Low - 100% correct species group, 88.71% correct species, 1.08% unknown, 10.22% misidentified (Eptesicus fuscus, Lasiurus cinereus, Lasionycteris noctivagans) (n = 186), Mid – 97.24% correct species group, 88.95% correct species, 1.66% unknown, 9.39% misidentified (L. borealis, Nycticeius humeralis, Perimyotis subflavus) (n = 181), Myotis – 95.88% correct species group, 86.60% correct species, 2.06% unknown, 11.34% misidentified (Myotis sodalis, M. septentrionalis, M. grisescens, M. lucifugus, M. leibii) (n = 291). The overall performance of the software with these species is: 97.42% correct species group, 87.84% correct species, 1.67% unknown, 10.49% misidentified. BCID allows individuals with no experience to obtain meaningful results, while those with extensive experience are able to adjust settings in order to suit their needs.

A NON-INVASIVE ACOUSTIC MONITORING TECHNIQUE FOR WHITE-NOSE SYNDROME SURVEILLANCE

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Interior surveys of hibernacula are currently the most effective method of White-Nose Syndrome (WNS) surveillance; however, possibility of human transmission, increased disturbance to hibernating bats, and/or the large number of hibernating sites serves to easily overwhelm resource managers. As early reports documented abnormal activity (e.g., below freezing and daytime bat activity) at hibernacula entrances, we investigated the ability of Anabat II detectors to record differences in bat activity levels at WNS symptomatic (infected) and asymptomatic (assumed WNS-free) hibernacula. We deployed Anabat systems from 21 December 2009 to 13 April 2010 to automatically record bat activity at 7 hibernacula (3 – second-winter infected sites, 2 – first-

winter infected sites (one only PCR confirmed), and 2 – asymptomatic sites) in Pennsylvania. Second-winter WNS sites had higher activity than both first-winter and asymptomatic sites during January and February, although in March activity for a first-winter infected site, visibly confirmed fungus, had surpassed even second-winter infected sites. Similarly, mean daytime activity and activity below freezing were lower for asymptomatic sites than the other two groups, although the PCR positive site had similar activity levels to the asymptomatic sites. This may suggest that abnormal behavior is only demonstrated after the fungus has progressed to a certain level within a colony. We also sampled the same sites during the winter of 2010-2011 and preliminary results will be discussed. While more data is needed on the relationship between the degree of WNS infection and activity rates, acoustic monitoring appears to offer a non-invasive, effective, and affordable approach for WNS surveillance.

EFFECTIVENESS OF USING A BAT HAT REFLECTOR PLATE OR PVC TUBE IN PRECONSTRUCTION ACOUSTIC SURVEYS TO ACCESS BAT ACTIVITY AND SPECIES COMPOSITION

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Large numbers of bats being killed at wind energy facilities encourages preconstruction surveys of bat activity using acoustic monitors. Several different monitoring designs are currently in use that have varying levels of success. This study explores the differences between Anabat Detectors (Titley Electronics, Australia) in waterproof boxes utilizing either a 90 degree PVC elbow or the Bat Hat with reflection plate. This study was done as part of a preconstruction survey from August to October of 2010 at a potential construction location. At two meteorological towers, bat hats with reflection plates were placed at 3 meters (low) and 55 meters (high). Ten ground based detectors employing the 90 degree PVC elbow were placed across the project area. An additional ground based detector was affixed with the bat hat and reflection plate and placed next to one of the PVC tube ground detectors. An automated bat call identification software program was used to identify call sequences. The side-by-side comparison of the bat hat versus the PVC tube show 46% more 2-pulse bat passes using the PVC tube set up (PVC=3891 bat passes, bat hat=1772 bat passes). Using 5-pulse call sequences, 2,062 more species specific identifications were made using the PVC tube (PVC=3111, bat hat=1049). Ground detectors using the PVC tube recorded 59% more 2-pulse sequences/detector night, and 42% more 5-pulse sequences/detector night as compared to bat hats at the low placement at met towers. These results indicate that these two setups are not equivalent and cannot be used interchangeably. Further more, using a bat hat reflector plate appears to result in an underestimation of total and relative bat activity.

Human Dimensions

IMPACTS OF DIFFERENT FOREST TREE-HARVEST METHODS ON POPULATIONS AND DIETS OF INSECTIVOROUS FOREST BATS.

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The Hardwood Ecosystem Experiment (HEE) in central Indiana presents an excellent opportunity to study species reactions to different forestry practices. These different practices include clearcutting, shelterwood cutting, and single tree selections. My master's thesis focuses on the change in diets of the different insectivorous bat populations in each of the HEE management

units. Species in this study are bats and include *Myotis septentrionalis, Lasiurus borealis, Eptesicus fuscus, Perimyotis subflavus, Myotis sodalis, Myotis lucifugus,* and *Lasionycteris noctivagans*. Since insectivorous bats are theorized to not simply eat whatever is available, it is hypothesized that the diets of these bats will not change despite their changing environment. Guano has been collected between years 2006-2010. I have analyzed 440 guano samples. The invertebrate parts in the guano are identified to as low a taxonomic level as possible; this is most often to family, but always order for the highly digested Lepidopterans. Species can be determined in some insects with very unique colorings. The data are compared within each species: before and after treatment, across treatment types, between males and females, between adults and juveniles, and across different months. The data are also compared between species, i.e. which one changed the most. Preliminary results suggest that despite a significant change in numbers of captured bats and therefore a probable affect of forestry practices on the local bat populations, there is no significant change between bat diets before and after treatment. This result reinforces previous theories about bats specifically selecting their diets and not simply eating available foods.

COMPARING PRE- AND POST-CONSTRUCTION BAT ACTIVITY TO BAT FATALITY RATES AT A WISCONSIN WIND PROJECT

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Pre-construction acoustic surveys for bats at a proposed wind project in central Wisconsin yielded two different estimates of relative bat activity with two different implications for predicted fatalities. One estimate, derived from ground-based Anabat™ detectors at met towers, suggested relatively low fatality rates. However, the addition of data from a "reference" location within the proposed project site yielded a much higher estimate of bat activity, and therefore suggested the possibility of relatively higher fatality rates. Fatality searches at 30 turbines from July to October 2008 and from March to May 2009, yielded a higher than expected estimate of approximately 25 bats per MW during the study. In addition to the surprising level of fatalities, species composition deviated from that generally observed at other wind projects, with a relatively high proportion of non-lasiurine fatalities. We are currently completing re-analysis of the pre-construction acoustic data to incorporate species identification where possible, and including post-construction bat acoustic data that was collected concurrently with fatality searches to determine if there are significant correlations with overall activity levels, species activity levels, species presence histories, or spatial or temporal correlations. Results will be presented in the context of the predictive value of pre-construction bat activity data and suggestions for future study design will be discussed.

BAT USE OF FOREST STANDS IN RESPONSE TO SILVICULTURAL TREATMENTS IN THE DANIEL BOONE NATIONAL FOREST

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Previous studies have shown that forest management techniques that reduce forest clutter may have a positive effect on foraging bats. The objective of this study was to further assess bat community response to forest management practices by comparing bat response to various silvicultural treatments. Anabat II ultrasonic detector systems were used to determine bat activity

in 30 study units (7-19 ha) on the Cold Hill Area of the Daniel Boone National Forest, Kentucky. Bat activity was monitored in each unit for two consecutive nights a month from May through August 2006-2010. Sampling occurred for two to three years pre-treatment and two to three years post-treatment, depending on when treatments were implemented. Five treatments were implemented: shelterwood with reserves, oak-shelterwood, thinning, woodland-thinning, and control. Analook software was used to filter echolocation calls and calls were identified to species using a discriminant function analysis. A one-way Analysis of Variance was used to test whether bat activity differed pre- vs. post-treatment for each treatment and whether post-treatment activity differed among treatments. Bat species detected within the study area were big brown bats (*Eptesicus fuscus*), evening bats (*Nycticeius humeralis*), little brown bats (*Myotis lucifugus*), northern bats (*M. septentrionalis*), tricolored bats (*Perimyotis subflavus*), and red bats (*Eptesicus fuscus*). Post-treatment bat activity was significantly greater than pre-treatment activity in shelterwood with reserves, thinning, and woodland-thinning units ($P<0.05$). Post-treatment bat activity in shelterwood with reserves, thinning, and woodland-thinning stands was significantly greater than in oak-shelterwood and control stands. Overall, big brown bat, evening bat, tricolored bat, and red bat activity increased across the entire study area in response to the treatments, while northern bat activity did not vary throughout the study. These results suggest that treatments which greatly reduce clutter increase the overall suitability of forest stands for foraging bats in this region.

EFFECTS OF INTERCROPPING SWITCHGRASS AND LOBLOLLY PINE ON THE DIET AND TROPHIC POSITION OF *PEROMYSCUS LEUCOPUS*.

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Rodents are an important energy link between producers and higher trophic consumers. While effects of traditional timber management on vertebrates are well studied, effects of management of forests for biofuels production on rodents are poorly understood. Intercropping switchgrass (*Panicum virgatum* L., a native C_4 grass) in existing loblolly pine (*Pinus taeda*) plantations is being considered as a sustainable method for producing biofuels feedstocks. We conducted a study of a common native rodent, the white-footed mouse (*Peromyscus leucopus*), to examine if they would use planted switchgrass as a food source, or if they would maintain a diet of existing food resources associated with pine. Rodents were live trapped in four replicates of three different treatments: (1) pine with residual woody biomass removed, (2) pine with biomass removed and intercropped with switchgrass and (3) switchgrass-only. We assessed the diet and trophic position of mice using carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotope analysis of ear tissue samples collected in 2009. We hypothesized that there would be a treatment effect of intercropping switchgrass on the dietary preference and trophic position of *P. leucopus*. Analysis of 2009 samples showed that diet was heavily influenced by C^3 plants. However, there was no treatment effect on the mean $\delta^{13}C$ and $\delta^{15}N$ values of skin samples. In contrast, there was a seasonal effect on the mean $\delta^{13}C$ and $\delta^{15}N$ values when comparing the summer and fall months. Mouse tissue was more enriched in the summer and became more depleted in the fall. Enriched values suggest some influence of C^4 plants, potentially switchgrass, in the diet. For $\delta^{15}N$, mouse tissue was more enriched in the fall than in the summer, which suggests mice were eating at a higher trophic position in the fall. We are currently analyzing data from the 2010 field season and will discuss combined results from 2009 and 2010.

THE USE OF BRIDGE EXPANSION JOINTS AS MATERNITY ROOSTS BY *MYOTIS LEIBII* (EASTERN SMALL-FOOTED BAT) IN WEST VIRGINIA

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Myotis leibii (Eastern Small-footed Bat) is considered a "Species of Management Concern" and has recently been recommended for federal protection. In addition, *Myotis leibii* is one of the six (6) bat species in which there have been documented mortalities as a direct result of White Nose Syndrome. Artificial or man-made structures are known to provide roosting habitat for several species of bats. The most common artificial roosts include houses (attics, eves, siding, and shutters), barns, buildings, shelters, cisterns, culverts, and bridges. Bats roosting in bridges are typically located underneath the structure. However, *Myotis leibii* appears to show a preference for roosting within narrow crevices ("expansion joints") on the upper sides of concrete bridges. This phenomenon was first documented for *Myotis leibii* in the 1960s in Pulaski/Laurel County, Kentucky. This colony still persists. Since that time a few other bridges within the range of this species have been found to harbor *Myotis leibii*. Some bridges contain only a single bat, a small number of bats (usually males and non-reproductive females), or a large number (20 – 50) of bats (maternity colonies). During 2010, eight (8) bridges containing *Myotis leibii* were documented in West Virginia. Three (3) of these bridges are maternity colonies. Observations, video recordings, and ultrasonic recordings at these bridges showed that *Myotis leibii* is a species that utilizes passive (non-flight) foraging during the daytime. This strategy has been documented in a few other bat species. While I do not necessarily advocate the incorporation of artificial bat roosts into bridge construction or replacement projects, information gleamed from this study and other bridge surveys can serve as an indicator for the health of this species (for which there is a notable lack of solid population data) and also to guide artificial bat roost construction efforts.

White-nose Syndrome

IDENTIFICATION OF INTEGUMENTARY DEGRADING PROTEASES IN *GEOMYCES DESTRUCTANS* BY PEPTIDE MASS FINGERPRINTING

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Geomyces destructans is a dermatophytic agent isolated from cave-dwelling bats and is the putative pathogen responsible for White-Nose Syndrome (WNS) and the associated mass mortality of North American cave bats. Dermatophytosis normally requires the fungus adhere to the extracellular matrix of a host organism, which consists of hard cornified insoluble structural proteins. The fungus can then activate a suite of genes expressing proteolytic enzymes thus degrading and metabolizing the host integument. One clinical sign of WNS is necrosis of fragile wing tissue of bats. We hypothesize that *G. destructans* secretes extracellular proteases that are responsible for lesions observed in infected host tissue and play a critical role in pathogenicity. We are attempting to identify putative proteases based on structure using matrix assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS). Enzymes secreted by *G. destructans* grown *in vitro* in protein-limited culture media were separated by SDS-PAGE. Protein targets were digested with trypsin and peptide mass fingerprints (PMF) were acquired by MALDI-TOF MS. The PMF data will be processed and evaluated with the annotated genome

sequence for *G. destructans* (soon to be available at www.broadinstitute.org.) These studies will aid in the identification of possible virulence factors released by *G. destructans*.

DEMOGRAPHIC AND BIOMETRIC CHANGES IN *MYOTIS LUCIFUGUS* WITH THE ONSET OF WNS IN VIRGINIA: PRELIMINARY RESULTS

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White-Nose Syndrome (WNS) was first discovered in Virginia in February 2009. In response we initiated a banding effort to document demographic and biometric changes in bats potentially affected by WNS. From May 2009 to November 2010 we banded 2,632 bats at 15 sites. Bats were banded during the fall swarm (729) and early (1079) and late hibernation (824) periods. We recaptured 91 individuals 95 times for a recapture rate of 3.6%. Of these, 82 (86.3%) were captured during early hibernation, 7 (7.4%) in late hibernation, and 6 (6.3%) in fall swarm. Eleven (12%) of the recaptures were banded during fall swarm, 33 (36.4%) in early hibernation, and 51 (51.6%) in late hibernation. The percentage of *Myotis lucifugus* captures during fall swarm declined between 2008 (45.3%), 2009 (33.7%), and 2010 (18.6%) at four sites sampled annually as well as across all sites combined, 45.3%, 23.3%, and 19.1%, respectively. The male to female sex ratio for *Myotis lucifugus* during fall swarm was similar between 2008 (7.3:1) and 2009 (7.9:1), $X^2 = 0.03$, df = 1, $P = 0.85$, but declined significantly in 2010 (1.5:1), $X^2 = 18.9$, df = 2, $P < 0.001$. This decline was also documented in the early hibernation surveys, 2.2:1 in 2009 and 1:1 in 2010, $X^2 = 24.7$, df = 1, $P < 0.001$. Body Mass Index (BMI) for adult male *Myotis lucifugus* in October was significantly different at some sites compared to pre-WNS sites. For example, the BMI at a second year WNS site did not differ significantly between 2008 (0.25, pre-WNS) and 2009 (0.24, 1st yr. WNS), $t = -1.27$, $P = 0.21$, and between 2008 and 2010 (0.25, 2nd yr. WNS), $T = 156.0$, $P = 0.72$, while the BMI at a first year site was significantly different between 2008 and 2010 (0.21), $T = 2476.0$, $P < 0.001$. For all sites combined, BMI was not significantly different between 2008 (0.25) and 2009 (0.24), $t = 1.72$, $P = 0.09$, but was significantly different between 2008 and 2010 (0.21), $T = 4716.5$, $P < 0.001$, and between 2009 and 2010, $T = 5689.5$, $P < 0.001$.

ZERO-INFLATED COUNT MODELS FOR IMPERFECTLY DETECTED INVASIONS: IMPLICATIONS FOR WHITE NOSE SYNDROME SURVEILLANCE

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Zero-inflation describes distributions for count data in which the proportion of zeroes exceeds that expected for an ordinary distribution. Early in the course of invasions, counts of invasive organisms may be characterized by zero-inflation of two origins: true zeroes recorded at locations beyond the margins of the invasion, and false zeroes due to imperfect detection of invading organisms. One such imperfectly detected invading organism is *Geomyces destructans*, the infective agent implicated in White Nose Syndrome (WNS) of bats. Imperfect detection may be accommodated by using mixture models, such as occupancy models. These models typically rely on repeated measures sampling schemes, but such intensive samples are not always available, particularly when working with disturbance-sensitive organisms such as hibernating bats. We tested zero-inflated negative binomial mixture models for imperfectly detected invasions using independent, non-repeated measures data. We used simulated data where population parameters were known. We found that the proportion of false zeroes could be estimated when covariates of

both true zeroes and detection probability were measured and included in the models. Models including these covariates were reliably selected by Akaike's Information Criterion over intercept-only models suggesting that covariates of detection can improve the reliability of occurrence estimates from WNS surveillance data.

EVALUATING CHANGES IN BAT ACTIVITY AND SPECIES COMPOSITION FROM WHITE NOSE SYNDROME AT FIXED ACOUSTIC MONITORING LOCATIONS IN VERMONT

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White Nose Syndrome (WNS) was first documented in southeastern Vermont during the winter of 2007/2008. This syndrome has since spread throughout the region causing unprecedented mortality in certain bat species over the past three winters. In Vermont, mortality associated with WNS has been documented at 80-90 percent in selected hibernacula. It is vital to verify and model expected declines in northeastern bat populations due to the possible future extirpation of local or regional populations. With that in mind, Stantec augmented a two-year acoustic survey of bat activity on Grandpa's Knob in Vermont conducted in summers 2007 and 2008 with a third and fourth summer of acoustic surveys in 2009 and 2010 to document changes in acoustic activity potentially related to the onset of WNS. Five Anabat detectors were deployed in the same locations each year and passively recorded activity data from June 1 to July 31 to target the residency period of WNS-affected species. Recorded files containing pulses with minimum frequencies above 30 kHz were used in a discriminant function analysis to assign species identification, and files were summarized by year and species. Monthly and yearly detection rates varied among identified species, but were lowest in 2010. Because data collection began before WNS spread into Vermont, these studies provide an opportunity to compare pre- and post-WNS acoustic activity, and represent the most intensive acoustic survey conducted in Vermont to date.

CAPTURE AND REPRODUCTIVE TRENDS OF SUMMER BAT COMMUNITIES IN WEST VIRGINIA: ASSESSING THE IMPACT OF WHITE NOSE SYNDROME

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Although the short-term impacts are evident, the long-term impact of white-nose syndrome (WNS) on bat communities in the eastern United States is largely unknown. However, "historical" (pre-WNS) capture records and individual reproductive observations provide baseline data about bat communities. In West Virginia, WNS was first detected in Spring 2009 and spread along the extent of the Ridge and Valley east of the Allegheny Front where most of the state's caves occur and where many bats summering west of the Allegheny Front presumably hibernate. Therefore, we examined trends in summer (15 May – 15 August) capture success and reproductive patterns before (1997-2008; 10,000 captures) versus after (2010; 1,300 captures) detection of WNS across the state. We predicted that capture success (no. individuals captured/

net-night) would decrease in 2010. Moreover, we posited that the presumed energetic strain of WNS would cause females to delay reproduction, denoted by a greater proportion of pregnant/lactating females later in the summer. Female reproductive failure also could be noted by a lower relative proportion of juvenile captures in the mid-late summer post-WNS. From >5000 records where capture success could be calculated, we found a dramatic drop in capture rates of little brown (*Myotis lucifugus*), northern long-eared (*M. septentrionalis*), small-footed (*M. leibii*), and tri-colored (*Perimyotis subflavus*) bats. In all cases, 2010 capture rates were ≤ 50% of pre-WNS rates. Conversely, capture success of big brown (*Eptesicus fuscus*) and red (*Lasiurus borealis*) bats significantly increased in 2010, and together comprised 55% of all captures (pre-WNS captures = 11% each). Data acquisition and reproductive analyses are on-going. Results may further elucidate short-term impacts and help us envision long-term consequences of WNS. Data may also be used to track temporal population trends and predict regional extirpations similar to recent studies of the little brown bat in the northeastern Unites States.

Survey/Inventories

USE OF ACOUSTIC BAT DATA TO CHARACTERIZE LARGE-SCALE MIGRATION PATTERNS FOR LONG-DISTANCE MIGRATORY BAT SPECIES IN THE NORTHEASTERN U.S.

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Stantec has collected acoustic bat data from over 20 distinct sites in the northeastern United States proposed for commercial wind development between 2007 and 2010. Results and analysis of 2007 and 2008 monitoring have been presented previously, although Stantec has now incorporated results from 2009 and 2010 monitoring to increase the rigor of analyses and conclusions drawn from these data. Nightly acoustic activity rates from each site were compared within and among regions to determine spatial and temporal activity patterns on a regional scale, which were then used to characterize large-scale migration patterns. Whereas the utility of acoustic bat data collected at a single site to document migration events is confounded by numerous sampling biases, simultaneous collection of acoustic data at multiple sites in a large area dramatically increases the analytical power and relevance of this survey method for characterizing bat migration. The addition of two years of acoustic data will improve not only the temporal but the spatial scope and accuracy of the analysis. This dataset is the largest of its kind available for the northeast region and will help understand patterns of regional movement and therefore risk of mortality of long-distance migratory bats at wind projects.

ACOUSTIC SURVEY OF OFFSHORE BAT ACTIVITY AND MIGRATION IN THE GULF OF MAINE

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While migratory bat species are known to cross large bodies of water and have been documented far offshore, little quantitative data exist on the seasonal movements and activity patterns of bats in the offshore marine environment. In 2009 and 2010, we coordinated and conducted the first regional offshore acoustic bat monitoring effort to occur along the northeast Atlantic coast. Paired detectors were placed in lighthouses and on temporary towers in locations along an approximately 180-mile offshore transect in the Gulf of Maine to assess species presence and

regional patterns of seasonal offshore activity. Acoustic activity was monitored on a nightly basis between mid July and early November at each location, and data were summarized to document species-specific activity patterns during the fall migration period. Migratory bat species were documented at all survey points, including sampling locations up to 20 miles offshore. Temporal and spatial patterns of acoustic activity suggested that large-scale migration events may occur offshore, and that timing of offshore migration is similar to that documented inland. In addition to facilitating better understanding of seasonal movement and activity patterns of bats offshore, implications of these data include predicting and mitigating potential risk of bat mortality at offshore wind energy developments.

A SURVEY OF THE MAMMALS AT RUSSELL CAVE NATIONAL MONUMENT

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A survey of the mammals at Russell Cave National Monument (RCNM) in Jackson County, Alabama, was conducted during the summer and fall of 2009 and spring of 2010. Sampling procedures included live trapping, bait/camera stations, scent stations, mist netting, spotlight surveys, and general observations. Twenty-nine species, representing 8 orders and 14 families, were verified to occur on the site. Results reflected the presence of 1 species of opossum (Virginia Opossum, *Didelphis virginiana*), 1 species of shrew (Northern Short-tailed Shrew, *Blarina brevicauda*), 1 species of mole (Eastern Mole, *Scalopus aquaticus*), and 6 species of bats (Gray Myotis, *Myotis grisescens*; Northern Myotis, *Myotis septentrionalis*; Tri-colored Bat, *Perimyotis subflavus*; Big Brown Bat, *Eptesicus fuscus*; Eastern Red Bat, *Lasiurus borealis*; and Evening Bat, *Nycticeius humeralis*). Other species documented included: Nine-banded Armadillo (*Dasypus novemcinctus*), Eastern Cottontail (*Sylvilagus floridanus*), 11 species of rodents (Eastern Chipmunk, *Tamias striatus*; Woodchuck, *Marmota monax*; Eastern Gray Squirrel, *Sciurus carolinensis*; Southern Flying Squirrel *Glaucomys volans*; American Beaver, *Castor canadensis*; White-footed Deermouse, *Peromyscus leucopus*; Cotton Deermouse, *Peromyscus gossypinus*; Hispid Cotton Rat, *Sigmodon hispidus*; Allegheny Woodrat, *Neotoma magister*; Woodland Vole, *Microtus pinetorum*), Domestic Dog (*Canis familiaris*), Coyote (*Canis latrans*), Gray Fox (*Urocyon cinereoargenteus*), Raccoon (*Procyon lotor*), Eastern Striped Skunk (*Mephitis mephitis*), Feral Cat (*Felis catus*), and White-tailed Deer (*Odocoileus virginianus*). One endangered species (Gray Myotis) was recorded during the survey.

RESULTS OF A LARGE SCALE MIST-NETTING SURVEY OF THE PINE CREEK GORGE AREA, TIOGA AND POTTER COUNTIES, PENNSYLVANIA

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During the summer of 2010, a large-scale mist-netting survey was conducted along the west rim of the Pine Creek Gorge, located in northcentral Pennsylvania, as part of a survey for Indiana bats. One hundred thirty sites were mist-netted using the USFWS Standard Protocol for surveying for Indiana bats. The habitat ranged from deciduous forest along ridgetops and the sides of small valleys, stream corridors with mixed forests and edge habitat along agricultural fields or other openlands. All surveys consisted of triple-high nets (6m to 12m wide) set in appropriate corridors and opened for not less than 5 hours. All sites were netted for 2 nights. Other established White Nose Syndrom were guidelines followed included assessing bats for wing damage as well as decontamination protocols. A total of 1,835 bats of 7 species were captured over the course of the project including 790 *Myotis septentrionalis*, 648 *M. lucifugus*,

166 *Eptesicus fuscus*, 122 *Lasiurus borealis*, 56 *L. cinereus*, 45 *Lasionycteris noctivagans* and 2 *M. leibii* with 6 bats not identified. The totals for both *Lasiurus cinereus* and *Lasionycteris noctivagans* are presently thought to be the historically largest single season capture numbers for these two species in Pennsylvania and include a lactating *Lasiurus cinereus.* The number of captured silver-haired bats may indicate a resident population within the Pine Creek Gorge area, which would support a change in status of this species from non-resident migrant to resident. In light of ongoing declines in bat populations due to WNS, this project should provide a good baseline comparison for future reference should someone undertake to duplicate this particular study.

SEVENTEEN YEARS OF BAT HIBERNACULA MONITORING IN WISCONSIN

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Since 1994 and 1995 through 2009, censuses of hibernating bats have been conducted in three abandoned lead mines and one railroad tunnel in southwestern Wisconsin have been censused. Originally intended to determine whether a non-standard gate on one of the abandoned mines was suitable to protect cave bats, this study has provided the first long term trend data of Wisconsin cave bats. The census protocol calls for all counts to be taken during the last week of January or first week of February, with each site being checked as close to the same calendar date as possible to previous visits. Sites were generally checked every other year, (range 1-6 years). Search effort was also recorded. While the results are variable from check to check, some long term trends have emerged, some significant. *Myotis lucifugus* counts have remained stable to slightly increasing. *Perimyotis subflavus* counts have significantly increased, corresponding to reports elsewhere in the United Stated that this species seems to be expanding its range. The numbers counted of *Myotis septentrionalis* and (except for one site) *Eptesicus fuscus* have been too small characterize trends. The railroad tunnel contains hundreds of *E. fuscus*, but the numbers fluctuate greatly each year. Given the crevice roosting of hibernating *M. septentrionalis* and the mobility of *E. fuscus* during the winter, these censuses are not adequate for describing trends in these two species. Censuses should be conducted in 2011 and data from those will update these results. With the imminent arrival of White Nose Syndrome, which has not yet been documented in Wisconsin, 2011 may mark an inflection point in the trend data.

Habitat

LANDSCAPE METRICS OF INDIANA BAT (*Myotis sodalis*) HABITAT IN CENTRAL NEW YORK

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Indiana bat (*Myotis sodalis*) habitat has most frequently been defined in the literature in terms of roost structure metrics. The limited research on Indiana bat habitat at broader landscape scales has tended to focus on arbitrarily defined spatial extents. Organisms select habitat at multiple spatial scales, however, so it is important to understand habitat metrics for a given species at multiple spatial scales in order to develop useful models for identifying potential habitat for that species. Spatial scales should be related to specific ecological processes of the species being studied if the resulting data are to be relevant, useful, and applicable to habitat modeling. Radio telemetry data were used to define ecological neighborhoods for roosts, foraging areas, and seasonal dispersal regions of Indiana bats in Central New York. I measured 5 independent physiographic landscape metrics for each neighborhood type relative to patch size, complexity,

arrangement, and distance to fixed landscape features. I compared variation among those metrics with those found in randomly selected areas of equal size to determine which metrics varied least, suggesting selection based on that metric. Results of this analysis will be presented to illustrate how each metric varied relative to random locations and whether any of the metrics might be used to model Indiana bat habitat in Central New York.

HABITAT ASSOCIATION OF FORAGING BATS ON GEORGIA'S BARRIER ISLANDS

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While bat habitat associations have been studied across much of the Southeast, few studies have focused on foraging habitat associations of bats on barrier islands of the Atlantic coast. We examined habitat associations of foraging bats on Jekyll, Sapelo, Little St. Simons, and St. Simons Islands, Georgia, in summer 2010 using active acoustic transects with Anabat II detectors. As a secondary objective, mist netting and acoustic data were compared for their ability to determine species richness for Sapelo and Little St. Simons Islands. Each acoustic route was run approximately 30 minutes after sunset while foraging activity was high. A GPS unit was connected to the detector to record the location of each recorded call. Analook software was used to identify species from each call. Using Arc GIS we plotted call locations onto a vegetation cover map obtained from Georgia Department of Natural Resources. We created 100 m and 500 m buffers around each location and examined habitat attributes within each buffer. Attributes included percentage of each habitat type, percentage of area developed, and linear road distance within each buffer. Most calls were recorded along the edge of hardwood stands with freshwater or swamp/marsh nearby. Comparison of methods suggest that active acoustic transects detect greater species richness than mist nets. With the demand for increasing development of coastal areas, conservation of freshwater wetlands interspersed within forested habitats is an important consideration in bat conservation.

HABITAT AND POPULATION FEATURES OF THE VIRGINIA OPOSSUM (*DIDELPHIS VIRGINIANA*) IN WESTERN TENNESSEE

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Habitat and population features of the Virginia opossum (*Didelphis virginiana*) were investigated over a 10-year period. The study was conducted at the Meeman Biological Station in western Tennessee. Sampling (during winter) was carried out on a trapping grid of 50 traps spaced approximately 150 m apart in a 5 x 10 pattern. Trapping (utilizing mark/recapture techniques) was for 40 nights during each year, which resulted in about 20,000 trap nights during the investigation. Population density, sex ratio, total length, and body weight were determined from captured animals. Additionally, captures were assessed in light of selected habitat variables. The population was found to be dynamic across years. Values for natural-history traits and habitat features are discussed in light of previous reports.

ROOST SITE DENSITIES NEEDED BY INDIANA BAT (*MYOTIS SODALIS)* MATERNITY COLONIES

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The proposed density of snags per hectare needed to support a maternity colony of *Myotis sodalis* (Indiana bats) is based on 1 study in Illinois from the 1980s. It was determined that there were 64 snags per hectare in upland areas and 41 snags per hectare in floodplains (Garner and Gardner 1992). Therefore, land managers have taken these recommendations and used them to base their subsequent manage decisions. With the population numbers of *Myotis sodalis* again declining, it is increasingly important to understand the habitat requirements of these maternity colonies. Therefore, this study aimed to further investigate the relationship of snag densities (i.e. potential roost sites) to maternity colonies. In the summer and early fall of 2009 and 2010, a total of 10 sites were surveyed for snags, 3 hydric areas and 3 non-hydric areas in Indiana, 2 hydric and 2 non-hydric areas in Illinois. At each location, multiple transects (300m x 30m) were surveyed for snags. A suite of variables were used to determine if each snag was a suitable as a potential roost. The density of snags for both hydric and non- hydric areas in Indiana and Illinois were drastically less than the densities presented by Garner and Gardner (1992). At least in these study areas, it appears that significantly fewer snags are needed to maintain *Myotis sodalis* maternity colonies. Additionally, the snag density between hydric and non-hydric areas did not show a clear trend. This suggests that snag density may not be a driving force behind habitat selection of *Myotis sodalis.*

WINTER ROOST SELECTION AND ACTIVITY PATTERNS BY BATS IN A CYPRESS-GUM SWAMP IN GEORGIA

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Knowledge of winter roosts and activity of southeastern bats lags understanding of summer roosting ecology despite their importance to bats' persistence. Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) and southeastern myotis (*Myotis austroriparius*) are species of concern whose winter tree roost selection is constrained by seasonal flooding typical in cypress-gum swamps. Additionally, as tree roosting bats, they must survive the winter in roosts that are less buffered against temperature changes than typical cave hibernacula. Our goals were to locate winter roosts for these bat species, compare them to summer roosts, and relate temperature data to roost selection and activity levels. We used basal hollow searches, arborist climbing techniques, and radio telemetry at River Bend WMA in Laurens County, Georgia to identify and characterize diurnal winter roosts. We measured characteristics of potential roosts and compared them to winter roosts and previously measured summer roosts. We also measured the temperature profiles of 22 hollow trees and 10 bats. We used logistic regression to predict roost tree occupancy and bat activity from temperature data and used Akaike's information criterion to select the most parsimonious models. We identified 149 potential roost trees and we were able to inspect the interior of 46. We also radio tracked 10 bats with temperature sensitive radio transmitters. We located 23 Rafinesque's big-eared bat roosts and 5 southeastern myotis roosts. For Rafinesque's big-eared bats, winter roost trees were similar to available trees and summer roost trees. For southeastern myotis, winter roost trees were smaller than available trees and summer roost trees. The best supported hypotheses were that bat activity increased with maximum ambient temperatures and that roost occupancy was unrelated to roost temperatures. Rafinesque's big-eared bat roost selection appeared to be less affected by seasonal flooding, while activity levels were more affected by winter temperatures, relative to southeastern myotis.

SUMMER ROOSTING HABITAT SELECTION OF THE NORTHERN YELLOW BAT (*LASIURUS INTERMEDIUS*) ON SAPELO ISLAND, GEORGIA

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Anecdotal evidence suggests that the northern yellow bat (*Lasiurus intermedius*) typically roosts solitarily in Spanish moss (*Tillandsia usneoides*) along the Georgia coast and on Eastern barrier islands. However, few quantitative data are available regarding roost tree and landscape level factors affecting northern yellow bat roost site selection. We examined roost-selection by 4 northern yellow bats on Sapelo Island, Georgia summer 2010 using radio telemetry. Bats were captured 18 May-2 June in mist nets set over water sources. For each captured bat, sex, reproductive status, age, forearm length, weight, and wing condition were recorded and a 0.33 g transmitter was attached using surgical adhesive. Roosts were located daily using a telemetry receiver and a 3-element Yagi antenna. A random tree was paired with each roost tree identified. For each roost and random tree, species, DBH, tree height, roost height, roost description (foliage, moss, bark, etc.), and whether the tree was dead or alive were recorded. The number of midstory trees and the DBH and height of each overstory species was recorded within a 0.04-ha plot around each roost and random tree. Landscape metrics including distance from capture site, distance to roads, distance to water, and distance to varying stand types were determined in ArcGIS for all roost trees and random trees. All bats in our study roosted in Spanish moss hanging in hardwood trees and all were located within 1 km of their capture sites. Results suggest that northern yellow bats select roost trees that have a larger DBH and are taller than random trees. Males (n=3) showed a greater tendency to switch roost trees than pregnant females (n=1). Due to the small sample size, reliable trends between sexes may not be discerned from this study. However, because little roost selection data exists for this species, this work will be the foundation for future studies.

Ecology

OBSERVATIONS OF GOLDEN MOUSE (*OCHROTOMYS NUTTALLI*) VISITATION OF SWAINSON'S WARBLER (*LYMNOTHLYPIS SWAINSONII*) NESTS

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In the Southeast, the distribution and habitat of *Ochrotomys nuttalli* and *Lymnothlypis swainsonii* greatly overlap. Swainson's warbler (*Lymnothlypis swainsonii*), a species of high management concern, is a medium-sized neotropical migrant that breeds in the southeastern United States and winters on Caribbean islands, the Yucatán Peninsula, and in eastern Mexico. It is considered a "dead-leaf" specialist that is dependent upon dense understory vegetation within forests to forage for arthropods by flipping over dead leaves on the ground. Its cup-shaped nest of leaves, moss and pine needles is built up to 3m above the ground in this dense vegetation; much like the nests of *O. nuttalli*. In fact, *O. nuttalli* often move into abandoned *L. swainsonii* nests. In a recent study investigating factors influencing Swainson's warbler, *L. swainsonii*, breeding biology at the Roanoke River National Wildlife Refuge, Bertie CO., NC, infrared video cameras were used to continuously monitor nests for parental activity and nest depredation. Field work was conducted during breeding seasons of 2006 through 2009. From thousands of hours of video, four events of

the visitation of *L. swainsonii* nests by *O. nuttalli* were documented. The recording of one such event seems to document the partial scavenging of a non-viable chick.

SOCIAL NETWORKS OF RAFINESQUE'S BIG-EARED BAT (*CORYNORHINUS RAFINESQUII*) IN KENTUCKY

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The nature of social interactions among colonial bat species has been an area of interest for researchers and land managers for several years. Understanding the relationships between individuals within and among bat colonies holds important insights to conservation efforts, but is difficult to observe. To date, methodologies used to examine these relationships have been limited in their ability to provide insights beyond the understanding that many bat species exhibit non-random, fission-fusion colonial behaviors. Our study aimed to describe the nature of colonial behavior in a socially roosting bat species, Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), using social network analysis. Data was collected concurrently in a bottomland hardwood landscape and an upland karst landscape, where use and availability of day-roosts differed. We radiotagged 85 of Rafinesque's big-eared bats from 2009 through 2010, tracking radiotagged bats to 101 day-roosts in the two study areas. Data were analyzed using the computer program UCINET to examine the properties of social networks of big-eared bats, including centrality, homophily, clustering and cohesion. Data will be presented for network analyses based on characteristics of radiotagged bats as well as analyses based on properties of day-roosts. Data will be analyzed and presented for both study areas. Potential differences in social behaviors between study areas, and differences in individual bats' attributes within the social network will also be presented.

SELECTION OF ROOSTS BY MALE EASTERN SMALL-FOOTED BATS (*MYOTIS LEIBII*) IN NEW HAMPSHIRE: IMPORTANCE OF TEMPERATURE AND SIZE OF CREVICES

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Roosting ecology of the eastern small-footed bat (*Myotis leibii*) is poorly understood. We studied physical dimensions and temperature profiles of 28 roosts of 7 male *M. leibii* in New Hampshire and compared these characteristics to an equal number of nearby randomly selected crevices. Most roosts (n=23) were in crevices between boulders on a dam resembling a natural talus slope, with fewer roosts occurring on cliffs 50-m to 4-km from the dam. Bats typically roosted alone and moved to new roosts each day. Roosts on the dam were narrower, but longer and deeper, and were more likely to occur on South facing slopes and have openings that faced Southwest, relative to random crevices. Crevices on the dam generally reached temperatures that averaged 9.4°C higher than maximum ambient temperature. However, roosts obtained maximum temperatures that were significantly farther above ambient than those reached by random crevices. Maximum temperature of crevices was positively correlated with depth of crevices, but was random with respect to remaining variables. Results suggest that exposed rock formations are substantially warmer than alternative habitats. Furthermore, male *M. leibii* apparently selected some attributes of crevices for thermoregulatory benefits but other characteristics likely were chosen for different reasons, such as protection from predators. Researchers seeking to locate *M. leibii* should focus their efforts close to exposed, and probably South facing, rock formations.

VARIATION IN THE ECHOLOCATION CALLS OF THE EASTERN RED BAT AND THE IMPLICATIONS FOR SPECIES IDENTIFICATION

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Identification of bat echolocation calls to species is becoming increasingly important, particularly in monitoring the spread and long-term effects of White-Nose Syndrome and in assessing the risk to sensitive bat species posed by wind development. However, bat call identification is a complex process, often made difficult by highly-variable echolocation calls and overlap in call characteristics between species. The stereotypical echolocation call of the eastern red bat (*Lasiurus borealis*) has been described by many authors and calls of this species are generally thought to be relatively easy to identify. However, the eastern red bat has an extremely variable vocal repertoire, much of which is quite distinct from the stereotypical red bat call. I compiled a preliminary call library of eastern red bat calls which was designed to encompass the entire range of call variation exhibited by this species, excluding social calls. All calls included in the call library were passively-recorded by the Anabat ultrasonic detectors (Titley™ Scientific, Australia). First, I quantified the level of call variation in this species and compared it to other species of bats. Second, I highlighted non-stereotypical calls of the eastern red bat and examined the extent to which these types of calls may be confused with other species of bats. Finally, I used quantitative call analysis to: 1) examine how often non-stereotypical calls are misidentified and 2) explore ways to deal with the call misidentification.

SPRING MIGRATION OF FEMALE INDIANA BATS (*MYOTIS SODALIS*) FROM CAVES IN EASTERN TENNESSEE

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We used active radio telemetry tracking to conduct a spring migration study of female Indiana bats (*Myotis sodalis*) from hibernacula in eastern Tennessee. Female bats were followed intensively with both ground and aerial support to determine staging areas, migration direction and routes, flight duration and speed, stopover roosts, and link to summer and winter populations. We conducted three distinct tracking phases: one in spring 2009 and two in spring 2010. A total of 15 female Indiana bats were radio-tagged from three caves. Radio-telemetry efforts tracked 6 of the 15 bats for 1-3 days. None of the bats stayed in Tennessee. Most moved north as expected with one bat linked to a newly discovered maternity colony 233 km in Kentucky. However, one bat migrated southwest into Alabama. The latter traveled a total distance of 280 km over three nights before being lost as it continued towards Birmingham, Alabama. Bats followed the same absolute direction as they started and they appeared to follow landscape features such as streams, rivers, mountain ranges, and roads. One bat also took advantage of a mountain gap to pass from one side to the other. Bats traveled an average distance of 76.0±32.6 km during a night. Flight duration ranged from 0.5-8 hrs and may have depended upon ambient temperature. Some evidence suggested that bats foraged and night roosted for short periods along their route. Minimum flight speed for bats during a nightly migration averaged 19.2 km/hr (range 12.2-32.0 km/hrs). Five stopover roosts were located: three Acer spp. (2 *A. saccharinum*, 1 *A. rubrum*), one *Robinia pseudoacaia*, and 1 *Carya tomentosa*. Mean dbh and height of all trees was 37.92±13.38 cm and 13.4±4.7 m, respectively. Roosts were located under bark of three trees and within the crevices of two split topped trees. Trees were used for one night while bats were migrating.

These records represent one of the first descriptions of spring migration of Indiana bats within the southern portion of the species range.

ECOLOGICAL CORRELATES OF DIETARY VARIATION IN THE WIDESPREAD INSECTIVOROUS BATS *EPTESICUS FUSCUS* AND *MYOTIS LUCIFUGUS*

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Foraging and niche partitioning by insectivorous bats likely is shaped by large-scale ecological factors such as availability of prey and interspecific competition, however, these factors are difficult to measure and there is little empirical evidence for either. Diet is the most common measure of foraging and diet *Eptesicus fuscus* and *Myotis lucifugus* are particularly well studied. We examined diet of these species using published descriptions from various regions of North America and our own data from New England to better understand intraspecific variation in use of prey, and to test whether use of prey corresponded with climatic variables (an indicator of availability of prey), and species richness of bat communities (a measure of potential competition). Both species of bats ate significantly more beetles and fewer other prey in regions with the greatest mean monthly precipitation and temperature during summer. However, each also consumed significantly fewer beetles and more other prey when present with greater numbers of potential competitors. Results suggest diet is influenced by limited availability of prey in regions with cold dry summers, but also by interspecific competition. These relationships may explain why diets of *E. fuscus* and *M. lucifugus* are substantially in western North America compared to eastern North America, and generally support past hypotheses about niche partitioning. Dietary investigations clearly are valuable resources that should continue to be conducted, particularly for species of bats that are understudied. Additional insight may be gained by broad-scaled analyses of lower taxonomic levels of prey.

Gentics/Toxins

POPULATION GENETIC STRUCTURE SUPPORTS FEMALE ROOST PHILOPATRY IN LITTLE BROWN BATS (*MYOTIS LUCIFUGUS)*

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There has been a rapid growth in the use of molecular genetics tools to investigate a variety of aspects of bat biology, including the degree of male and female driven gene flow among populations. Surprisingly, modern molecular techniques have not been brought to bear on questions regarding population genetic structure of *Myotis lucifugus*, the most common bat in North America. Previous work using allozymes and mark/recapture has suggested that like many mammals, including other temperate Vespertillionid bats, gene flow in this species is largely driven by males, while females faithfully return each year to the roosts in which they were born to rear pups. In order to determine if this species displays a pattern of population genetic structure that is consistent with this hypothesis, I sampled 182 female *M. lucifugus* at 12 maternity colonies throughout the state of Minnesota. Using a portion of the mitochondrial gene cytochrome B and 10 polymorphic nuclear microsatellites, I found that there was significant structure among

colonies, and population differentiation was much higher for the mitochondrial locus. This supports the hypothesis that female *M. lucifugus* display some degree of natal philopatry. However, estimated migration rates were quite high for the mitochondrial locus, suggesting that it is not as uncommon as it has previously been supposed for females to move among colonies, which could have important implications for the spread of white nose syndrome.

IS CONSERVATION GENETICS A WASTE OF TIME? A POWER ANALYSIS OF GENETIC POPULATION MONITORING

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The monitoring of genetic diversity has become an important tool in conservation biology, with the loss of diversity at neutral loci being used as a proxy for the loss of individuals. Furthermore, corresponding decreases in genetic diversity at coding regions may lead directly to a loss of evolutionary responsiveness or cause detrimental effects from inbreeding in threatened species. While genetic data may provide a means of monitoring populations particularly when traditional mark-recapture methods are unsuitable, the utility of genetic tools under specific models of population decline have not been fully explored. Are we, under some circumstances, asking more of a genetic-based monitoring approach than it can deliver? I used coalescent-based simulation analyses to determine the efficacy of genetic data as a monitoring tools for short-term population declines. Specifically, I addressed several questions: (1) which type of molecular marker (DNA sequence data vs. microsatellite genotypes) responds more quickly to population declines?, (2) over what time spans do population declines become statistically detectable?, (3) how does population structure affect our power to detect population declines?, and (4) which analytical tools are most useful for detecting population declines? These questions are addressed using biologically realistic population parameters from two species recently of conservation concern in North America, eastern red bats (*Lasiurus borealis*) and little brown bats (*Myotis lucifugus*).

ASSESSMENT OF MERCURY ACCUMULATION IN BAT TISSUES IN THE NORTHEASTERN UNITED STATES

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Anthropogenic inputs of mercury (Hg) in surface water across the Northeastern United States have potential to created hotspots which may have long-term impacts on ecological and human health. Bats were captured and tested for Hg accumulation in blood and fur tissues to assess the mercury levels in contaminated and uncontaminated areas. Bats were chosen because their foraging behavior and long life spans make them potentially susceptible to high Hg exposure. During 2006-2009 tissue samples were collected in 7 northeastern states at 57 individual sites. A total of 2163 tissue samples were analyzed for Hg, including 1418 fur samples and 693 blood samples. Fur samples were analyzed for all years and Hg concentrations ranged from 0.1 to over 700 ppm. Little brown (*Myotis lucifugus*), tricolored (*Perimyotis subflavus*) and northern bats (*Myotis septentrionalis*) were species with some of the highest accumulation in the fur and blood.

POSTER ABSTRACTS

Posters are located in Salon B for open viewing

PRELIMINARY RESULTS OF A COMPARISON OF FORAGING BEHAVIOR BETWEEEN LITTLE BROWN BATS (*MYOTIS LUCIFUGUS*) AND INDIANA BATS (*MYOTIS SODALIS*)

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The purpose of this research is to compare the foraging behavior, focusing on summer home ranges, of little brown bats (*Myotis lucifugus*) and Indiana bats (*Myotis sodalis*) in order to determine whether behavioral differences between the species exist. This information will be used to determine if using little brown bats as surrogates for Indiana bats is a reliable management tool as well as increase the knowledge on the infrequently studied foraging behavior of little brown bats. Additionally, this study will be conducted before white-nose syndrome (WNS) decimates the bats' populations in order to gather information for future comparisons with post WNS populations. In the summer of 2010 little brown bat and Indiana bat populations were studied at 2 sites in Illinois' Mississippi River floodplains: Oakwood Bottoms Greentree Reservoir and Bluff Lake/ Union County Conservation Area. Simultaneous triangulation radio telemetry was used to track bats and obtain location points for each species to determine home range and habitat use. Both the minimum convex polygon and adaptive kernel methods will be used to determine home range sizes for each individual bat. The home range sizes of each species will be compared using an analysis of variance (ANOVA). Approximately 5 little brown bats and 6 Indiana bats have been tracked to date. A total of 254 radio telemetry locations were estimated for little brown bats and 371 for Indiana bats. Preliminary observations show that little brown bats have larger home ranges than Indiana bats due to faster, more rapid movement over large areas. This could show a behavioral variation between the 2 species and lead to the conclusion that little brown bats are a poor surrogate for use in Indiana bat management.

COMPARISON OF THREE ACOUSTIC SURVEYING TECHNIQUES FOR DETECTION OF ADIRONDACK BAT SPECIES RICHNESS AND FORAGING ACTIVITY

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I present results of acoustic bat surveys conducted at Huntington Wildlife Forest, in the central Adirondacks, NY. Determining bat species composition is common in acoustical surveys, but no comparison between acoustical surveying methods has ensured these techniques are equivalent. Transects have been developed throughout the Adirondack Park to monitor for the effects of White Nose Syndrome on *Myotis* populations through mobile surveying. This investigation uses four Anabat II detectors to compare the efficiency of mobile surveys to traditional active and passive techniques. I identified nine species acoustically over 43 nights at 12 stations along four routes, on the basis of call signatures using Analook and Bat Call Identification (BCID) software. Only calls recorded within three hours after sunset were analyzed, and calls were averaged each night as number detected per hour, for each technique. Significant differences between techniques were found using an ANOVA test in minitab (P-level < .001 for both Technique and Species, and interaction of species richness x method, P = .002). Mobile recording detected five species, (55% of the species detected by either passive or active), but did detect a greater number of big brown (*Eptesicus fuscus)* and hoary bat *(Lasiurus cinereus*) calls. Passive and active detected significantly more little brown bat (*Myotis lucifugus*) and Indiana bat (*Myotis sodalis)* calls.

Passive detectors recorded the greatest activity but significantly more unknown calls and noise files. Results indicate active detectors record proportionately more identifiable calls due to longer call sequences and higher-quality recordings, but fewer total calls. Results suggest difference in methodology may yield different species richness, call quality, and activity data. Standardized survey methods for obtaining reliable information on bat populations are particularly crucial as the federally endangered Indiana bat is an Adirondack resident.

ACOUSTIC MONITORING OF WINTER BAT ACTIVITY AT CAVE ENTRANCES: A PRELIMINARY REPORT

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Ozark National Scenic Riverways (ONSR) contains over 300 caves across more than 80,000 acres in South Central Missouri. It is at the front of the expanding range of white-nose syndrome (WNS), making it a critical area for monitoring the potential impacts of this disease. Acoustic surveillance with Anabat ultrasonic detectors is currently being performed at cave entrances within ONSR to gather critical baseline data on normal winter bat activity levels pre-WNS exposure. This surveillance also monitors for unusual bat activity, including flight during daylight hours in winter. During the end of November 2010, a passive, solar powered Anabat detector was placed approximately 10 meters away from the entrance at each of five known Indiana (*Myotis sodalis*) and gray bat (*Myotis grisescens*) hibernacula and/or maternity caves. Three of these cave locations are WNS-unaffected sites and two were PCR-positive for the syndrome. Temperature and relative humidity data loggers have been placed near each detector to determine if these environmental influences correlate with bat activity. Each detector is set to record continuously until April 30, 2011. A preliminary report of species group dynamics and total bat activity will be presented. As of Jan. 1, 2011, no abnormal bat activity levels have been detected at any site. Some bat activity occurs near sunset/sunrise and no mid-day bat activity has been detected. Monitoring of bat movement, particularly of listed species, will provide critical trend information on the progression of WNS and identify potential problem areas with the goal of preventing or delaying the spread of this disease.

AUTUMN BAT ACTIVITY LEVELS IN THE SOUTHERN APPALACHIAN MOUNTAINS

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Autumn bat activity levels in the southern Appalachian Mountains were assessed by doing acoustic surveys using AnaBat II detectors and ZCAIM recorders during the fall of 2010. The study took place in and near Blacksburg, Virginia in Montgomery County. Two stations were placed in an urban setting on the campus of Virginia Tech and two more were located in a forested environment within Jefferson National Forest. All stations were over or near a body of water. The following species were examined in this study: *Corynorhinus townsendii, Eptesicus fuscus, Lasionycteris noctivagans, Lasiurus borealis, Lasiurus cinereus, Nycticeius humeralis, Perimyotis subflavus*, and four species of *Myotis* (which were lumped together for analysis - *M. grisescens, M. lucifugus, M. septentrionalis,* and *M. sodalis*). The Activity Index (AI) was calculated for each station after running species filters on the recorded data to identify bat echolocation calls. This study expected to find a time of "demergence" for hibernation, especially in cave hibernating species, by recording nightly activity levels between mid-September and mid-

November. However, no strict date was found. Instead activity levels fluctuated throughout the fall, closely related with temperature (urban stations $P<0.001$; forest stations $P<0.05$). Peaks in activity levels were found throughout the study, although these gradually decreased in magnitude by mid-November and did give a decreasing trend between date and AI ($P=0.003$ and $P<0.001$for the two urban stations). Species specific differences in activity levels in autumn have been noted in other studies, but none were seen here.

USING STABLE ISOTOPES TO IDENTIFY POPULATION DYNAMICS OF BATS AT ACADIA NATIONAL PARK, MAINE

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Bats in northeastern North America face anthropogenic challenges such as heavy metal contamination, habitat loss and degradation, white-nose syndrome, and wind power development. Little information is known about the natural history and coastal usage patterns of bat species in Maine, facilitating the need for baseline natural history data for these species. We used several methods—banding, acoustic recording, and stable isotope sampling—to better understand spatial and temporal bat activity along the coast of Maine and monitor variance in the population at Acadia National Park. In 2009 and 2010, we captured and banded 909 bats, sampled 256 for stable isotopes, and recaptured 10. We also passively recorded echolocation calls in 2010 from April 4th to September 30th at two distinct high activity sites. Though stable isotope and acoustic recording data have not yet been analyzed, capture data reveal a substantial population of little brown (*Myotis lucifigus*, n=533), northern long-eared (*Myotis septentrionalis*, n=244), and eastern small-footed (*Myotis leibii*, n=122) bats at this coastal refuge. Temporally, little brown and eastern small-footed bats shared an inverse relationship: *Myotis leibii* dominated captures in April, May and September whereas *Myotis lucifigus* dominated in June, July and August. *Myotis septentrionalis* maintained stable representation during capture efforts from April through September. Our data provides a natural history baseline for a population of bats at one geographic location, indicating further need for quantitative studies on specific issues in similar bat populations. Acadia National Park may be at the convergence of many age-old coastal movements and migrations, thus a stronghold for these *Myotine* species—which have all recently been petitioned for listing under the Endangered Species Act.

FIRST-YEAR RESPONSES OF FOREST BATS AND THEIR ARTHROPOD PREY TO PRESCRIBED FIRE DURING THE SWARMING PERIOD AT MAMMOTH CAVE NATIONAL PARK

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Prescribed fires in the mixed-oak forests of ea stern North America are hypothesized to have positive effects on foraging and roosting habitat that may outweigh the risks to forest bats from smoke and heat exposures during fires. Our ongoing project focuses on testing hypotheses about the relationships between effects of fire on insect prey availability and canopy structure and the relationship to selection of foraging areas by bats during the swarming and staging periods at

Mammoth Cave National Park. We monitored bat activity and insect occurrence concurrently in paired burned and unburned land parcels from August-October 2010. Burns were implemented the previous April. Acoustic surveys (Anabat II) over 53 nights demonstrate higher bat activity (echolocation pulses / night) in unburned land parcels ($P < 0.05$). Insect surveys using blacklight traps on 9 nights suggest varied responses to prescribed fire across common prey taxa. Though no differences were detected for coleopteran or dipteran abundance ($P > 0.05$), lepidopteran abundance was greater in unburned parcels ($P < 0.05$). We also considered variation of predator and prey due to survey period. Bat activity declined as the season progressed ($P < 0.05$). Abundance of Coleoptera, Diptera, and Lepidoptera all declined as the season progressed ($P < 0.05$). These first-year data suggest consistent responses for predator and prey as the dormant season approaches. We will continue to provide a stronger scientific basis for fire management as we build a more robust data set that spans a wider window of time post-burn.

AVOIDING AND MINIMIZING IMPACTS TO STATE-LISTED MAMMALS FROM WIND ENERGY DEVELOPMENT IN PENNSYLVANIA

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The Pennsylvania Game Commission, under its jurisdiction from Title 34 (Game and Wildlife Code), has the authority to manage and preserve wildlife in the Commonwealth. The Pennsylvania Alternative Energy Portfolio Standards Act, signed in 2004, requires that 18% of electricity sold to retail customers come from renewable energy sources within 15 years. The wind power industry has competed for a substantial portion of Pennsylvania's alternative energy market. To further understand, avoid, and minimize potential impacts to wildlife and its habitat from wind energy development, the Game Commission worked collaboratively with the wind industry to develop a Voluntary Wind Energy Cooperative Agreement (Cooperative Agreement) in 2007. Survey data gathered through the Cooperative Agreement is coupled with the state's natural heritage data and best available science-based knowledge to protect Pennsylvania's mammals from potential threats posed by wind energy development. Of utmost concern are those Pennsylvania mammal species that have already been listed as endangered or threatened in Pennsylvania, such as the Indiana bat (*Myotis sodalis*, state and federally endangered), eastern small-footed bat (*Myotis leibii*, state threatened), Allegheny woodrat (*Neotoma magister*, state threatened), and northern flying squirrel (*Glaucomys sabrinus*, state endangered). The cumulative impacts to bats from wind energy development and other threats, especially White Nose Syndrome, have elevated the Game Commission's concern for all Pennsylvania bat species. The Pennsylvania Game Commission has and continues to work with wind energy Cooperators to avoid and minimize impacts to these species to the greatest extent practicable. However, additional research on migratory tree bat population ecology, efficacy of bat deterrents at multiple wind sites, economic and ecological viability of curtailment at multiple wind sites, and effects of forest fragmentation on Allegheny woodrat and northern flying squirrel populations would greatly enhance our ability to protect imperiled species from wind energy development.

HEY YOU …TAKE THE DAMN PICTURES! WHY ADAQUATE WNS SURVAILANCE DEMANDS PHOTOGRAPHY

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Photography has always been the cornerstone of Indiana bat winter surveys in NY and has slowly gained recognition as the methodology of choice across the species' range. It creates a record that allows for detailed analyses that are not otherwise possible, and one that can be revisited for answering new questions. Photography provides the same strengths for WNS investigations but, regrettably, it has not yet been widely applied. To date, photographs of bats in hibernacula provided the earliest record of the disease in North America, a year before any other symptoms were recognized. It was the basis for suspecting Europe as a likely source (and a long time reservoir), and that these fungal infections did not occur in NY prior to the other symptoms of WNS. It provided the first clear evidence that the disease affects species differently, and that visible infections occur rapidly after exposure. The review of photographs has repeatedly proven to be far more accurate than on-site observers for counting bats and for detecting animals visibly infected with *Geomyces destructans* in hibernacula. It is generally quicker and requires less illumination than on-site inspections, thus potentially reducing stress to the animals. Measuring changes in overall numbers, in cluster sizes, or visible infection rates within colonies all are more accurate using photography. It offers the opportunity to track the status of marked individuals without handling, and to quantify the intensity and extent of visible infection on individuals by species, group size, micro habitat, time of year, or year of infection. The taking of photographs should be a standard part of all winter surveys regarding WNS.

SUMMER MIST-NETTING ON THE MONONGAHELA NATIONAL FOREST: A TOOL FOR ASSESSING BAT POPULATION RESPONSE TO BROAD-SCALE THREATS AND CONSERVATION/RECOVERY EFFORTS

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The Monongahela National Forest (MNF) in West Virginia has conducted summer bat mist-netting for 14 years, collecting annual demographic data for bat species across the Forest. This baseline database provides a unique and valuable tool for evaluating potential impacts to bat populations on the Forest and surrounding lands and for assessing the efficacy of conservation and recovery efforts for these species. In the face of White-Nose Syndrome (WNS), the need to continue this data collection, in conjunction with other monitoring efforts, is particularly important. Such data also help us to target management and conservation efforts across the Forest and will allow assessment of long-term population responses to such efforts. To date, over 10,000 individual bats of ten species have been captured as part of this monitoring effort, from 1997-2010, at approximately 400 sites across the forest. While the number and location of sites varies annually, the Forest has conducted consistent monitoring efforts at several long-term sites to allow for comparisons across years. Preliminary analyses of these long-term site data indicate decreases in capture rates for several species (including the little brown bat, *Myotis lucifigus*, and the northern myotis, *Myotis septentrionalis*) before and after 2008, though specific demographic parameters did not show obvious changes; WNS was first observed in WV caves in Pendleton County in the winter of 2008-09. However, if the disease continues to spread in the coming years, we anticipate seeing more dramatic shifts in data from that collected during pre-WNS monitoring.

COMMUNITY ECOLOGY OF BATS ON THE MATERNITY RANGE: A COMPARISON PRE- AND POST-WHITE NOSE SYNDROME

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Since the onset of white-nose syndrome, species of hibernating bats in the northeast have experienced massive die-offs. Much attention has been given to the declines witnessed in winter hibernacula, but little data has been available to document the impact on maternity colonies. From 2006-2010, maternity season mist netting was conducted at Great Swamp National Wildlife Refuge (Basking Ridge, NJ) as a part of thesis research examining roost selection of Indiana bats *(Myotis sodalis.)* Following USFWS guidelines, mist net surveys were conducted between May 15 and August 15 along potential flight corridors such as streams, roads and trails. Nets were checked at 10-15 minute intervals between 2100 and 0200; species, age, sex, reproductive status, weight, and forearm length was recorded and each bat received a uniquely numbered aluminum band. Bats were examined for external parasites, scarring, frostbite damage and other injuries in order to determine general health. Following the January 2009 onset of white-nose syndrome (WNS) in NJ, wing scores were also recorded. Lastly, transmitters placed on *M. sodalis* permitted the identification of roost trees at which emergence counts were conducted. A total of 1177 bats of 7 species were captured over 5 years. Peak emergence counts of 252, 164, 214, 97 and 60 showed a potential decline in *M. sodalis* colony size from 2006-2010 (respectively.) Few bats showed evidence of wing scarring, however, significant changes in both the bat population and in the proportion of reproductive females were evident following the onset of WNS ($p<0.0001$.) While expected, these results indicate that the impacts of WNS on maternity colonies may be difficult to detect in the absence of baseline information and without significant mist-netting efforts.

LOOKING AT POPULATION DECLINES OF CAVE BATS THROUGH SUMMER MIST NETTING

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Many studies have reported apparent losses of bats at winter hibernacula in the region affected by white-nose syndrome (WNS). Confidence that these apparent declines accurately represent regional population trends varies by species. Furthermore, the extent to which declines noted at hibernacula due to WNS result in changes in the abundance of bats on the surrounding summer landscape has not been well demonstrated. We examined the results of mist net surveys done in New York from 2003-2010 to see the extent to which observations of WNS impacts at hibernacula might be supported. Observed changes in catch-per-unit-effort for little brown bats (*Myotis lucifugus*) and northern bats (*Myotis septentrionalis*) agree with declines seen in winter survey data, i.e., losses of 90% and 99%, respectively. Mist net captures for big brown bats (*Eptesicus fuscus*) show no clear trend over the study period, also consistent with winter survey data.

INDIANA BAT ROOST TREE SELECTION IN THE SOUTHERN APPALACHIAN MOUNTAINS

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The Indiana bat (*Myotis sodalis*), a federally endangered species distributed throughout much of the eastern U.S., is now threatened by white-nose syndrome in the Northeast. A better understanding of roost ecology may facilitate conservation of healthy populations in the southern part of the species' range and could be critical to the overall survival of the species. In their core range in the Midwest, female Indiana bats typically roost in large dead hardwoods in riparian areas. However, data suggest that Indiana bat maternity colonies primarily use conifer snags in the southern Appalachians. From May–August 2008–2010, we measured characteristics of Indiana bat day roosts in southeastern TN and southwestern NC. We attached 0.32–0.42 g radio transmitters to 3 adult males and 31 adult females, and measured characteristics of trees (e.g., species, diameter, height, and bark) and 0.1 ha plots (e.g., tree counts and basal areas, and percent canopy closure estimate) for 48 day roosts and associated random trees. Roosts were mainly yellow (*Pinus* subgenus *Diploxylon)* or white (*P. strobus*) pine snags in mixed pine-hardwood stands. Roosts were taller, larger in diameter, and in a lower state of decay than random trees. White pine roosts were typically larger in diameter and height than yellow pine roosts and tended to house more bats. There is a consistent pattern for Indiana bats to use tall low decay snags as roosts. Most yellow pine snags on the landscape are in advanced decay and recruitment is low. We may be witnessing a shift in which white pines become the dominant roost type used by Indiana bats in this region.

FIDELITY OF BATS TO FOREST SITES REVEALED FROM MIST-NETTING RECAPTURES

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Although site fidelity to permanent roost structures by bats is generally known, long-term fidelity to areas such as foraging or drinking sites is unknown. Furthermore, mist-net recaptures of bats over multiple years are rarely reported. Therefore, I used recaptures of forest bats from 8 years of extensive mist netting in the same forested area of Arkansas to investigate long-term site fidelity. Among 1,717 banded individuals of eight species, five species were recaptured over spans ≥1 year, including eastern red bats (*Lasiurus borealis*), Seminole bats (*L. seminolus*), evening bats (*Nycticeius humeralis*), tri-colored bats (*Perimyotis subflavus*), and northern long-eared bats *Myotis septentrionalis*. I recaptured no hoary bats *L. cinereus*, silver-haired bats *Lasionycteris noctivagans*, or big brown bats *Eptesicus fuscus*. I recaptured some individuals multiple times over multiple years, and the maximum span over which a bat was captured was 1 year for Seminole bats, 2 years for tri-colored bats, 3 years for evening bats, 4 years for eastern red bats, and 5 years for northern long-eared bats. My results indicate some eastern red bats, Seminole bats, tri-colored bats, evening bats, and northern long-eared bats either remain in the area year round or return to the same forested location each summer.

INDIANA BAT (*MYOTIS SODALIS*) MIST NET CAPTURE EFFICACY ON THE MONONGAHELA NATIONAL FOREST

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On the Monongahela National Forest (MNF) in West Virginia, the United States Forest Service (USFS) has conducted bat monitoring, focusing on endangered species, for over a decade. From the year 2000 to the present day, Sanders Environmental, Inc. has performed the annual summer mist-netting on the MNF. This dataset catalogs 11 years of mist-netting data from a single National Forest, providing a rare opportunity to examine, on a large, long-term scale, which netting tactics are most effective at catching bats, specifically, the federally endangered *Myotis sodalis*. During this study, 8960 bats of 10 species were captured. Of these, 33 individuals were *sodalis*. This poster will use two separate datasets (both taken from the 2000-2010 MNF data) to evaluate the efficacy of different netting techniques. First, all of the site setup and capture data will be used to examine the frequency and success of various netting tactics. Next, the data pertaining specifically to *sodalis* will be analyzed to determine which methods are most effective for sampling Indiana bats. Overall, this poster will demonstrate which nets (by length and height), configurations (the use of multiple nets as a single "set"), and placements (road vs. water way vs. forest, etc.) result in the most captures, and the best results.

THE IMPORTANCE OF HETEROGENEITY IN PROTECTED AREAS FOR BAT SPECIES

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Summer foraging requirements for bats, a taxa of conservation interest, are poorly understood, especially in areas that are highly fragmented, located in an urban/suburban matrix, or in critically endangered oak savanna habitats. To increase our understanding of these habitat requirements, we are collecting data on bat species assemblages and relative foraging activities for The Oak Openings Region of Northwest Ohio, which includes all three conditions. As urban parks become refugia for species it is important to understand the critical characteristics to species persistence within these areas. Therefore, we conducted a fine scale survey of bat activity in two protected areas within the Oak Openings Region. Established methods of echolocation monitoring using an Anabat monitor were employed from June-September of 2009 and 2010. Data at the microhabitat, local, and landscape scale were also collected. Specific species composition included *Myotis* spp, *Perimyotis subflavus, Eptesicus fuscus, Lasionycteris moctivagans, Lasiurus borealis, L. cinereus,* and *Nycticeius humeralis*. The presence of *Eptesicus fuscus, Myotis lucifugus* and *Lasiurus borealis* was also confirmed with mist netting. Preliminary results of acoustic data indicate that microhabitat characteristics were more critical to relative activity than composition at the local or landscape level, and that within park heterogeneity was important to maintain species diversity. Acoustic surveys of oak savanna and oak woodland also highlighted the importance for habitat heterogeneity as these areas are widely and differentially used. The findings of this research will increase our ecological knowledge and aid management of the region in promoting biodiversity.

DESIGNING AND ASSESSING AN OUTREACH CAMPAIGN TO REDUCE THE HUMAN-MEDIATED TRANSMISSION OF WHITE NOSE SYNDROME (WNS)

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White Nose Syndrome (WNS), a fungal disease affecting bats and first noted in the U.S. in 2006, has resulted in mass mortality of cave-dwelling bats in North America and is continuing to spread across the continent. Although WNS has not been documented in Iowa, the fungus has been found as close as northern Missouri. We are working with the Iowa Department of Natural Resources (IDNR) to develop an outreach campaign to help reduce human-mediated transmission of WNS. We are targeting three stakeholder groups because of their occupational exposure to bats: Iowa Department of Public Health employees, Veterinarians and Wildlife Rehabilitators, and Nuisance Control Operators. Our main objectives are to: 1) assess current beliefs, attitudes and behaviors of stakeholders toward bats and WNS, 2) inform stakeholders and other segments of the public about WNS and any actions they should take involving infected bats, and 3) assess beliefs, attitudes and behaviors of stakeholders after implementing an outreach campaign. To date, we have designed Web pages with content for the IDNR Website about bats and WNS aimed at our specific audiences, and have administered a pre-intervention questionnaire. Upon questionnaire completion, individuals will be sent a brochure which includes information on Iowa's bats and WNS and the URL for our newly launched WNS Web pages. We will present the results of our pre-intervention questionnaire, Web pages development and content, brochure development and content and an educational presentation that we have developed for use by naturalists and other educators. A post-intervention questionnaire will be administered in spring 2011 and used to assess the campaign. Our results can be used to assist Iowa and other states in developing persuasive and comprehensive outreach campaigns aimed at reducing any human-mediated spread of WNS and heightening awareness of the threat WNS poses to North America's cave-dwelling bats.

INDIANA BAT (*MYOTIS SODALIS*) HOME RANGE SIZE IN FRAGMENTED HABITAT DOMINTATED BY AGRICULTURE

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While it is known that Indiana bats occupy distinct home ranges, few studies have estimated home range size (Garner and Gardner 1992, USFWS 2007). Understanding home range size is important for both impact assessment and conservation. To address this knowledge gap, we present home range estimates for three lactating female Indiana bats that utilized maternity roosts in a rural area dominated by agriculture in central Ohio. Telemetry data were collected for each bat from10 July through 21 July, 2008. Point locations were determined using simultaneous triangulation from at least two separate telemetry stations. Points were recorded every five minutes from approximately dusk until 02:00. Data errors and outliers were discarded from analysis, and the resultant points were run through "Outlier Removal" tool using ArcView 3.3 (ESRI 2002) and the Animal Movement extension (Hooge and Eichenlaub 2000), resulting in a 95% minimum convex polygon describing the approximate home range utilized by each bat during the study period. The mean number of points used to calculate home range was 180 (range=142-232). Mean home range size for Indiana bats tracked during this study was 381.5 ha (range=812.2-157.6 ha). Results from this study are generally consistent with previous findings, however, observed distances from roost trees to the furthest point within the observed home ranges tended to fall toward the upper end of the range of distances cited in existing literature. Based upon overlap of some home ranges and use of at least one roost tree by multiple

transmittered bats, it appears likely that the Indiana bats tracked during this study are part of a single large colony.

EVALUATING THE EFFECTIVENESS OF MOBILE ACOUSTIC TRANSECTS CONDUCTED ON ROADS AND RIVERS

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Understanding population status and trends of any species is essential to conservation and management of that animal. However, landscape level population status of many bat species is not well understood. Recent threats (e.g. White-nose Syndrome and wind energy development) to the bat population have exacerbated the need to better understand the status of bat populations and provide baseline information to monitor population trends. Monitoring bat populations has always been a challenge for researchers. In an effort to resolve this issue, especially with emerging threats, a national mobile acoustic monitoring protocol was developed to monitor summer bat populations. Monitoring transects were established along roadways by many state and federal agencies; however, when conducted on the Shawnee National Forest, Illinois, this protocol was unable to detect species known from a decade of mist netting records to be abundant along the transect. Since many bats are known to occur near or along river corridors, mobile transects conducted from boats may provide a more accurate picture of the bat community on a landscape. Three mobile acoustic transects along roadways were established in 2009 at the Shawnee National Forest following the national mobile acoustic monitoring program developed by Britzke and Herzog. In 2010 mobile transects along nearby rivers were also conducted. This study compares bat activity and diversity detected along those rivers and roads to determine the most effective method at gathering population data. While data has not yet been analyzed, simple number of files recorded indicates that mobile transect on rivers gather 2.5 more files than those on roadways. Results will help managers choose the appropriate technique to monitor summer bat populations.

FORAGING RESOURCE SELECTION OF AN INDIANA BAT MATERNITY COLONY IN NORTHEASTERN MISSOURI

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Foraging studies focused on Indiana bats during summer have documented the high variability between individuals within and between colonies. However, no study has looked at difference in resource selection between reproductive groups within the same maternity colony. Bats display high site fidelity; therefore, to fully understand the impacts of land management practices, long-term monitoring of specific colonies will provide more information compared to monitoring many colonies throughout the species range. Our study took place in the summers of 2008 – 2010 at Charles Heath Memorial Conservation Area owned by the Missouri Department of Conservation in Clark County, Missouri. We asked questions which sought to understand how foraging resources where selected within an Indiana bat maternity colony (*Myotis sodalis*). We also wanted to determine if there were differences in resource selection based on reproductive condition (i.e., pregnancy, lactation, and post-lactation). We used radio telemetry to monitor individuals throughout the night and triangulated foraging locations using GTM3. We evaluated *a priori* hypotheses using an objective model selection criterion for small sample size (Akaike's Information Criteria, AIC_c) to rank the candidate models in terms of their ability to explain the

empirical data for each individual bat. We used individual Indiana bat point data along with the random points that we generated and input both into Proc MDC (Multinomial Discrete Choice; SAS 9.1) to determine resource selection. The overall goal of our study was first to provide for a more complete understanding of resource needs during summer allowing for management decisions to be based on more aspects of habitat needs of this species. Secondly provide information that will aide in reducing the population loss of Indiana bats in Missouri. In the preliminary results, we have found that there does seem to be a difference in resources selected between reproductive groups.

ASSESSMENT OF MERCURY CONTAMINATION IN BATS AT THE GREAT DISMAL SWAMP NWR, VIRGINIA

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In order to assess the potential impacts and injury to invertivore mammals at the Great Dismal Swamp National Wildlife Refuge (GDSNWR), we initiated an investigation to determine Mercury (Hg) concentrations and potential effects on the local bat community. Results will be used to expand knowledge of biota impacted by atmospheric deposition of Hg, as most studies focus on the piscivorous food chain and not the insectivorous food chain. GDSNWR is critical to evaluate because Hg may be more bioavailable than at other habitat types due to the unique conditions of the wetland environment (low dissolved oxygen and low pH). The study area encompasses the 112,000 acre GDSNWR. The refuge is in both Virginia and North Carolina. All sampling locations are within the cities of Suffolk and Chesapeake, Virginia. Bats were captured from 2007 to 2009. A total of 218 bats, representing 8 species, were captured from six locations in the GDSNWR. Fur was taken from 188 bats consisting of 94 adults and 94 juveniles. Hg concentrations ranged from 1.1 to over 49.2 ppm. Big brown bats (*Eptesicus fuscus*) and evening bats (*Nycticeius humeralis*) had the highest Hg concentrations of all species sampled.