6th Annual Meeting

Midwest Bat Working Group
Indiana State University
April 3-4, 2014

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PROGRAM OVERVIEW

Day 1 – April 3rd (Thursday)

8:00 – 10:00am	Breakfast *Sponsored by CEC*	Banquet Center
8:00am – 5:00pm	Registration and Vendors	Banquet Center
8:00 – 9:30am	Board of Directors Meeting	Banquet Center
10:00 – 10:10am	Welcome	Banquet Center
10:10 – 10:40am	Indiana Bat National Protocol	Banquet Center
10:40 – 11:30am	Northern Bat Listing/Compliance	Banquet Center
11:30 – 11:40am	MYLU/MYLE/PESU Info	Banquet Center
11:40am – 12:00pm	National and Regional WNS Updates	Banquet Center
12:00 – 1:30pm	Lunch	On Your Own
1:30 – 2:00pm	Bats and Wind Energy Update	Banquet Center
2:00 – 3:45pm	Bats and Forestry Symposium	Banquet Center
3:45 – 4:00pm	Break *Sponsored by Titley Scientific*	Banquet Center
4:00 – 4:20pm	NABCA Update	Banquet Center
4:20 – 4:35pm	Wildlife Materials Update	Banquet Center
7:00 – 10:00pm	Social & Poster Session *Sponsored by OBC and Wildlife Materials* Heavy hors d'oeuvres and cash bar	Banquet Center

Day 2 – April 4th (Friday)

7:30 – 9:30am	Breakfast *Sponsored by WEST, Inc.*	Banquet Center
8:00am – 2:00pm	Registration and Vendors	Banquet Center
9:00 – 10:00am	Oral Presentations 1	Banquet Center
10:00 – 11:30am	State Reports	Banquet Center
11:305am – 12:45pm	Lunch (Provided) *Sponsored by GAI Consultants and AllStar Ecology LLC*	Banquet Center
11:45 – 12:45pm	Business Meeting	Banquet Center
12:45 – 1:45pm	Oral Presentations 2	Banquet Center
1:45 – 2:00pm	Awards, Announcements, Close	Banquet Center

Meeting Host

Indiana State University
Center for Bat Research, Outreach, and Conservation

Detailed Program

Thursday, 4 April 2013

8:00 – 10:00am	**Breakfast** *Sponsored by Civil & Environmental Consultants, Inc.*	Banquet Center
8:00am – 5:00pm	**Registration and Vendors**	Banquet Center
10:00 – 10:10am	**Welcome** by President Rob Mies and Host Brianne Walters	Banquet Center
	Regulatory Session	Banquet Center
10:10 – 10:40am	**UPDATE ON THE U.S. FISH AND WILDLIFE SERVICE'S INDIANA BAT SUMMER SURVEY GUIDANCE.** R.A. King, M.P. Armstrong and R.A. Niver. *U. S. Fish and Wildlife Service, Bloomington Field Office, Bloomington, IN (RAK); U. S. Fish and Wildlife Service, Kentucky Field Office, Frankfort, KY (MPA); U. S. Fish and Wildlife Service, New York Field Office, Cortland, NY (RAN)*	
10:40 – 11:00am	**CURRENT FEDERAL LISTING STATUS OF THE NORTHERN LONG-EARED BAT.** J. Utrup. *U. S. Fish and Wildlife Service, Bloomington, MN*	
11:00 – 11:30am	**NORTHERN LONG-EARED BAT INTERIM CONFERENCE AND CONSERVATION PLANNING GUIDANCE**. J. Hogrefe. *U. S. Fish and Wildlife Service, Bloomington, MN*	
11:30 – 11:40am	**STATUS UPDATE ON MYLU/PESU/MYLE**. *U. S. Fish and Wildlife Service, Bloomington Field Office, Bloomington, IN*	
11:40 – 12:00pm	**WHITE-NOSE SYNDROME: CURRENT STATUS OF THE DISEASE AND THE COLLABORATIVE RESPONSE.** R.A. Geboy, J.T.H. Coleman, J.D. Reichard, and C.J. Kocer. *U.S. Fish and Wildlife Service, Bloomington Field Office, Bloomington, IN*	
12:00 – 1:30pm	**Lunch**	On Your Own
1:30 – 2:00pm	**BATS AND WIND ENERGY UPDATE.** M. Schirmacher. *Bat Conservation International*	Banquet Center
	Bats and Forestry Symposium	Banquet Center
2:00 – 2:30pm	**MYOTIS BATS NEED FORESTS.** J.M. O'Keefe. *Center for Bat Research, Outreach, and Conservation, Indiana State University, Terre Haute, IN*	
2:30 – 3:00pm	**FOREST MANAGEMENT AND THE PRIVATE WOODLAND OWNER – AN INDUSTRIES PERSPECTIVE.** P. Myers. *Superior Hardwoods, Montezuma, IN*	
3:00 – 3:30pm	**HABITAT CONSERVATION PLAN FOR BATS ON INDIANA'S STATE FORESTS.** S. Haulton. *Indiana DNR Division of Forestry, Indianapolis, IN*	
3:30 – 3:45pm	Q&A for Forestry Symposium	
3:45 – 4:00pm	Break *Sponsored by Titley Scientific*	Banquet Center
4:00 – 4:20pm	**NABCA: A FEDERATION OF BAT WORKING GROUPS**. R. Mies. *Organization for Bat Conservation, Bloomfield Hills, MI*	
4:20 – 4:35pm	**WILDLIFE ACOUSTICS UPDATE**. P. Ullrich. *Wildlife Acoustics, Inc. Maynard, MA.*	
7:00 – 10:00pm	**SOCIAL AND POSTER SESSION** *Sponsored by Organization for Bat Conservation and Wildlife Materials* Heavy hors d'oeuvres and cash bar	Banquet Center

Friday, 5 April 2013

7:30 – 9:30am	**Breakfast** *Sponsored by WEST, Inc.*	Banquet Center
8:00am – 2:00pm	**Registration and Vendors**	Banquet Center
	Oral Presentations 1	Banquet Center
9:00 – 9:15am	**DOES *GEOMYCES DESTRUCTANS* INFECTION IMPAIR REPRODUCTIVE CAPACITY IN *MYOTIS LUCIFUGUS*?** L. Powers*, E. Pritchard, J. Bailey and B. Francis. *University of Illinois, Urbana, IL, USA.*	
9:15 – 9:30am	**BIOTIC AND ABIOTIC FACTORS INFLUENCING THE ENVIRONMENTAL PERSISTENCE AND GROWTH OF *PSEUDOGYMNOASCUS DESTRUCTANS*.** D.B. Raudabaugh* and A.N. Miller. *Department of Plant Biology, University of Illinois at Urbana-Champaign. Illinois Natural History Survey. 1816 South Oak Street, MC-652 Champaign, IL 61820*	
9:30 – 9:45am	**IMPACTS OF WHITE-NOSE SYNDROME ON A BAT COMMUNITY NEAR PLAINFIELD, INDIANA.** J.L. Pettit* and J.M. O'Keefe. *Center for Bat Research, Outreach, and Conservation, Indiana State University, Terre Haute, IN 47809*	
9:45 – 10:00am	**BATS & POOLS.** Z. Nickerson* and J.M. O'Keefe. *Center for Bat Research, Outreach, and Conservation, Indiana State University, Terre Haute, IN 47809*	
10:00 – 11:30am	**State Reports**	Banquet Center
11:30am – 12:45pm	**Lunch (Provided)** *Sponsored by GAI Consultants, Inc. and AllStar Ecology LLC*	Banquet Center
11:45am – 12:45pm	**MWBWG Business Meeting**	Banquet Center
	Oral Presentations 2	Banquet Center
12:45 – 1:00pm	**DON'T FORGET THE GUYS! MALE INDIANA BAT SELECTION IN A MANAGED FOREST.** S.M. Bergeson* and J.M. O'Keefe. *Indiana State University Center for Bat Research, Outreach, and Conservation, 600 Chestnut St., Terre Haute, IN, 47809*	
1:00 – 1:15pm	**USING SPATIAL MODELS TO PREDICT RELATIVE BAT MORTALITY AT WIND FARMS IN THE CENTRAL UNITED STATES.** G.M. Forcey, C. Sutter, L.A. Hooton, and C. Newman. *Normandeau Associates, Inc., Gainesville, FL 32601*	
1:15 – 1:30pm	**DIGITAL APPLICATION FOR BAT FIELD DATA COLLECTION.** J.L. Jackson and K.A. Cunningham. *Jackson Group, 3945 Simpson Lane, Richmond, Kentucky 40475* (JLJ, KAC).	
1:30 –1:45pm	**FACTORS EFFECTING THE PROBABILITY OF ACOUSTIC DETECTION AND SITE OCCUPANCY OF INDIANA BATS**. Z.D.E. Kaiser and J.M. O'Keefe. *Indiana State University, Terre Haute, IN, 47809*	
1:45 – 2:00pm	**Awards, Announcements, Close**	Banquet Center

***Indicates Student Presenter**

ORAL PRESENTATION ABSTRACTS

DON'T FORGET THE GUYS! MALE INDIANA BAT SELECTION IN A MANAGED FOREST

Scott M. Bergeson* and Joy M. O'Keefe. *Indiana State University Center for Bat Research, Outreach, and Conservation, 600 Chestnut St., Terre Haute, IN, 47809*

Far more research has been conducted on the summer roosting ecology of female Indiana bats (*Myotis sodalis*) than males, though we know both sexes rely on trees as roosts and are often found together in forested landscapes. Additionally, there is a growing interest in the effects of timber harvest on forest-dwelling bats, particularly threatened and endangered species. Therefore, our goal was to determine how male Indiana bats select roosts in a managed forest. During the summers of 2012-2013, we tracked 4 adult male Indiana bats to 18 roosts in south-central Indiana. We collected roost, plot, stand, and landscape scale data on roosts and associated random trees, randomly located throughout in the same landscape. We generated 13 linear regression models based on roosting selection hypotheses and ranked them using Akaike's Information Criteria. Two models, "ease of discovery + roost availability" and "predator avoidance", were the most biologically relevant to male Indiana bats. Based on model averaging of the parameters within these two models we determined that male Indiana bats select tall trees surrounded by more live trees and snags than expected within this managed forest. We also determined that bats used hickory species (primarily live shagbark hickory) more than expected. Interestingly, forest management did not affect roost selection in our study site. However, we were unable to take single tree selection harvest into account (due to a lack of fine-detail GIS data) and were unable to compare our data to a non-harvested control. Based on our results, it would likely benefit male Indiana bats if our study site was managed for large hickory trees surrounded by large numbers of live trees and snags.

USING SPATIAL MODELS TO PREDICT RELATIVE BAT MORTALITY AT WIND FARMS IN THE CENTRAL UNITED STATES

Greg M. Forcey, Crissy Sutter, Lauren A. Hooton, and Christian Newman. *Normandeau Associates, Inc., Gainesville, FL 32601*

Studies of bat collision mortality most often occur at the scale of the individual wind power facility and do not examine larger-scale influences of mortality at the state level or beyond. We modeled predicted relative collision mortality of Eastern red bats (*Lasiurus borealis*), hoary bats (*L. cinereus*), and silver-haired bats (*Lasionycteris noctivagans*) at wind facilities as a function of habitat, weather, topography, and behavior in the central United States from North Dakota to Texas. Season-specific habitat models, weather, and behavioral data were used to form a cumulative measure of predicted collision probability across all seasons for an entire year. Collision risks for all three species were predicted to be highest in areas containing tree cover and along stream and river corridors. Relatively higher risk was also found in the extreme southern portion of the study area (i.e., Texas) for both hoary bats and silver-haired bats. Model evaluation exercises showed that habitat was more important than exposure for predicting both red bat and silver-haired bat mortality; the best model fit for red bats occurred when habitat was weighted 8 times as much as weather (r = 0.89 observed vs predicted mortality) while the best model fit for silver-haired bats had weather weighted ½ as much as habitat (r = 0.91 observed vs predicted mortality). Conversely, model evaluation for hoary bats showed the best model fit occurred when habitat was weighted ½ as much as weather (r = 0.85 observed vs predicted mortality). Our models are applicable for predicting relative rates of mortality at regional scales, making comparisons of relative collision probabilities among sites, and focusing field studies to locations where species of concern are most at risk of colliding with turbines.

WHITE-NOSE SYNDROME: CURRENT STATUS OF THE DISEASE AND THE COLLABORATIVE RESPONSE

Richard A. Geboy, Jeremy T. H. Coleman, Jonathan D. Reichard, and Christina J. Kocer. *U.S. Fish and Wildlife Service, Bloomington, IN 47403*

White-nose syndrome (WNS) is an infectious disease responsible for decimating hibernating bat populations in eastern North America. Caused by the fungus *Pseudogymnoascus destructans*, WNS has spread rapidly since its discovery in New York in 2007, and is now present in 22 states and 5 provinces. As of January 2014 seven North American species have been confirmed with the disease and four others have been identified carrying *P. destructans*. The fungus infects torpid bats and causes severe damage to the integument, resulting in physiological and behavioral impacts, often leading to mortality. Population declines exceeding 90% are routinely documented in affected hibernacula, and are corroborated by direct counts of summer colonies and by acoustic and trapping indices. A national response plan (2011), provides the framework for a comprehensive North American response, and establishes seven working groups to address research and management needs for the disease. The U.S. Fish and Wildlife Service is the lead federal agency coordinating the response to WNS in the U.S., and, since 2008 has provided over $12 million to researchers and state and federal agencies to address WNS. These efforts have lead to advances in our understanding of hibernation physiology, bat population dynamics, disease ecology, and general behavior. Studies of *P. destructans* have also revealed links to European bat species that appear to be resilient to impacts of the disease. Collaboration between the many groups engaged in the WNS response remains critical, and is responsible for the considerable advances we have made in our understanding of this disease.

FACTORS AFFECTING THE PROBABILITY OF ACOUSTIC DETECTION AND SITE OCCUPANCY OF INDIANA BATS

Zachary D. Kaiser and Joy M. O'Keefe, *Indiana State University, Terre Haute, IN*

Documenting the presence of rare bat species can be difficult. The current summer survey protocol for the federally endangered Indiana bat requires passive acoustic sampling with directional microphones (e.g., Anabats), but there are still questions about best practices for choosing survey sites and appropriate detector models. Indiana bats are capable of foraging in an array of cover types, including structurally-complex, interior forests. Further, data acquisition among different commercially available bat detectors is likely highly variable due to different frequency responses, sensitivities, and directionality. We paired omnidirectional Wildlife Acoustic SM2BAT+ (SM2) and directional Titley Scientific Anabat SD2 (Anabat) detectors at 71 random points near Indianapolis, Indiana from May-August 2012-2013 to compare data acquisition by phonic group (low, mid, *Myotis*) and to determine what factors affect probability of detection and site occupancy for Indiana bats when sampling with acoustics near an active maternity colony (0.20-8.39 km away). Files were identified using BCID software, with visual inspection of Indiana bat calls. Anabats recorded more low and midrange files, but fewer *Myotis* files per site than SM2s. Indiana bat detections were low for both detector types, representing only 4.4% of identifiable bat files recorded by SM2s. We detected Indiana bats at 43.7% of sampled sites and on 31.4% of detector-nights; detectability increased as "forest closure" and mean nightly temperature increased, likely due to reduced clutter and increased bat activity, respectively. Proximity to colony trees and specific cover types generally did not affect occupancy, suggesting that Indiana bats use a variety of cover types in this landscape. Omnidirectional SMX-US microphones may be more appropriate for Indiana bat surveys than directional Anabat microphones. However, we conclude that passive acoustic sampling may be insufficient for reliably detecting this species even when it is present. In turn, the use of acoustic monitoring as a means to document presence/absence should be reassessed.

DIGITAL APPLICATION FOR BAT FIELD DATA COLLECTION

Jeremy L. Jackson and Kathryn A. Cunningham. *Jackson Group, 3945 Simpson Lane, Richmond, Kentucky 40475* (JLJ, KAC).

Data management is a major component of bat research and is a very time consuming aspect of this profession that cannot be avoided. While very important, a lot of energy can be wasted when entering data for writing reports and permitting. Problems arise when there are any illegible data sheets. To alleviate this issue and to allow us to focus more on bat work, we at Jackson Group have created a digital application to enter bat field data. Instead of writing out data on field sheets, you can enter it straight into your tablet and at the push of a button your data goes straight to your computer. This application is designed to provide uniformity with data collection and streamlining data submission. It is specifically designed to get us back to what we are really in the field to do, catching bats.

2014 UPDATE ON THE U.S. FISH AND WILDLIFE SERVICE'S INDIANA BAT SUMMER SURVEY GUIDELINES

R. Andrew King, Mike P. Armstrong and Robyn A. Niver. *U. S. Fish and Wildlife Service, Bloomington Field Office, Bloomington, IN (RAK); U. S. Fish and Wildlife Service, Kentucky Field Office, Frankfort, KY (MPA); U. S. Fish and Wildlife Service, New York Field Office, Cortland, NY (RAN)*

Over the past few years, the U.S. Fish and Wildlife Service (Service) has led a multi-agency team in developing revisions to the 2007 summer survey protocols for determining presence/probable absence of the Federally endangered Indiana bat (*Myotis sodalis*). The revised protocols were drafted primarily in response to (1) documented declines in mist-netting capture rates of Indiana bats in areas with population declines due to white-nose syndrome; (2) increasing demand and frequency of use of acoustic surveys without a standardized approach and (3) availability of several software programs for automated analysis and identification of Indiana bat calls. The revised guidelines employ a phased approach and provide standardized protocols for conducting habitat assessments, as well as acoustic, mist-netting, radio-tracking, and emergence surveys. We will present changes in the 2014 guidelines from the 2013 version and provide a status update on the ongoing testing of acoustic software programs.

NABCA: A FEDERATION OF BAT WORKING GROUPS

Rob Mies. *Organization for Bat Conservation, Bloomfield Hills, MI*

The North American Bat Conservation Partnership (NABCP) was established in 1997, with the intended purpose of providing a forum for bat conservationists to share resources, funding, and critical information. The collaboration included researchers, corporations, private organizations, and foundations, as well as government agencies in Mexico, Canada, and the United States. There is a renewed interest to rejuvenate the partnership and create an association, a federation of groups working together to address common priorities at a regional scale. NABCA is not intended to replace or direct the regional working groups or topic-driven response teams (e.g. WNS), but rather provide a venue for the working groups to address issues that cross regional and international boundaries. We are currently working as a collaborative group toward broad continental conservation priorities for bats.

BATS & POOLS

Zachary Nickerson* and Joy M. O'Keefe. *Center for Bat Research, Outreach, and Conservation, Indiana State University, Terre Haute, IN 47809*

Anecdotal reports suggest bats have been choosing to use man-made water sources, and this may become more common with climate change and natural water scarcity. Our aim was to determine if bats are using swimming pools as an alternative water source, if bats only use a certain kind of pool, if there is a trend in pool use by bats across the country, and if there are any management actions being taken by any to reduce wildlife mortality in pools. We created an online survey with 29 questions and sent this survey out to pool owners and users across the U.S. and Canada. From May- Dec 2013, 318 responses to the survey were submitted; 248 respondents (78%) indicated they have observed bats around their pool. Of those who observed bats, 167 (67%) observed bats drinking from their pool and 32 (13%) reported having found a drowned bat in their pool. When we examined the data by ZIP code, we found that responses were evenly distributed across the country, though responses were clumped in areas of dense human populations. Reports of drowned bats were present in about 10% of responses in most regions of country, but the southeast U.S. was an outlier, reporting bat mortality in 20% of responses. It is apparent that bats are using pools across a broad geographic area, and some bats are drowning in pools. We plan to simplify the online survey and will distribute it again in 2014 with the goal of gathering 1,000 responses. Please visit the survey's website (*batsandpools.wordpress.com*) for more information.

IMPACTS OF WHITE-NOSE SYNDROME ON A BAT COMMUNITY NEAR PLAINFIELD, INDIANA

Joseph L. Pettit* and Joy M. O'Keefe. *Center for Bat Research, Outreach, and Conservation, Indiana State University, Terre Haute, IN 47809*

White-nose syndrome (WNS), which is suspected to have hit Indiana caves in the winter of 2010-2011, has been shown to put strain on cave wintering bats by forcing them to wake and use energy reserves. Changes in energy reserves might force female bats to forgo or delay pregnancy during summer. Our aim was to examine changes in summer populations that may be attributable to WNS presence during winter. We used capture data gathered on a long-term study (1998-2013) in Plainfield, Indiana. We separated all data from 11 repeatedly netted locations into 3 periods: pre-WNS (1998-2010), initial-WNS (2011), and post-WNS (2012-2013). Females captured during summer were assigned a reproductive condition (non-reproductive, pregnant, lactating, post-lactating, and juvenile). We used chi-squared tests to test for differences in how captures were distributed across reproductive classes by period. Generally, more non-reproductive adults were caught post-WNS, but results differed by species. For example, we captured 13 adult non-reproductive *Eptesicus fuscus* females in 84 netting nights post-WNS, but only 1 in the 538 net nights in the pre-WNS and initial-WNS periods. Similarly, there had been no record of an adult non-reproductive *Myotis lucifugus* female until 2012. Interestingly, patterns for reproductive classes of *Myotis sodalis* and *Perimyotis subflavus* varied little with WNS period. For *Eptesicus fuscus*, the mean date of the first juvenile capture was June 29th pre-WNS and July 4th after the initial-WNS. *P. subflavus* and *Lasiurus borealis* juveniles were detected earlier post-WNS. Some bats that summer in Plainfield are choosing to forgo and possibly delay reproduction post-WNS. This suggests that WNS affects bats that survive WNS in caves and species that are presumed to be more resistant to WNS. However, other species do not alter reproductive effort or produce volant young earlier, which may relate to other factors like climate change.

DOES *GEOMYCES DESTRUCTANS* INFECTION IMPAIR REPRODUCTIVE CAPACITY IN *MYOTIS LUCIFUGUS*?

Lisa Powers*, Elizabeth Pritchard, Jeanette Bailey and Bettina Francis. *University of Illinois, Urbana, IL, USA.*

White-nose syndrome (WNS) is a disease caused by a cold-adapted fungus, *Pseudogymnoascus destructans* (*Pd*), that results in devastating population declines of North American cave-hibernating bats. Rates of decline at most sites are estimated by annual counts, so it is uncertain whether declines are due entirely to increased mortality or if reduced fecundity also occurs. Female little brown bats (*Myotis lucifugus*) store sperm and a single Graafian follicle throughout hibernation, and will not produce any offspring if storage fails before spring emergence. Bats with WNS become emaciated and dehydrated, which could compromise their ability to maintain the stored follicle and sperm. We conducted a histological study of reproductive tissues from 58 hibernating female *M. lucifugus*, including both *Pd*-positive and *Pd*-negative individuals, to determine if *Pd*-positive females would be less likely than *Pd*-negative females to maintain a Graafian follicle and stored sperm.

BIOTIC AND ABIOTIC FACTORS INFLUENCING THE ENVIRONMENTAL PERSISTENCE AND GROWTH OF *PSEUDOGYMNOASCUS DESTRUCTANS*.

Daniel B. Raudabaugh* and Andrew N. Miller. *Department of Plant Biology, University of Illinois at Urbana-Champaign. Illinois Natural History Survey. 1816 South Oak Street, MC-652 Champaign, IL 61820*

Several important aspects of *Pseudogymnoascus destructans* including its genomic sequence, phylogenetic relationships, geographic distribution and temperature-dependent growth have been intensively studied, but little is known about the basic biology and ecology of this pathogen. In an attempt to understand how this fungus responds to the physical, chemical and nutritional limitations of the cave environment, numerous *in vitro* assays were conducted on *P. destructans* cultures from different geographical localities. *Pseudogymnoascus destructans* can utilize the majority of cave nitrogen sources and complex carbon containing substrates, tolerates elevated levels of inhibitory sulfur compounds and calcium, can grow and sporulate over a wide pH range (alkali-tolerant) and demonstrates sensitivity to water availability. In addition, preliminary results indicate that *P. destructans* has environmentally-induced phenotypic plasticity and that infection may be altered by the presence of host-associated microbiota. These results suggest that *P. destructans* can persist as a saprophyte on cellulosic, chitinaceous, keratinaceous and lipid/protein rich substrates. Substrates containing water surface tension reducing agents (free fatty acids) are beneficial to the growth of *P. destructans* due to its sensitivity to water availability. Substrate chemistry and host-associated microbiota may play important roles related to the infection process and distribution of *P. destructans.*

POSTER PRESENTATION ABSTRACTS

BAT ACTIVITY IN A MANAGED LANDSCAPE: HOW DO *MYOTIS* SPECIES USE TIMBER HARVESTS?

Katherine L. Caldwell* and Timothy C. Carter. *Department of Biology, Ball State University, Muncie, IN 47306*

The influence of timber harvest on bats has been widely studied, yet greater understanding is needed to effectively manage forests that promote bat conservation. Bat response to timber harvest varies based on many factors including harvest technique and species-specific characteristics, making harvest effect difficult to predict. Furthermore, effect on bat use of forests adjacent to harvests is poorly understood. We examined bat activity in management areas on Morgan-Monroe and Yellowwood State Forests in Indiana as contributors to the Hardwood Ecosystem Experiment. We collected bat calls from May to July, 2013 using Wildlife Acoustics Song Meter SM2BAT+ detectors positioned at five locations relative to three harvest treatment types: clearcut, patch cut, and shelterwood. We focused on the response of *Myotis* species as these bats are currently of greatest conservation concern and their response to harvest appears inconsistent across studies. The results provide insight on how *Myotis* species are using timber harvests within a managed landscape.

ATYPICAL AMERICAN BEECH TREE USED BY INDIANA BAT MATERNITY

Megan Caylor and Jeremy Sheets. *Cardno JFNew 3901 Industrial Blvd, Indianapolis, Indiana 46254 (MC). Orbis Environmental Consulting P.O. Box 10235, South Bend, Indiana, 46680 (JS).*

Two juvenile male Indiana bats were radio-tracked to an American beech (*Fagus grandifolia*) during the summer maternity season of 2013 in Clermont County, Ohio. Two consecutive emergence counts conducted at the American beech resulted in 45 bats seen emerging. This total was the greatest across the five known roost trees discovered during the study and indicates that it may have been a primary maternity roost. Indiana bat maternity roosts are typically in trees that provide specific characteristics (exfoliating bark, solar exposure, etc.) although certain tree species exhibit these characteristics more than others. American beech trees typically have smooth bark that does not exfoliate in a way that Indiana bats can utilize. Existing Indiana bat summer protocols to determine summer roost trees include broadly generalized characteristics of typical trees used by Indiana bats. The information about this tree may be important and could influence the interpretation of the protocols used when searching for potential Indiana bat roosts. American beeches may be ignored by bat biologists because they are thought to not exhibit the characteristics Indiana bats require for roost trees. Although this use could be an isolated incident, it is important to note because there are so few records in the literature of Indiana bats using American beech trees as roosts.

COMPARING BAT DETECTOR DEPLOYMENTS AT DIFFERENT HEIGHTS, IN DIFFERENT ORIENTATIONS, AND USING DIFFERENT MICROPHONE TYPES

John D. Chenger and Janet D. Tyburec. *Bat Conservation and Management, Inc., 220 Old Stonehouse Road, North Carlisle, PA 17015 USA. (JDC). Janet Tyburec Consulting, P.O. Box 86493, Tucson AZ 85754 USA. (JDT)*

Protocols have been developed for conducting acoustic inventories that contain recommendations for effectively deploying detectors and microphones to intercept free-flying bats during Endangered Species and other species-of-interest surveys. These protocols have been based partly on actual field trials with bat detectors, combined with assumptions for how bats travel through their habitats. But today, most acoustic monitoring efforts are conducted using detectors and microphones that were not included in the original field trials, and did not even exist when recommendations for deploying acoustic equipment were adopted. This seven-season, seven-site project tests eleven combinations of modern ultrasonic microphones and acoustic detectors for monitoring bats. Trials were conducted side-by-side, to evaluate the relative effectiveness of different deployment heights, orientations, and microphone types under typical field conditions, in various habitats throughout the United States. Though the scope of this effort is exceptionally broad, several consistent results have emerged, indicating that using a high-quality microphone combined with the highest possible elevation above ground, or at least a 45-degree from horizontal orientation of the microphone, all play important parts in documenting species occupancy, especially for short-term monitoring efforts when rare or uncommon species are being targeted. Because acoustic monitoring efforts for bats will likely only increase in the near future, researchers should be encouraged to deploy equipment to maximize inventory efficiency.

EFFECTIVENESS OF AMBIENT TEMPERATURE SENSITIVE TRANSMITTERS IN MEASURING BAT ROOST TEMPERATURE

James H. Cox III, Scott M. Bergeson*, and Joy M. O'Keefe. *Indiana State University Center for Bat Research, Outreach, and Conservation, Terre Haute, IN, 47809*

Due to the ephemeral nature of exfoliating bark roosts used by bats, it is often difficult to record the internal roost temperatures (T_{roost}), a vital variable in studies on microhabitat selection and thermoregulation. Ambient temperature sensitive radio transmitters (T_{amb} transmitters) may allow us to measure T_{roost} of these ephemeral bat roosts. However heat emanating from a bat's skin may bias a T_{amb} transmitter's measurements. To determine the extent of this bias, we conducted a study on big brown bats (*Eptesicus fuscus*) roosting on the side of a horse barn in St. Mary of the Woods, IN, from 2-28 October 2013. We measured T_{roost} using HOBO temperature data loggers placed within the roost (T_{HOBO}). We captured 4 bats from the roost and affixed both T_{amb} transmitters and skin temperature (T_{sk}) sensitive transmitters to their backs, ensuring that the combined weight of the 2 transmitters remained below 5% of bats' body mass. We compared data on T_{amb} and T_{sk} to T_{HOBO}, which was measured continuously. We collected data over 29 bat days (≥1 data point for 1 bat on 1 day), 25 of which were full bat days (data collected from roosting to emergence for 1 bat on 1 day). Mean T_{sk} was 21.76°C ± 0.02 (9.34 – 44.98°C; mean ± S.E.), mean T_{amb} was 20.36°C ± 0.02 (6.44 – 44.96°C), and mean T_{HOBO} was 16.81°C ± 0.03 (1.96 – 36.34°C). Both *T*sk and *T*amb remained warmer than T_{HOBO} throughout the study except during periods during relative extreme temperatures, when T_{amb} tracked closer to T_{HOBO} than T_{sk}. Preliminary analyses suggest that T_{amb} transmitters may be ineffective for measuring T_{roost}.

ARE SMALL CANOPY GAPS ATTRACTIVE TO WOODLAND BATS?

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Southern Appalachian forests host at least 12 species of bats; how these bats forage within forests can vary depending on their size and dietary needs. Forest openings may be attractive as foraging grounds for many species, but how bats use openings is not well-studied. We measured bat foraging activity in small canopy gaps to examine how activity varies by phonic group (Low, Mid, and Myotis) and by height (ground or canopy-level). We conducted this study in the Unicoi Mountains of southern Tennessee and North Carolina. From late May to early July in 2011 and 2012, we recorded bat calls from 32 randomly selected stands with Anabat SD2 acoustic detectors in waterproof housing, placing detectors at 1 or 2 points per stand. At each point, we deployed a ground (~1.5 m high) and canopy level (~20 m high) detector. Using Bat Call ID software (East version 2.6a), we filtered recorded calls into Low (LACI, LANO, EPFU), Mid (LABO, PESU), and Myotis frequency groups. We collected 1216 calls during 1156 hours of recordings. Overall, bat activity was greater at canopy height in these forest openings. We recorded >2X as much activity for Low and Mid bats at the canopy vs. the ground height, while Myotis activity was similar at the two heights. Furthermore, we recorded higher activity overall for Mid bats than for the other two groups. In a heavily forested landscape, bats of all three phonic groups used forest openings, but Mid group bats were most active. Most importantly, Low and Mid phonic groups were more active at the canopy level of forest openings. Open-space bats, such as big brown bats or eastern red bats, may be attracted to small canopy gaps for ease of navigation or if such gaps host a greater abundance of insect prey than the surrounding forest.

LUNAR PHOBIA IN TEMPERATE VESPERTILIONID BATS: MODELING MOONLIGHT'S IMPACT ON BAT ACTIVITY

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Lunar cycles have long been associated with changes in animal behavior. Previous studies concerning bat behavior in response to lunar cycle have described lunar phobia tendencies. We examined how lunar cycle influences three bat species within the *Myotis* genus and assessed if lunar phobia explains their behavior. Study sites included three sites in Indiana; two in Illinois; and one in Kentucky. Within the five study sites, a total of fifty bats were captured and fitted with transmitters. Receivers were placed within the roosting sites and recorded data on bat activity during nighttime hours. Moon phase, (moon) percent illumination, moonrise / moonset times, and cloud cover data were converted into numerical forms and factored into a model to estimate the relative amount of moonlight received each night. Results suggest that bat foraging time was significantly influenced by moonlight level, while number of bats captured each night showed no such relationship. North American *Myotis* bats may have a preference for foraging during nights where the moon is brighter and has more of a presence. Instances of lunar phobia in bats are likely the result of regional differences in preferred prey and influential predator species.

SEASONAL MIGRATION OF GRAY BATS (MYOTIS GRISESCENS) IN RELATION TO POTENTIAL SPREAD OF WHITE-NOSE SYNDROME (WNS).

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Gray bats (*Myotis grisescens*) are cave-obligate, roosting in caves during all seasons. Individuals in Missouri will migrate large distances, sometimes up to 640 km, between winter hibernacula and summer maternity colonies. Gray bats can roost in caves that contain other species of bats, and have been known to roost in physical contact with these species. White-nose Syndrome (WNS) is known to occur in gray bats, however, no gray bat mortality from WNS has yet been documented (Cryan et al. 2013). It is possible that gray bats, due to their migration, possible resistance to infection, and year-round use of cave roosts, could serve as a vector for WNS between caves. This study aims to detail the movement of bats to and from Coffin Cave during seasonal migration. Over 600 fluorescent bands were deployed on gray bats across the state, and an additional 1000 bands will be deployed in the next season. In addition to these recent banding efforts, historic band data in Missouri and Kentucky were plotted using ArcGis and subsequently overlaid onto a map of WNS spread. Of 43 documented movements in the area, 29 (66%) of the movements were both to and from a location that is positive for WNS. Only 19 (43%) of the movements had only one direction of their movement positive for WNS. No movements were found that were both to and from WNS negative areas. These data suggest a possible relationship between WNS status by county and linkage via gray bat movement, but further analysis is required to rule out alternate explanations, as many potentially confounding variables exist. Future work on this project will include the use of radio telemetry and acoustic data to document gray bat movements.

ARE LITTLE BROWN BATS INGESTING THE LIVER TOXIN MICROCYSTIN THROUGH *HEXAGENIA* MAYFLIES?

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The liver toxin microcystin (MC) can cause complications such as skin irritations, vomiting, liver cancer, and death in humans, livestock, pets, and aquatic organisms. This toxin is produced by a blue-green algae *Microcystis aeruginosa* that has been increasingly prevalent in the Great Lakes Basin. *Microcystis* is a possible food source for aquatic species such as *Hexagenia* spp., a burrowing mayfly. *Hexagenia* spend part of their lifecycle as aquatic nymphs, which have the potential to acquire the MC toxin from ingesting *M. aeruginosa*. During mayfly emergence, *Hexagenia* may serve as a food source for bats and possibly spread MC into the terrestrial ecosystem. To determine if the MC toxin is being transferred to bats through *Hexagenia*, bats and bat fecal samples were collected near Little Traverse Lake in Michigan before and after the *M. aeruginosa* bloom. Our results will show whether little brown bats (*Myotis lucifugus)* are eating *Hexagenia* spp. and whether they are acquiring the MC toxin.

BAT-HABITAT ASSOCIATIONS BASED ON MULTIPLE DETECTION METHODS IN NORTHERN ILLINOIS

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Decreases in available habitat, impacts of white nose syndrome, and wind power development are motivating a closer examination of what constitutes critical bat habitat. We are using mist netting and acoustic recordings in conjunction with vegetation sampling and landscape quantification to draw conclusions about bat activity and habitat relationships at multiple spatial scales. In summer 2013 we sampled bat communities at fifteen sites in the McHenry County Conservation District in northern Illinois. Mist netting locations were selected for ideal capture conditions while acoustic recorders were dispersed according to the proportion of land cover types within each park; these included grassland, forest, riparian, and open/mowed areas. We also placed one recorder at each mist-netting location to compare the two sampling methods. We examined relationships between bat species activity levels and surrounding land cover at the sixty-one recording locations to estimate habitat associations. Our preliminary results show that bats tend to prefer open and riparian areas based on acoustic activity levels, however a second field season and additional statistical analyses will aid in drawing conclusions from the data. With this study we hope to better understand bat habitat associations with land cover types embedded across a variety of landscape contexts to better inform management of this taxonomic group.

BAT RABIES IN ILLINOIS

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Rabies is one of the main potential human health problems associated with bats. Every year thousands of bats in the United States are submitted for rabies testing. We have identified most of the bats submitted in Illinois since 2002. Until recently, the number of bats submitted for testing in Illinois has been steadily increasing. However, the percentage of submitted bats that test positive for rabies has remained relatively constant. The vast majority of the submitted bats are big brown bats (*Eptesicus fuscus*) which frequently use buildings for roosting in the summer and hibernating in the winter. However, the bats with the highest prevalence of rabies are bats that are not typically associated with humans (hoary bat [*Lasiurus cinereus*], eastern pipistrelle [*Perimyotis subflavus*], and eastern red bat [*Lasiurus borealis*]). We will continue to monitor and examine long term trends of bats submitted for rabies testing in Illinois.

DETECTION OF WNS DURING INITIAL INVASION: AGREEMENT AMONG SURVEY METHODS

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We surveyed nine bat hibernacula in six Illinois counties for indications of white-nose syndrome (WNS) in the winters of 2012, 2013, and 2014. We examined hibernating bats for symptoms of WNS (e.g., white fungal growth on snout, ears, or wings), collected swab samples from bats to use in genetic analyses (DNA sequencing of ITS fungal barcode) and fungal culturing to identify the causal agent, *Pseudogymnoascus destructans* (*Pd*), and collected dead or moribund bats for histopathologic examination. We did not find evidence of *Pd* in any of our samples or note any symptomatic bats in 2012. In 2013, we observed small numbers of bats showing symptoms of WNS in three caves in three counties. Genetic analyses, fungal culturing, and necropsies detected *Pd* in these three caves, but not in the other four caves surveyed. In 2014, symptomatic bats were observed to an even greater extent in these three hibernacula plus one more, and numbers of bats appeared lower in these locations, but no obvious symptomatic bats were detected in the other five sites. Histopathologic examination and culturing confirmed *Pd* at the new site, but genetic analyses are ongoing at this time. Although we were able to observe symptomatic bats at the onset of invasion, they were few in number and could have easily been missed. All four of the methods we used concurred in their detection of Pd, or in suggesting its absence. However, a substantial proportion of the swab samples detected *Pd* during the initial invasion, and many of these were from apparently asymptomatic bats. A site where we observed a single symptomatic bat in February 2013 was re-visited in late March, at which time >40% of the hibernating bats appeared symptomatic. Swab samples from this site in February predicted this higher prevalence.

PROBABILITY OF DETECTION: MISTNET VS. ACOUSTIC SURVEYS

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It is crucial that we understand the capabilities and limitations of survey methods for bats. For example, some species may travel at different heights and some may emit calls more often or louder than others. These differences, what we don't know about bat behavior, plus the challenges of working in a forest where bats may be not be conspicuous, are important to consider when surveying bat populations. Our goal was to determine if probability of detection varies by bat phonic groups (Low, Mid, Myotis) when employing two different sampling methods, acoustic and mistnet surveys. We sampled one night/site, 21:00-02:00 EDT, at 18 sites using simultaneous mistnet and acoustic surveys from 19 May - 29 July 2013. We used Anabat SD2s; 2m high microphones were directed 35° across the road corridors we mistnetted. Acoustic data were analyzed using Bat Call ID v2.6a. Preliminary analyses show that probability of detection for each group varies by method. Myotis bats represented 73.8% of acoustic files, but only 16.2% of captures. Only 3.4% of acoustic files were identified as Mid frequency bats, which comprised 41.5% of captures. Low frequency bats were 22.8% of the calls identified and 42.3% of captures. We plan to use occupancy models to test the effects of moon illumination, temperature, humidity, barometric pressure and date that may explain differences in detection probabilities for the two sampling methods. The presence of the target group may be overlooked if the appropriate survey method is not used. A combination of both methods might be optimal when surveying for all three phonic groups.

THE USE OF PASSIVELY RECORDED CALLS TO ASSESS THE ENCROACHMENT OF WHITE-NOSE DISEASE INTO SOUTH CENTRAL MISSOURI

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As White-nose Syndrome (WNS) spreads eastward across the U.S., many of the eastern states have seen large declines in bat numbers and shifts in species assemblages. The first confirmed case of WNS was documented in Missouri in 2012, potentially leading to similar impacts on Missouri bat populations. Using acoustic data gathered from a stationary passive detector near a major hibernacula in Washington county Missouri, comparisons were made of the total number of calls and species. Data were collected over multiple years. Washington County was announced as WNS suspect in 2011 and confirmed in 2012.This comparison will hopefully shed light on the effects of WNS on species assemblages as it arrives in the area.

ACOUSTIC SURVEILLANCE TO MONITOR THE PREVALENCE OF WHITE-NOSE SYNDROME AT WINTER HIBERNACULA

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Monitoring the prevalence of White-nose Syndrome (WNS) is an important aspect of disease mitigation and hibernacula management. The use of acoustics to monitor bat activity at winter hibernacula offers a different perspective to more traditional survey methods and also has numerous advantages: disturbance is kept to a minimum, hibernacula may be monitored in perpetuity, difficult-to-access hibernacula need not be entered, risk of the anthropogenic spread of *Pseudogymnoascus destructans* is eliminated, equipment is relatively quick and easy to setup, little training is needed to collect data, and results are objective and quantitative. Beginning in 2010, Anabat SD2 bat detectors were installed near the entrances of eight caves in Indiana known to have populations of hibernating bats. The collected data were analyzed for behaviors indicative of WNS infection such as diurnal flight or activity in below-freezing conditions. Results suggest that acoustics are capable of identifying WNS-infected hibernacula. Furthermore, a relative severity of infection may be ascertained from the proportion of abnormal activity to the whole. Acoustics cannot be a substitute for histopathological testing of bat tissue for confirmation of WNS, and the physical examination of hibernacula offers insights that acoustics cannot provide. However, acoustic surveillance is a viable means for assessing WNS prevalence, and it provides an understanding of bat activity at hibernacula throughout the winter that is otherwise lacking.

***Indicates Student Presenter**