



# Nightwing News



The Newsletter of the Southeastern Bat Diversity Network

Volume 105, Number 1

Spring 2015

## PRESIDENT'S ADDRESS

Spring is here and the field season is upon us. As an academic, this time of year is especially hectic with efforts of trying to wrap up the end of the semester. Trying to cram the last bit of lecture material into a course (or deciding what to cut out because of a lack of time), grading term papers, and writing and grading final exams all take up a lot of time. But there is also planning for the summer – making sure graduate students have crossed their t’s and dotted their i’s so that they get paid, making sure they have the equipment they need to do the research (where did those scales disappear to, anyway?), ensuring that everyone has copies of their necessary permits, etc. And of course the proposal and grant writing never seems to end. And don’t forget about all of those unfinished manuscripts that need to be revised and sent out for review for publication!

In the consulting world the checklist may be slightly different, but the intensity is the same. There are proposals to write, budgets to construct, agencies to send study plans to, equipment to purchase, repair, clean and re-clean, vehicles to maintain, seasonal staff to hire, payrolls to process, maps to make, revised protocols to read, and more.

At heart I am a conservation biologist. I love the diversity of living things in our world and want to see them thrive (as much as possible in our highly-altered world) and persist. I want future generations to be able to experience and enjoy nature as much or more than I have. The work we do as bat biologists is a key component of that vision. Our studies inform managers about best management practices to benefit bats. They provide needed information for legislators and agencies to set priorities and help manage for multiple uses. They provide new insight into behavior, ecology, and physiology that improves our abilities to help populations that are stressed by habitat degradation and loss as well as by white-nose disease. All of these are great things, and I am proud of the work that we are doing!

In everything that we do, however, we need to be especially aware of the interdisciplinary nature of our work. This spring, as in most spring semesters, I’ve been teaching a course in conservation biology. I am constantly stressing in that course that our goals and motives as biologists will never be enough to preserve biodiversity. We need others to understand the importance of biodiversity and we need them to be willing to change their attitudes and actions. Our efforts with bats will only be successful if we can get others interested in and excited about bats. Every time a non-biologist gets excited enough to build a bat house, we have won a small victory. Every time a child or college student learns that bats consume millions of pest insects every year that benefit agriculture, we have won another victory. For us to be truly successful, we can’t just be doing the field work.

We can’t just be learning about fungal pathogens or directing graduate students. We have to be busy engaging the public as well.

Let me encourage you this summer to educate as you work. For those of you who are doing this already, let me say “Thank You!” If you are not actively involved in education or outreach, think about ways to get involved. Instead of just asking a landowner for permission to access their land in order to net, also ask them what they know about bats and give a brief lesson about bats. Design a handout about bat biology and benefits of bats that you can leave with these landowners. If you’re going to be in the same area for a while, contact the local newspaper and see if they would like to run a story on the work you are doing. Learn to take good photographs and use them in presentations to schools. Contact your local civic organizations and see if you can speak to them about bats and the work you do. Participate in SBDN’s Bat Blitz in South Carolina this year or in a local blitz this fall, and make sure those events receive publicity.

I will leave you with this quote by Senegalese ecologist Baba Dioum: *“For in the end we will conserve only what we love. We will love only what we understand, and we will understand only what we are taught.”*

– Brian

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# Executive Committee Meeting

## Southeastern Bat Diversity Network Executive Committee Minutes of the Annual Board Meeting March 3, 2015

### Attendees

#### **Executive Committee**

Joy O'Keefe, President  
Brian Carver, President Elect  
Tim Carter, Treasurer  
Piper Roby, Secretary

Steve Samoray, Member at Large  
Mike Lacki, Past President  
Trina Morris, Incoming President Elect  
Luke Dodd, Incoming Member at Large (via phone)

### Action Items

**AI1:** Roby will ask Nikki Castleberry to send her list of award winners for cross-reference with the financial list of award winners sent by Carter.

**AI2:** Once complete, Roby will send list of award winners to Samoray to put on website.

**AI3:** O'Keefe will write up blurb about Susan Loeb's Lifetime Achievement Award for Samoray to put on the website.

**AI4:** O'Keefe will talk to Tom Risch about the preferred method of conducting the audit: electronically or paper.

**AI5:** Lacki will write a narrative about the CORA/MYAU Conservation Strategy document for Samoray to put on website.

**AI6:** Samoray will find out from Running Ducks how many domain names we have and how much it will cost to keep them. Also find out if the current website address (southeasternbatdiversitynetwork.org) can be changed to sbdn.org.

**AI7:** Samoray will tell Carver when things are added to the website so Carver can post to Facebook.

**AI8:** Samoray put all passwords, domain names, contacts for Running Ducks, etc. and send to the Executive Committee. Also occasionally burn everything to a DVD (copy of website, etc.) and send to the President.

**AI9:** Dodd will email the EC ideas about people who could lead a small/meso-mammal symposium at future meetings.

**AI10:** Carver add to host package the mailer created to inform potential participants about the desire for non-bat mammal talks and the possibility of a student award.

Call to Order: 7:13pm CST, President O'Keefe

### General Discussion

Executive Committee election had <60 votes. Welcome back to the EC to Trina Morris and welcome for the first time to Luke Dodd. Thank you for your service, Lacki. Thanks to Carter for forwarding votes to Lacki.

### December 2014 Executive Committee meeting action items:

- Carter provided financial list of award winners to Roby, but O'Keefe still needs to check with Steve Burnett to get a list of student and lifetime achievement awards. **AI1:** Roby will ask Nikki Castleberry to send her list of award winners for cross-reference with the financial list of award winners sent by Carter. **AI2:** Once complete, Roby will send list of award winners to Samoray to put on website. **AI3:** O'Keefe will write up blurb about Susan Loeb's Lifetime Achievement Award for Samoray to put on the website.
- Lacki – the Federal Advisory Committee was formed after issues were brought to light about CORA and MYAU management at the 2011 Mississippi SBDN meeting and functioned for about 6 months. USFWS was never clear about what

they wanted and Chuck Hunter (Chief, Division of Planning and Resource Management) wanted more than the committee could provide so the committee outlived its usefulness. Lacki suggests the committee be disbanded, President O'Keefe made this decision, so the Federal Advisory Committee is no more.

- Carter printed off all 2014 documents for audit, only 20-30 transactions since there was no SBDN-sponsored bat blitz in 2014. Carter can download all bank statements and a report from the accounting software. The bank account currently has more money than in Carter's records, but a student will go through transactions to find the discrepancy. **AI4:** O'Keefe will talk to Tom Risch about the preferred method of conducting the audit: electronically or paper.
- O'Keefe talked to Chris Comer about the membership committee. Carter suggested that people are given a list of the benefits of being a member and post flyers to post at schools to alert students to the organization and boost membership. Morris suggested that Steven Castleberry would gladly step down as co-chair and O'Keefe has a student interested (Scott Bergeson) in stepping up. Morris will inform Castleberry. Discussion about which committee should be in charge of boosting the submission of non-bat mammal talks: Membership or Host Committee? Lacki suggested that the Membership Committee should boost non-mammal bat talks as they are pulling in new members.
- Lacki did not write a narrative about the CORA/MYAU Conservation Strategy document since the website was being revamped. **AI5:** Lacki will write a narrative about the CORA/MYAU Conservation Strategy document for Samoray to put on website.
- Done. Thanks to Samoray for working with Running Ducks to revamp the SBDN website. Initial cost was \$2,500 and there will be a yearly fee for the server and the host (GoDaddy). There are a few domain names that we can keep or let expire. **AI6:** Samoray will find out from Running Ducks how many domain names we have and how much it will cost to keep them. Also find out if the current website address (southeasternbatdiversitynetwork.org) can be changed to sbdn.org. **AI7:** Samoray will tell Carver when things are added to the website so Carver can post to Facebook.
- Done. Sitting SBDN president will be on the steering board of NABCA. This role is currently filled by Carver.
- Done. There was no social at the museum.
- Done. Next year's meeting will be hosted by TVA (Holly LeGrand and Liz Hamrick) at the Guntersville State Park in Guntersville, AL. Not sure how much to charge. Looking for vendors to bring the cost down.

#### **March 2015 Executive Committee meeting action items:**

- Committee Reports:

##### -Bat Blitz Committee:

Michael Whitby created a great poster with results of multi-state bat blitz in fall 2014. The success and excitement of the blitz from the states prompted the decision to do another multi-state bat blitz 27 August – 3 September 2015, along with the SBDN sponsored blitz in SC. Registration for the multi-state blitz went well because of the Google form. Data sheets not all filled out entirely but still resulted in good data. The public aspect of the blitz is great. School will be in session so it will be easier to get school groups involved. There will be an attempt to do the multi-state blitz every year. Working with Laura Ellison (USGS) to get the data in the NABat database.

2015 blitz planning is going well and registration is open on the SBDN website. It is sponsored by the Palmetto Bluff Conservancy and housing will be at the University of South Carolina Beaufort's Hilton Head Gateway Campus in Bluffton, SC. Mary Kay Clark is assisting with the organization of the blitz. Special bat bands will be purchased for use at this and future SBDN-hosted bat blitzes, but not the multi-state blitz. The number of participants will be limited to 100.

The Talladega National Forest is interested in hosting the 2016 blitz and Allison Cochran (Bankhead NF) is excited about helping out. They have the instructions on how to write a proposal and it's looking promising. Louisiana was interested in hosting a blitz previously, but were not able to, so hope to approach them about hosting in the future. Dave Pelren (USFWS-TFO) is interested in hosting a blitz at Land Between the Lakes in NW Tennessee.

Since Morris is now President Elect, she will be stepping down as Bat Blitz Committee chair and has appointed Whitby to take her place. He is willing and accepted the position.

##### -WNS Committee

Gabrielle Graeter is stepping down due to a change in her role at the state (NC). Katherine Caldwell (also works for NCWRC) will take her place. A poster was created and presented at SEAFWA in Fall 2014 and this meeting to discuss the decline in bat populations at certain caves in several states. The plan is to create a poster every other year (even years) with an update on WNS in select caves and states in the southeast. This committee will also discuss gathering information from universities about what research they are

doing and compiling a list for the SBDN website. It will be modeled after the [whitenosesyndrome.org](http://whitenosesyndrome.org) site that has a compilation of research done with USFWS money.

- Treasurer's Report:

The amount in the general account is down from last year because of the cost of revamping the website. Cost of doing taxes is the other big expense every year. Agreement made to take \$250 from the annual meeting income and the \$250 from the blitz income every year to help cover the cost of taxes if surplus funds are available. We bring in more than allowed for a simple form so have to pay an accountant to prepare our taxes. SBDN treasury is a big service to the bat community by housing funds for various organizations and conducting important services (e.g., the annual meeting, bat blitzes). The Georgia Bat Working Group just started an account with us to house their funding. The Nightwing Newsletter version of the report has been submitted and when approved, will be printed in the next issue.

Carter is stepping down in two years. The President will be involved in helping choose candidates to run for the office of Treasurer since those two people work very closely together. The process will begin next year. After a new Treasurer is elected, the past Treasurer will train the new one and be available to answer questions that arise.

### New Business:

#### Membership

There is a big gap in the number of paid members and the number of people subscribed to the listserv. O'Keefe suggested that members be given preference for attending SBDN sponsored bat blitzes, since the number of participants is often capped at a certain number.

#### Website

Samoray did an excellent job of handling the revamping of the website and even though he is no longer a board member, he will stay on as chair of the new Website Committee. Committee chairs have been, and will continue to, email Samoray with the information they would like on the website. Carter suggested that at least one more person to be on the committee to help Samoray, and possibly two. They can help with polishing: editing, pictures, etc. They can look at other websites for ideas. Other committee members need to know how to access the website to make changes in case Samoray is unable to. **A18:** Samoray put all passwords, domain names, contacts for Running Ducks, etc. and send to the Executive Committee. Also occasionally burn everything to a DVD (copy of website, etc.) and send to the President. A call for volunteer committee members will be made at the business meetings. Samoray will ask the EC about making large changes to the website, but not small ones, e.g., font, color, editing changes.

#### NABCA update

The idea has been discussed for years, but now it is up and running. Jeremy Coleman (USFWS) is the representative for the U.S. The action plans in the draft strategy can be taken back to the working groups to be addressed. Ideas put forth by the NABCA working groups during this meeting will be compiled and used to further develop the strategic plan. The revamping of NABCA is evidence that bat working groups are communicating across the continent. NABCA will take their ideas to the trilateral board to show that bat conservation is important for funding. At NASBR in New York in 2014, Charles Francis (Canadian representative) debuted his proposed steering committee. There has been increased communication and activity in recent months, but there is still a lot of work to get the completed strategy off the ground.

#### SBDN Archives

David Saugey has been sending physical documents (meeting agendas, pictures of boards, pictures of awards winners, Nightwing Newsletters, important posters such as WNS and blitz results, etc.) to a library at Auburn University in Alabama where all SBDN history is held. The Board Member at Large will be in charge of compiling all info from each meeting and mailing it to the library. Archive materials can be sent to Dwayne Cox, Special Collections, Draughn Library, 231 Mell Street, Auburn University, AL 36849.

#### 2016 SBDN Annual Meeting

This meeting has been planned for a while and it's going well. There were only 3 non-bat talks submitted for the 2015 Colloquium, so we hope to increase the number for future years. ASM is one of the only other meetings where non-bat mammal people have a place to present their data. SBDN was created because the ASM meeting was in June when bat researchers were not available to attend. Other outlets include state meetings and TWS, but they are very localized. **A19:** Dodd will email the EC ideas about people who could lead a small/meso-mammal symposium at future meetings. Carver emailed professors to encourage students to give non-bat

mammal talks at the meeting he ran (2012) and it worked. **AI10:** Carver add to host package the mailer created to inform potential participants about the desire for non-bat mammal talks and the possibility of a student award. The main issue is that bats are a hot topic and there are very few other endangered mammals in the southeast so not as much funding for them. Meeting adjourned at 8:57pm

**BUSINESS MEETING – MARCH 4, 2015**

Begin 2:10pm CST – President Joy O’Keefe

O’Keefe – background about SBDN. Used to have 10 board members, and now down to 6. We communicate with agencies and policy makers to make decisions about bat conservation. This is the 25<sup>th</sup> anniversary of the Mammal Colloquium and the 20<sup>th</sup> anniversary for SBDN. We have had several joint meetings: 2008 – SBDN and NEBWG; 2011 – SBDN, NEBWG, and MWBWG; and 2015 – SBDN, MWBWG, and WBWG.

Introduction of new EC:

- President Elect – Trina Morris
- President – Brian Carver
- Past President – Joy O’Keefe
- Treasurer – Tim Carter
- Secretary – Piper Roby
- Board Member at Large – Luke Dodd

Thanks to Mike Lacki (former President) and Steve Samoray (former Board member) for their service to SBDN.

**Committee Reports**

Membership Committee: Chris Comer

Overall, the majority of membership has been from students (27%), but membership as of the meeting in 2015 was made up mostly of consultants. This breakdown may change once all of the memberships are added from the 2015 meeting.

<u>Affiliation</u>	<u>Current</u>	<u>Percent</u>	<u>Past*</u>	<u>Percent</u>
Consultant	53	30%	30	15%
Academic	37	21%	19	9%
Student	29	16%	55	27%
State Govt	23	13%	11	5%
Federal Govt	14	8%	47	23%
NGO	9	5%	22	11%
Corporate	8	4%	4	2%
Other	6	3%	16	8%
	179		204	

\* since 2006

Steven Castleberry is working on a questionnaire to send out to the listserv to poll people about why they are members or not and what it would take them to be members. It will be sent out soon. Scott Bergeson is now the co-chair of this committee.

Awards Committee: Chris Comer reporting for Steve Burnett

Joey Weber won the travel award to go to NASBR. Nikki Castleberry has done an amazing job taking care of all that goes along with judging posters and talks. There were no nominations for Lifetime Achievement Award this year. The announcement for the student awards is on the website.

Newsletter Committee: Vanessa Rojas for JD Wilhide

JD would like to thank Vanessa for all her help. The next issue in the spring will be about this meeting. Please send pictures and photos to [nightwingnewsletter@gmail.com](mailto:nightwingnewsletter@gmail.com). The fall issue will be state reports. Want to get info on website for the membership to access.

WNS Committee: Piper Roby for Luke Dodd

See notes from EC Meeting (above)

Website Committee: Steve Samoray

SBDN has had a website for a long time, which is great, but the EC decided to spend some money to revamp it. Email Steve at [ssamoray@gmail.com](mailto:ssamoray@gmail.com) with any comments, additions, or changes to the website.

Bat Blitz Committee: Trina Morris

Trina stepping down and Michael Whitby taking over. Mary Kay is looking for team leaders for the 2015 blitz in South Carolina. Mary Socci from the Palmetto Bluff Conservancy is the committee chair for 2015 blitz. If you are interested in hosting a bat blitz in the future, talk to Whitby. See minutes from EC meeting for more info.

### **Treasurer's Report – Tim Carter**

Dues from membership are the major source of income. There is a lot of money coming in and going out every year, and we hold a lot of money for other groups. We have an audit every year so that it's not just Carter looking at the numbers. Tom Risch is helping with the audit, as he has done for several years. See minutes from EC meeting for more info.

### **2016 Annual Meeting – Holly LeGrand and Liz Hamrick**

Next year's meeting will be held 18 – 19 Feb 2016 at the Lake Guntersville State Park, Guntersville, AL. The meeting has been held here twice in the past, and the last one was in 2000. The reservoir is 69,000 acres of water and there are lots of things to do outside – birding, golf, hike, bike, fish, eagle awareness program, and tailored field trips. There are other state parks around, the US Space and Rocket Center in Huntsville is about an hour away, and several wildlife refuges. Lodging will be \$75-88/night (parking lot/lake side), or \$125/night for chalet (requires 2 night stay). The airport is 1 hr away.

Looking for volunteers to help with abstracts, tech (running presentations, microphones, etc.), registration, website (new SBDN site?), programs, food, t-shirt, event gopher, etc. Email Holly at [hlgrand@tva.gov](mailto:hlgrand@tva.gov) or Liz at [ecburton@tva.gov](mailto:ecburton@tva.gov).

### **2015 Treasurers Report – February Executive Committee Meeting**

One of the major services that SBDN offers to the bat community is holding and dispersing money for various functions and groups. Annually our two largest events are the Bat Blitz, and the Annual Meeting and Colloquium. The 2015 Joint Bat Working Group Meeting is especially large.

Currently we have \$5,828.73 in our general operations account. Membership dues remain our primary source of operating income. The largest general expenses of this year were the creation of the new website (\$2,500) and having our taxes prepared (\$660). In 2014, we received \$34,430.45 and spent \$15,247.94. Most of that is from the 2015 Bat Blitz and 2014 Annual Meeting. As you can see from the amount of money moving through our bank account on behalf of various functions and groups, we perform a valuable service to the bat community.

We currently have 116 paid members. We have 598 people subscribed to the SBDN mailing list.

Respectfully submitted: 3/2/2015 – By Tim Carter – SBDN Treasurer

# Contact Information for Executive Committee

## EXECUTIVE COMMITTEE

### **President:**

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### **Past President:**

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### **Treasurer:**

Timothy Carter - Associate Professor  
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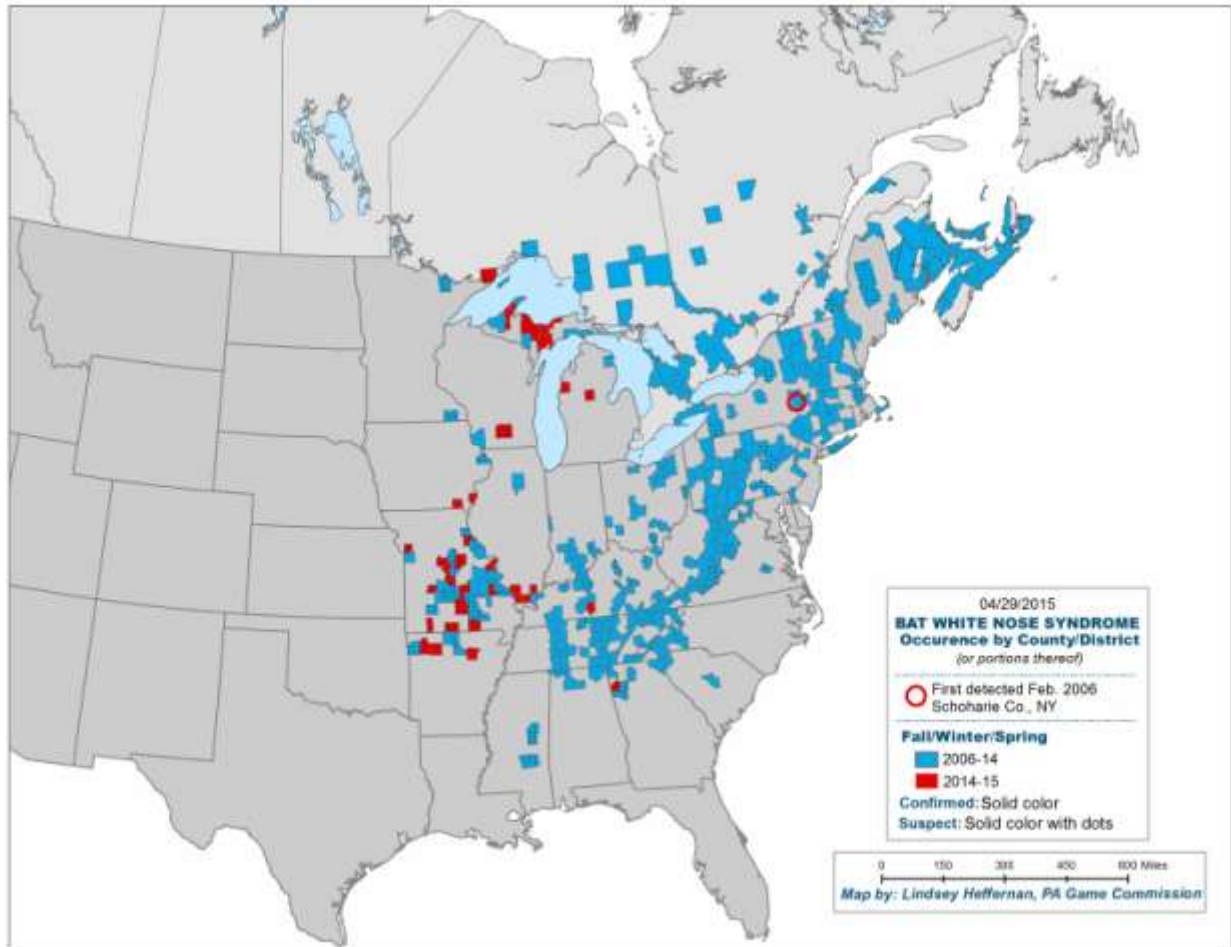
### **Secretary:**

Piper Roby - Wildlife Biologist  
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### **Board Member at Large:**

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# WHITE NOSE SYNDROME UPDATE





## WNS HIBERNACULA SURVEY

A WNS hibernacula survey was conducted at Sauta Cave and Cave Springs Cave in Northern Alabama on Feb 10 – 11, 2015 by USFWS. Participants included myself, William Gates (Alabama USFWS), Christopher Lewzander (Alabama USFWS), Nicholas Sharp (Alabama Dept. of Conservation and Natural Resources), Dottie Brown (Ecological Solutions), Darwin Brack (Environmental Innovations & Solutions, Inc), and Shane Brodnick (Environmental Innovations & Solutions, Inc).



Cave Springs Cave, individuals in the photos (from left to right) Nicholas Sharp, Darwin Brack, Shane Brodnick. They are looking at a tri-colored bat with signs of WNS.

Entrance to Sauta Cave, William Gates investigating a bat located on the rock just outside the cave entrance.





Sauta Cave, Jeff Jackson searching for gray and Indiana bats.

# Contact Information for Committees

<b>BAT BLITZ COMMITTEE</b>		
<b>Member</b> Michael Whitby (Chair) Tim Carter Dennis Krusac Bree McMurray Joy O'Keefe Gary Libby Jason Robinson	<b>Affiliation</b> USACOE Ball State University US Forest Service MO DOT Indiana State University Skybax Ecological Services, LLC Biological Systems Consultants, Inc	<b>E-Mail</b> <a href="mailto:michael.whitby@gmail.com">michael.whitby@gmail.com</a> <a href="mailto:tcarter@bsu.edu">tcarter@bsu.edu</a> <a href="mailto:dkrusac@fs.fed.us">dkrusac@fs.fed.us</a> <a href="mailto:mobatgirl1@yahoo.com">mobatgirl1@yahoo.com</a> <a href="mailto:joyokeefe@gmail.com">joyokeefe@gmail.com</a> <a href="mailto:garylubby@windstream.net">garylubby@windstream.net</a> <a href="mailto:jason@biologicalsystemsconsultants.com">jason@biologicalsystemsconsultants.com</a>
<b>AWARDS COMMITTEE</b>		
<b>Member</b> Steven Burnett (Chair) Membership pending	<b>Affiliation</b> Clayton College & State University	<b>E-Mail</b> <a href="mailto:StephenBurnett@mail.clayton.edu">StephenBurnett@mail.clayton.edu</a> 1
<b>MEMBERSHIP COMMITTEE</b>		
<b>Member</b> Chris Corner (co-chair) Scott Bergeson – (co-chair) Steve Thomas Blake Sasse Vanessa Rojas	<b>Affiliation</b> Stephen F. Austin State University Indiana State University  Arkansas Game and Fish Commission Indiana State University	<b>E-Mail</b> <a href="mailto:comerce@sfasu.edu">comerce@sfasu.edu</a> <a href="mailto:smbergeson@gmail.com">smbergeson@gmail.com</a>  <a href="mailto:dbsasse@agfc.state.ar.us">dbsasse@agfc.state.ar.us</a> <a href="mailto:vanessaxrojas@gmail.com">vanessaxrojas@gmail.com</a>
<b>WHITE-NOSE SYNDROME COMMITTEE</b>		
<b>Member</b> Luke Dodd (Chair) Katie Gillies Katherine Caldwell Tom Risch Piper Roby	<b>Affiliation</b> University of Kentucky Bat Conservation International NC Wildlife Resources Commission Arkansas State University Copperhead Consulting	<b>E-Mail</b> <a href="mailto:luke.dodd@uky.edu">luke.dodd@uky.edu</a> <a href="mailto:kgillies@batcon.org">kgillies@batcon.org</a>  <a href="mailto:trisch@astate.edu">trisch@astate.edu</a> <a href="mailto:plroby@copperheadconsulting.com">plroby@copperheadconsulting.com</a>
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<b>WEBSITE COMMITTEE</b>		
<b>Member</b> Steve Samaray	<b>Affiliation</b> Copperhead Consulting	<b>E-Mail</b> <a href="mailto:ssamoray@gmail.com">ssamoray@gmail.com</a>

## AWARDS AND RECOGNITION



Chad Williamson – Best Student Paper



Daniel Istvanko – Best Bat paper

# DESCRIPTIONS OF SBDN AWARDS

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## SBDN SERVICE AWARD

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

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

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

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## SBDN LIFETIME ACHIEVEMENT AWARD

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

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

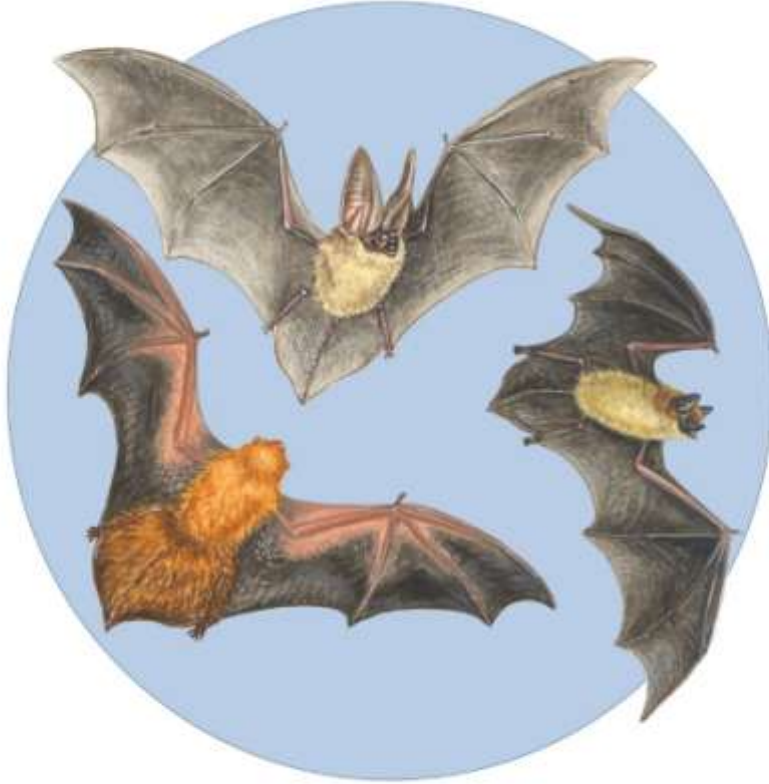
**Award Process:** The awardee will be announced at the SBDN annual meeting, usually held in February. A plaque will be presented to the awardee by the previous recipient or the SBDN president. The Awards committee will be responsible for obtaining the plaque and funds will be provided by SBDN. A copy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

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Please nominate qualified individuals to Stephen Burnett by November of each Year.

# ANNUAL MEETING

## North American Joint Bat Working Group Meeting



Midwest & Western Bat Working Groups

Southeastern Bat Diversity Network







# MEETING ABSTRACTS

## ORAL PRESENTATIONS

*(in alphabetical order by last name of first author)*

### **UNRAVELING ZERO CROSSING AND FULL SPECTRUM – WHAT DOES IT ALL MEAN?**

Ian Agranat, Wildlife Acoustics, Inc., 5 Clock Tower Place, Suite 210, Maynard, MA 01754 USA

Full spectrum and zero-crossing recording technologies have been used to record and analyze the echolocation calls of bats for decades. More recent advances in analysis software combine these technologies by extracting zero crossing information from full spectrum recordings using different combinations of signal processing techniques. The purpose of this paper is to explain the physics behind full spectrum and zero crossing technologies and modern hybrid algorithms for bat biologists and ecologists to better understand and appreciate the advantages, disadvantages, and modern capabilities of available technology. We first look at zero crossing and full spectrum recording technologies, how they work, and their relative advantages and disadvantages. We then explore a simple technique for extracting zero crossing data from full spectrum recordings using band-pass filtering and adaptive thresholds. Finally, we explore advanced signal processing techniques including Gaussian noise reduction, echo cancellation, call tracing, adaptive filtering and interpolation to study how they can be used to enhance a full spectrum signal in order to extract richer zero crossing data. We conclude that while zero crossing recordings do have some advantages in limited circumstances, it is far better to record bats in full spectrum and use modern signal processing techniques to enhance the signal before either analyzing the data with full spectrum tools or extracting zero crossing information and then analyzing the data using zero crossing or hybrid tools.

### **A PRELIMINARY ASSESSMENT OF THE CURRENT DISTRIBUTION OF THREE WHITE-NOSE SYNDROME IMPACTED BAT SPECIES IN VIRGINIA**

L.V. Austin\*, A. Silvis, W.M. Ford. Department of Fish and Wildlife Conservation, Virginia Tech, Blacksburg, VA 24061 (LA, AS, and WMF); U.S. Geological Survey, Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA 24061 (WMF)

Severe population declines in cave-hibernating bat species from White-nose syndrome (WNS) across the East has led to the proposed listing of the northern long-eared bat (*Myotis septentrionalis*) and additional status reviews of the eastern small-footed (*Myotis leibii*) and tri-colored bat (*Perimyotis subflavis*). Although cave survey data and mist-net records indicate changing distribution and abundance of WNS-sensitive species, efforts to document current bat species distribution are lacking for many areas. Understanding the current distribution of WNS-impacted bat species relative to both their historical and future distributions, however, will allow management efforts to be regionally targeted, and will help supplement information from cave surveys. We used acoustic surveys to document the current distributions of northern long-eared bats, Indiana bats (*Myotis sodalis*), and tri-colored bats in the Commonwealth of Virginia. We used multi-night site visit data to generate false-positive occupancy models in an information theoretic approach to predict the species' distributions relative to physiographic factors. Our preliminary analysis indicates that northern long-eared bat presence exhibits a curvilinear relationship with elevation and varies among regions such that probability of presence is greater in the Coastal Plain and Mountains than in the Piedmont. Tri-colored bat probability of presence also exhibited a curvilinear relationship with elevation, but presence was not influenced by physiographic region. Probability of Indiana bat presence was best predicted by our null model, which suggests that this species currently is unlikely to occur across the state, although small, local populations are known from winter cave counts. As the WNS-zoonotic disease continues to spread, it will be important to continue monitoring the changing distribution of impacted bat species.

### **INDIANA BATS DON'T ALL ROOST IN INDIANA! VARIATION IN ROOST AND LANDSCAPE CHARACTERISTICS ACROSS THE SPECIES' RANGE**

S.M. Bergeson, J.M. O'Keefe. Center for Bat Research, Outreach, and Conservation, Indiana State University, Terre Haute, IN

The majority of seminal Indiana bat studies that have informed management of the species throughout its distribution were conducted in the core of the species' range (i.e., Indiana and Illinois). However, the characteristics of both roosts and landscapes used by Indiana bats are likely to vary throughout the species' range. For example, Indiana bats roost in large hardwood snags and shagbark hickories in Midwestern fragmented forests, while Indiana bats in the Southern Appalachian roost in tall softwoods in contiguous forests. Our objective was to determine the extent of variation in roosts and landscapes used by roosting Indiana bats in different ecoregions. We used standardized roost data contributed by biologists throughout the species' range. We calculated landscape characteristics using a combination of GIS, Python scripts, and Fragstats. We compared roost and landscape characteristics between ecoregions as delineated by the USFWS and the EPA. Preliminary results suggest that roost (DBH, % bark remaining), plot (% plot canopy closure, # live trees, # snags), and stand (distance to water) scale roost characteristics (USFWS ecoregions:  $df = 78$ ,  $p < 0.001$ , EPA ecoregions:  $df = 117$ ,  $p < 0.001$ ) and landscape characteristics (forest coverage, forest patch size and shape; USFWS ecoregions:  $df = 84$ ,  $p < 0.001$ , EPA ecoregions:  $df = 189$ ,  $p < 0.001$ ) vary by ecoregion. These results suggest it may not be effective to use a "one-size-fits-all" set of

preferred roost characteristics to manage for Indiana bats across the species' distribution; instead, it may be necessary to define specific characteristics for optimal and suitable roost habitat at multiple scales for different regions in the species' range.

### **LITTLE BROWN BATS IN SOUTHEAST ALASKA HIBERNATE IN HOLES: IMPLICATIONS FOR THE SPREAD OF WHITE-NOSE SYNDROME**

K. M. Blejwas, M.L. Kohan, L.O. Beard, and G.W. Pendleton. Alaska Department of Fish and Game, Wildlife Diversity Program, Juneau, AK 99811 (KMB, MLK, and GWP); Wyoming Game and Fish Department, Lander, WY 82520 (LOB)

Little brown bats in eastern North America typically hibernate in caves and mines, often in large numbers, however few large hibernacula have been identified in the western part of their range and none have been found west of the Rocky Mountains. We used radiotelemetry to identify hibernation roosts of little brown bats in Southeast Alaska. We captured and radio-tagged adult little brown bats in September and early October in Juneau, Alaska and radio-tracked them daily from the air and on the ground. We located 10 hibernation roosts on 2 nearby ridge systems; distances from the capture site to the roost ranged from 1.3 to 24.1 km. Two roosts were under root wads on level ground at elevations  $\leq 86$  m. Eight roosts were located on steep, forested hillsides at elevations ranging from 128 to 452 m; 3 were rock roosts located in colluvium, 3 were associated with large rock outcrops, and 2 were in rocky soils. At least 1 roost was used in successive years. We compared winter temperatures and relative humidity inside ( $\sim 0.3 - 0.5$  m from the opening) and outside of 4 roosts located in 2013. Relative humidity dropped as low as 40-60% outside of roosts, but remained near 100% within the roosts throughout the winter. Average temperatures were also higher and more stable inside the holes ( $-1.04$  to  $2.03$  °C) than outside ( $-2.33$  to  $-0.63$  °C). If roosting solitarily in holes in the ground is a common overwintering strategy of little brown bats in the west, western populations should be much less vulnerable to White-nose Syndrome than their eastern counterparts.

### **AFFECT OF FOREST OPENING LANDSCAPE CHARACTERISTICS AND VEGETATION STRUCTURE ON BAT OCCUPANCY**

J.D. Brooks\* and S.C. Loeb. School of Agriculture, Forest, and Environmental Sciences, Clemson University, Clemson, SC 29634 (JDB); USDA Forest Service, Southern Research Station, Clemson University, Clemson, SC 29634 (SCL)

In the Central Hardwoods ecoregion, early successional habitat (ESH) is declining due to farmland abandonment and suppression of wildfire. As a result, populations of many ESH dependent species have declined. These declines have generated concern among scientists and land managers and have led many to ask how best to restore ESH. Bats, while not dependent on ESH, frequently use ESH for foraging and therefore may be affected by ESH restoration. Our objective was to determine bat occupancy of forest openings in relation to landscape and vegetation characteristics. We placed Anabat SD2 detectors at the center and edge of 21 forest openings in the Nantahala National Forest, NC ranging in size from 0.2 – 18.5 ha from June – August 2014. iButton temperature loggers were paired with each detector and vegetation structure was measured at each detector. Recorded calls were identified with the aid of Kaleidoscope Pro. ArcGIS was used to determine opening area, elevation, and distance to nearest waterbody. Program PRESENCE was used to estimate detection probabilities and probability of site occupancy for big brown (*Eptesicus fuscus*)/silver-haired (*Lasiorycteris noctivagans*) bats, hoary bats (*Lasiurus cinereus*), and *Myotis* species. The most highly supported model for big brown/silver-haired bats and hoary bats was the null model. The most highly supported model for *Myotis* spp. included distance to nearest water source. Occupancy of all species was negatively related to distance from water and distance from edge and positively related to area but all relationships had high variability. These data suggest that the landscape characteristics and vegetation structure of forest openings do not affect bat occupancy. However small bats, such as *Myotis* species, are affected by the position of openings on the landscape.

### **TESTING OF ACTINOBACTERIA ISOLATED FROM TWELVE WESTERN BAT SPECIES AGAINST PSEUDOGYMNOASCUS DESTRUCTANS: CLUES TO POTENTIAL NATURAL DEFENSES OF BATS**

D. C. Buecher, D. E. Northup, N. A. Caimi, A. Porrás-Alfaro, A. S. Kooser, J. M. Young, J. C. Kimble and E. W. Valdez. Buecher Biological Consulting, 7050 E. Katchina, Tucson, AZ 85715 (DCB); Department of Biology, Biology MSC03 2020, 1 University of New Mexico, Albuquerque, NM 87131 (DEN, NAC, ASK, JMY and JCK); Department of Biology, Waggoner Hall 372, Western Illinois University, Macomb, IL 61455 (APA); U. S. Geological Survey, Fort Collins Science Center, UNM Biology Department MSC03 2020, 1 University of New Mexico, Albuquerque, NM 87131 (EWW)

We monitored cave microclimates in 15 New Mexico bat hibernacula over 3 winters (2011-2013) to determine if these sites had conditions appropriate for the growth of *Pseudogymnoascus destructans*, the fungal pathogen responsible for the death of approximately 6 million bats in the eastern United States (U.S.). Complementing this project we swabbed bats to characterize the naturally occurring bacterial and fungal microbiota that reside on fur and membranes of bats captured in caves and at water sources in New Mexico and Arizona. This revealed the presence of many Actinobacteria, a bacterial phylum known for its secondary metabolite (e.g. antibiotic and antifungal) production. Different bat species varied in the abundance of Actinobacteria present on bats, leading us to hypothesize that some bat species may possess natural defenses against pathogens. To test this hypothesis in relation to *P. destructans*, we swabbed bats at El Malpais National Monument (ELMA) southwest of Grants, NM; Fort Stanton Cave near Capitan, NM; Bureau of Land Management (BLM) Caves 45 and 55 in south-central NM; and in Parashant National Monument in northwest Arizona. Swabs were immediately used to inoculate a suite of culture media that select for Actinobacteria, supplemented with

chemicals to isolate Actinobacteria. Our preliminary tests suggest that microbiota, especially *Streptomyces* spp., present on bats have the potential to produce anti-fungal chemicals that can inhibit *P. destructans*. These results may shed light on differences seen in the vulnerability of different bat species to *P. destructans* in the eastern U.S. This information is preliminary and is subject to revision. It is being provided to meet the need for timely 'best science' information. The assessment is provided on the condition that neither the U.S. Geological Survey nor the United States Government may be held liable for any damages resulting from the authorized or unauthorized use of the assessment.

## **INFLUENCE OF PRESCRIBED FIRE ON BAT PRESENCE AND ACTIVITY IN THE BIG SOUTH FORK NATIONAL RIVER AND RECREATION AREA**

L.K. Burns\*, S.C. Loeb, W.C. Bridges Jr., and P.G. Jodice. School of Agriculture, Forest, and Environmental Sciences, USGS South Carolina Cooperative Fish and Wildlife Research Unit, Department of Wildlife and Fisheries Biology, Clemson University, Clemson, SC 29634 (LKB and PGJ); USDA Forest Service, Southern Research Station, Clemson University, Clemson, SC 29634 (SCL); College of Engineering and Science, Department of Mathematical Sciences, Clemson University, Clemson, SC 29634 (WCB)

While prescribed fire is known to maintain forest health and minimize disease, little is known about its impact on bat activity. Past studies suggest reduction in vegetation from burning may increase access and foraging efficiency for bats. Our objective was to investigate bat activity in relation to burn history and vegetation structure in Big South Fork National River and Recreation Area, in Kentucky and Tennessee. We compared use of forest sites with varying burn histories (frequency, severity, and burn year) to adjacent unburned forest sites. We used AnabatII detectors to acoustically monitor activity levels for  $\geq 2$  nights during the 2014 maternity season across 22 paired treatment and control areas. All trees and snags  $>1.4$  m tall and  $>3$  cm diameter at breast height (DBH) in a 0.1 ha circular plot around each detector were identified and measured. We recorded 4079 bat passes at 66 sites. Echolocation files were separated into high ( $\geq 36$  kHz) and low ( $\leq 35$  kHz) phonic groups using a combination of AnalookW software and manual examination. The mean number of total bat passes and the mean number of high and low frequency calls were significantly higher in burned than unburned sites. As stem density was significantly lower in burn sites compared to controls, and bat activity was significantly higher in stands with lower stem densities, differences in activity between burns and controls appear related to differences in stem densities. Additional analyses among burned sites suggest that interactions between stand type and burn parameters affect stem density. Although further analyses of the structural effects of burning and the influence of meteorological factors are needed, prescribed fire and its subsequent effect on forest structure appear to have increased the suitability of forested sites for bats in our study area.

## **DESCRIBING THE SOCIAL BEHAVIOR OF THE INDIANA BAT AT DAY ROOST SITES**

\*Caroline Byrne and Joy O'Keefe, Center for Bat Research Outreach and Conservation, Indiana State University, Terre Haute, U.S.A.

Bats are highly social, but we do not fully understand how behaviors facilitate sociality. The study of bat social behavior was limited until recently due to technological limitations. Most of bat behavior is imperceptible to our senses, including both their use of ultrasound and their nocturnal activities. Since 1997, Indiana State University has monitored a population of endangered Indiana bats (*Myotis sodalis*) near Indianapolis, Indiana. During the maternity seasons (May-August) of 2013 and 2014, we recorded Indiana bat roost site behaviors with passive emergence count observation, video (Sony Nightshot HandyCams and IR lights), and acoustics (Pettersson D500X acoustic detectors). The objective of this study is to compile a catalog of visual and acoustic behaviors seen at Indiana bat day roost sites. Thus far, we have detected four general and 29 specific types of visual behavior, and 5 general types of acoustic behavior. Visual behaviors include behaviors similar to those categorized as "checking behavior" and agonistic behaviors seen in other bat species. A bat that is "checking" approaches a roost's surface and then may circle, land on or briefly enter the roost and then flies away; this behavior has also been observed for little brown bats (*Myotis lucifugus*). Behaviors that fell into the "checking" category make up the vast majority of documented behaviors during video observation. Within the documented acoustic behaviors there are calls similar to those documented in several previous studies for *M. lucifugus*. In *M. lucifugus* calls of similar structure were used in the contexts of agonistic, echolocation, infant isolation, and disturbance. These are some of the first systematic observations of social behavior for Indiana bats. Understanding the social behaviors of these highly social bats is crucial to gaining a full understanding of their life cycle and daily requirements.

## **OBSERVATIONS OF ROOST SELECTION BY MYOTIS SEPTENTRIONALIS**

Megan Caylor, Valerie Clarkston, Casey D. Swecker, Dale Sparks, and Virgil Brack, Jr. Environmental Solutions & Innovations, Inc., 4525 Este Ave. Cincinnati, USA

The northern long-eared bat (*Myotis septentrionalis*) was recently proposed to be listed as federally endangered, but data regarding the summer ecology and habitats used by this species are limited. Understanding summer roosts used is key to developing conservation efforts that contribute to recovery of this species once it is listed. From May to August 2014, we radio-tracked 42 northern long-eared bats to roosts in the Midwest (Missouri, Michigan, Nebraska, Ohio, Iowa) and Northeast (New York, Pennsylvania, West Virginia) regions of the United States. Ninety-six roosts were located, and characteristics and environmental data for each roost were collected and summarized. Observations were made of average foraging distances from fifty-three roost trees in West Virginia and Ohio. We found that roost types and environmental conditions of each roost varied remarkably among different individuals as well as within an

individual bat, regardless of age or sex. In a few instances, lactating female bats showed a marked difference in their roost selection from other reproductive statuses. Males and non-reproductive females were similar in their roost choices. There was also no correlation between size of tree and size of colony in the tree. Pregnant females also tended to be captured closer to their roosts than other reproductive statuses. Our observations confirm that the northern long-eared bat is a generalist in terms of roost selection, and the task of designating critical habitat for this species may prove to be more cumbersome than expected.

### **TRANSITIONING FROM TRADITIONAL DATA TO DIGITAL DATA MANAGEMENT**

J.L. Jackson, K.A. Cunningham. Jackson Group, Richmond, KY 40475.

Data management is an all-encompassing aspect of the job when working with bats. Time is wasted copying over data from field notebooks and datasheets into computer databases. Data can get lost or entered incorrectly. And the importance of this data have never been more important. With mass bat population declines, due in large part to white-nose syndrome (*Pseudogymnoascus destructans*) and habitat loss, it is vital to accurately gather as much data as possible. As it stands, every state has its own database, yet everyone wants the same information. A unified database can be achieved, saving everyone time and simplifying data entry. Chiro1 was created with the idea in mind that working with bats can be challenging, data management should not have to be. It allows the user to simplify data collection on digital tablets to allow for a more secure, faster, and more reliable way to handle all your information needs.

### **A COMPARISON OF METHODS FOR ACTIVE ACOUSTIC SAMPLING OF MIDWESTERN BATS**

L. E. D'Acunto, M. Moy, K. Johnson, B. Pauli, P. A. Zollner. Forestry and Natural Resources, Purdue University, West Lafayette, IN 47907 (LED, MM, KJ, PAZ); Department of Biology, Boise State University, Boise, ID 83725

Within the last decade, active acoustic sampling of bats using vehicles has grown in popularity as a method to monitor bat activity trends. This method of acoustic monitoring involves driving on roads with a microphone affixed to the top of the vehicle. Currently, the literature lacks empirical studies exploring different methodologies for conducting these road surveys. During summer 2013, we conducted acoustic road transects on three routes in northcentral Indiana using a traditional road survey (called a "smooth" method), a road survey where the vehicle stopped for 1 minute at every half mile of the survey route (called a "start-stop method"), and with an individual using a bicycle. Each survey used an ANABAT SD2 detector with an extended microphone attachment. Across all surveys, we were able to identify 844 recorded calls to species. Using a MANOVA, we tested whether there was a significant difference in bat detections based on method or time of night. For total bat species, we found no significant difference. We ran a GLM with a Poisson distribution on bat detections for each genus, which revealed that the start-stop method resulted in significantly more detections of bats in the genus *Myotis* ( $p < 0.01$ ), *Lasiurus* ( $p < 0.001$ ), and *Eptesicus* ( $p < 0.01$ ). Utilizing a start-stop method of active acoustic monitoring may increase detections of target species while reducing the inflation of call numbers found in passive sampling, which may be desirable for some monitoring goals.

### **NEST BOX OCCUPANCY OF THE ENDANGERED CAROLINA NORTHERN FLYING SQUIRREL IN HIGH-ELEVATION HABITATS IN THE SOUTHERN APPALACHIAN MOUNTAINS**

Corinne A. Diggins\*, W.M. Ford, and Christine A. Kelly, Department of Fisheries and Wildlife Conservation, Virginia Tech, Blacksburg, VA (CAD and CAK); U.S. Geological Survey Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA (WMF); North Carolina Wildlife Resources Commission, Asheville, NC (CAK)

The Endangered Carolina Northern Flying Squirrel (CNFS; *Glaucomys sabrinus coloratus*) is a rare subspecies occurring on highly disjunct sky islands in the southern Appalachian Mountains. Long-term monitoring of this subspecies is being conducted using nest box surveys. Although nest box occupancy for CNFS is relatively high in suitable habitat ( $\psi = 0.8$  with  $>30\%$  overstory conifer), other factors influencing occupancy, such as annual mast production and weather, have not been examined. We used nest box data from 69 sites monitored during varying periods from 1996-2014 in western North Carolina. We analyzed the effects of habitat quality, mast year, and weather on nest box occupancy of CNFS. Utilizing a multi-season occupancy modeling framework in Program PRESENCE, we used a two-step method to determine detection probability ( $p$ ), colonization ( $\gamma$ ), extinction ( $\epsilon$ ), and occupancy probability ( $\psi$ ). After determining covariates for  $p$ ,  $\gamma$ , and  $\epsilon$ , we modeled all possible combinations of 6 covariates thought to influence occupancy ( $N = 64$  models). Preliminary analysis indicate that increased annual winter precipitation and survey effort positively influenced detection probability. Nest box occupancy increased in areas of greater habitat quality (i.e., increased presence of conifer), lower canopy height, and in sheltered landforms with more northerly aspects. These preliminary results support our previous research on CNFS habitat selection on the stand and landscape scale within western North Carolina.

### **FORAGING ECOLOGY OF INDIANA AND NORTHERN LONG-EARED BATS IN A MANAGED FOREST ECOSYSTEM**

T. J. Divoll\* and J. M. O'Keefe. Center for Bat Research, Outreach, and Conservation, Indiana State University, Terre Haute, 47809 (TJD and JMO)

Since 2006, bat research has been conducted in 9 forest management units on the Hardwood Ecosystem Experiment (HEE) in central Indiana, a 100-year project in its infancy. Most research to date has focused on mist-netting, acoustics, and roost tree selection. Our

objective was to better understand spatial foraging habits of Indiana (*Myotis sodalis*; MYSO) and northern long-eared (*M. septentrionalis*; MYSE) bats in a managed forest with 3 different management unit types across a 19,000 ha area. In 2008, uneven-aged units received patch cuts and single tree selection, and even-aged units received clearcutting or shelterwood harvests in selected plots. Control units received single-tree selection prior to 2006, but will not be treated for the next 91 years. We tracked 21 ♀ MYSE, 2 ♀ MYSO, and 1 ♂ MYSO for 3-4 nights and collected  $65 \pm 5$  locations/individual using radio telemetry. For MYSE 95% fixed kernel density estimates (KDEs) averaged  $115 \pm 12$  ha ( $n=21$  bats), whereas MYSO KDEs were >twice the size, at  $301 \pm 66$  ha ( $n=3$  bats). Of the 24 bats tracked, 11 foraged in part within uneven-aged management units, one foraged in an even-aged management unit, 5 foraged within a control unit, and all were captured at small forest ponds. We will overlay KDEs with forest type, elevation, slope curvature, and distance to roads, ponds, and edges and perform a probabilistic weighted compositional analysis to rank order of resource use. MYSO traveled farther from roost sites to forage, while MYSE stayed closer to roost sites and used forested slopes. Several MYSE and MYSO foraged in recently harvested or regenerating areas. Bats' use of cut areas suggests that timber harvest may have a neutral or positive effect on bat foraging space. Strategies to promote forest heterogeneity at multiple spatial scales may promote foraging habitat for both *Myotis* species.

#### **POTENTIAL EFFECTS OF WIND ENERGY DEVELOPMENT ON INDIANA BAT POPULATION DYNAMICS**

R.A. Erickson, W.E. Thogmartin, J.A. Szymanski, R.E. Russell, and J.E. Diffendorfer. Upper Midwest Environmental Sciences Center, United States Geological Survey, La Crosse, WI (RAE and WET); Division of Endangered Species, U.S. Fish and Wildlife Service, Onalaska, WI (JAS), National Wildlife Health Center, United States Geological Survey, Madison, WI (RER); Geosciences and Environmental Change Science Center, United States Geological Survey, Denver, CO (JED).

The United States is increasing the production of energy from wind turbines as a method to decrease greenhouse gas emission and other types of pollution. These turbines have caused wildlife mortalities, including deaths to the federally endangered Indiana bat. The effect of these deaths on the population of the species is believed to have been minimal, but this may change as more wind turbines are built. We constructed a spatial model to examine current effects of wind energy development on Indiana bat population dynamics. We found minimal effects for current levels of take, but it is worth noting that there is little current overlap between the Indiana bat's range and wind farm development. We also examined different levels of take with our model. We found the greatest risk of population-level decline emerged only when meta-population dynamics were examined. Thus, small levels of take may be important because they may cause the extirpation of individual maternity colonies. Future research will include considering the synergistic effects of white-nose syndrome on the population dynamics of this endangered species.

#### **HABITAT ASSOCIATION AND SEASONALITY OF LITTLE BROWN BATS (*MYOTIS LUCIFUGUS*) IN THE CHUGACH NATIONAL FOREST, SOUTHCENTRAL ALASKA.**

J. Faust\* and D. Causey. Dept. Biological Sciences, University of Alaska Anchorage, Anchorage, Alaska 99508 (JF and DC); Applied Environmental Research Center, University of Alaska Anchorage, Anchorage, AK 99508 (DC).

The ecology of bats and bat roosting locations in Alaska is largely unknown, though Little Brown Bats (*Myotis lucifugus*) are found in southcentral and southeast Alaska, and associated with both natural and manmade structures. As White-nose syndrome decimates populations of *M. lucifugus* throughout the eastern United States, effective management and conservation of the Alaskan population becomes increasingly crucial. The USFS and ADF&G are collaborating to increase the awareness of bat species and habitat use across the Chugach National Forest (CNF), identify interspecies interaction, characterize winter hibernation behaviors, and increase understanding of how management activities may affect bats. As part of this larger effort, University of Alaska Anchorage biologists have begun work aiming to discover the ecological criteria that create a bat habitat, and to characterize wintering behaviors of *M. lucifugus* in the CNF. Acoustic monitors deployed at random points stratified by vegetative criteria will determine habitat factors that are useful to bats. Once roosts are located, radiotransmitters will be attached to bats in late fall to follow individuals to their winter hibernacula, so as to determine the distance of migration, duration of winter hibernation, and size of roost. Understanding habitat criteria and wintering strategies of *M. lucifugus* throughout the CNF will elucidate the urgency of their conservation and how best to do so. Furthermore, this work, being at the forefront of bat research in southcentral Alaska, aims to provide foundation for future bat work throughout the state.

#### **PRELIMINARY RESULTS OF A LONG-TERM MARK-RECAPTURE STUDY OF SMALL MAMMALS OF PRAIRIE RIDGE ECOSTATION, A RESTORED NATURAL AREA IN URBAN, CENTRAL NC**

L. J. Gatens, B. M. Hess, and A. Parsons. North Carolina Museum of Natural Sciences, Raleigh, NC 27601

With a history of heavy use, first as a military training site, then in agriculture, in 2004 the North Carolina Museum of Natural Sciences began converting a 38.5 acre tract to what is now Prairie Ridge Ecostation. Most recently, the majority of the tract was comprised of fescue fields and used for cattle grazing. The area has been partially transformed into native tall grass prairie, bottomland forest and arboretum, ponds, and a stream. Though undeveloped forest and pastures exist nearby, four-lane roads lie just to the west and south edges of Prairie Ridge and commercial and residential development are encroaching on all sides. In the summer of 2011 we began a long-term mark-recapture project to monitor small mammal populations of Prairie Ridge. We established three permanent grids of 50 traps each in three distinct field types: bottomland, fescue, and switchgrass. Trapping occurs seasonally, with trapping

sessions conducted in January, April, July, and October. To date, 1166 uniquely numbered ear tags have been applied to hispid cot rats (*Sigmodon hispidus*), 67 to white-footed mice (*Peromyscus leucopus*), 19 to house mice (*Mus musculus*), 16 to eastern harvest mice (*Reithrodontomys humulis*), and 3 to woodland voles (*Microtus pinetorum*). Additionally, 30 southern short-tailed shrews (*Blarina brevicauda*) were captured but not tagged. Findings are preliminary and both the study and analyses are ongoing. We are seeing seasonal variation and significant difference among field types ( $p < 0.05$ ).

### **GRAY BAT MIGRATION IN MISSOURI: METHODS FOR MONITORING MOVEMENT**

Cheyenne Gerdes\* and Lynn W. Robbins. Biology Department, Missouri State University 901 S. National, Springfield, MO 65897

Bat migration has been difficult to study due to low recapture rates and difficulty tracking captured bats across long distances. This research approaches the problem of studying bat migration using a variety of methods (band returns, radio telemetry, acoustic monitoring, and Doppler radar). We are studying two major aspects of gray bat (*Myotis grisescens*) migration – the connections between seasonally occupied caves and the phenology of migration. To study the connections between and among gray bat caves in Missouri, over 1100 fluorescent bands were deployed across the state at both hibernacula and maternity caves. By combining this information with historic band return data, we are creating a map of movements between caves. Several band returns from this study have been recorded thus far, and we anticipate more band returns in the future. In addition, eight female gray bats at a hibernaculum were radio-tagged with VHF transmitters. Two of these bats were relocated near a maternity cave 7.8 miles away 8 days later. To study the phenology of migration, bat detectors have been placed at sites across the region. For several sites, a timeline of gray bat activity was created. In addition, we are also exploring the possibility of studying migration phenology using NEXRAD weather radar data from a maternity colony.

### **YEAR ROUND ACTIVITY OF PERIPHERAL BAT POPULATIONS IN THE NORTH CAROLINA COASTAL PLAIN**

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Within a species' distribution are core populations containing most individuals. Under threats to persistence, the core populations receive the conservation attention. However, when a species is significantly threatened in the core of its range, as seen with White Nose Syndrome (WNS) and many bat species, shifting efforts to peripheral populations can be an effective conservation strategy. Warm temperatures along the Atlantic Coastal Plain may allow peripheral coastal bat populations to remain active through winter, thus decreasing their susceptibility to WNS or mortality associated with migration events. The objective of our study was to determine the year round activity, and specifically winter activity, of peripheral bat populations along the North Carolina Coastal Plain. We set up four Song Meter recording stations along a 295 kilometer north-south transect in the Coastal Plain (peripheral), and two Song Meter recording stations in the Piedmont (non-peripheral), of North Carolina. Recordings were made from sunrise to sunset, for two years. Although we found that bat activity was lower during the winter at all sites, the odds of recording a bat during winter were higher at peripheral sites when compared with non-peripheral sites. In addition the peripheral coastal plain sites had higher bat activity at any given winter temperature, when compared to non-peripheral piedmont sites. Lastly, the coastal plain sites appeared to be an overwintering ground for migratory bat species. We show that peripheral populations of bats, including *Myotis septentrionalis*, on the North Carolina Coastal Plain have increased levels of winter activity compared to those found in the North Carolina piedmont. We suggest that peripheral populations of bats on the North Carolina coastal plain have a unique winter biology that is important for species conservation in the face of winter mortality associated with both WNS and migration.

### **MODELING ENCOUNTERS BETWEEN MIGRATING BATS AND WIND PROJECTS**

Jeff Gruver, Christopher S. Nations, and David P. Young. Western EcoSystems Technologies, Inc., Laramie, WY (JG and CN), Cheyenne, WY (DY)

There is growing concern over incremental impacts of anthropogenic origin including wind energy development. We have developed a simulation model to aid evaluation of the potential impacts from individual wind projects on Indiana bats during seasonal migrations between hibernacula and maternity colonies. The model relies on publicly-available sources of data on hibernacula locations and population sizes, migration patterns, and maternity colony habitat characteristics, while recognizing that colony locations are generally unknown. Within simulations, maternity colony sizes and the number of bats "contributed" by each hibernaculum to each maternity colony are randomly generated. Then, colonies are randomly placed within suitable habitat, with constraints such that locations satisfy a minimum inter-colony distance criterion and mimic distance and direction distributions of migration data. Hibernacula are connected to colonies by straight migration paths, with width of several kilometers (typically, 5 – 20 km) intended to account for uncertainty in actual migration pathways. An "encounter" is defined as any overlap of a migration path with the wind project. By design, encounters represent potential interactions of migrants and a project, but not any aspect of direct impact such as collision risk. Results from simulations for several individual wind projects in different Recovery Units indicate that encounters are generally infrequent though distributed among a large number of hibernacula and maternity colonies. Also, the number of bats migrating within encountering paths typically represents a small proportion of the Recovery Unit population. If take has already been estimated by other methods, results from this model can be used to estimate the allocation of take among hibernacula and/or maternity colonies. Software is being further

developed as a desktop tool for use by the U.S. Fish and Wildlife Service. In addition, our approach may be useful to wind energy development companies seeking to minimize risk to migrating bats.

### **INFLUENCE OF EXTRINSIC ENVIRONMENTAL VARIABLES ON BODY TEMPERATURE OF FEMALE INDIANA BATS IN SUMMER ROOSTS**

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As technology advances, so does our ability to study and understand bat thermoregulation; however, in North America, the majority of studies done in situ have occurred at northern latitudes. Our objective was to describe general patterns of bat thermoregulation for Indiana bats in the southeastern U.S and to examine how reproductive condition, group size, roost characteristics, air temperature, and barometric pressure related to body temperature of roosting bats. In 2012, through the use of temperature sensitive transmitters, Lotek dataloggers, and a weather station we gathered roosting temperature data for Indiana bats (*Myotis sodalis*) in the southern Appalachians. We were able to gather full bat-days (sunrise to sunset) for 6 female Indiana bats (5 adults and 1 juvenile). Air temperature was the primary variable correlated with bats' body temperatures while at roost ( $P < 0.01$ ), with few differences detected among reproductive classes in terms of thermoregulatory strategies. Our findings have led to a better understanding of the thermoregulation strategies of Indiana bats and may guide efforts to create suitable natural and artificial roosting habitat.

### **EFFICACY OF USING AN ACOUSTIC LURE IN BAT NETTING EFFORTS IN INDIANA**

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Due to bat species becoming increasingly difficult to detect in the wild primarily because of anthropogenic factors, we tested the efficacy of using an acoustic lure to increase capture success. Need for increased detection is especially true for species that have been heavily affected by white-nose syndrome (WNS), such as the Indiana bat (*Myotis sodalis*), little brown bat (*Myotis lucifugus*), and northern long-eared bat (*Myotis septentrionalis*). We conducted our study at 3 locations in southern Indiana known as Purdue Agricultural Centers during summer 2014. We set up 7 mist-netting sites at each property, netting 2 times at each, both with the use and absence of an UltraSoundGate Player BL acoustic lure. The lure played recordings of *Myotis*, *Eptesicus*, and *Lasiurus* spp. distress calls from Europe and North America on a loop through the mist net night. A total of 24 bats were caught using the lure, while 47 were caught without the use of the lure. We ran a zero-inflated Poisson regression on number of bats captured per 15 minutes to test whether the lure produced a difference in capture rate of bats overall and among each genus. For overall bat captures, we did not detect significant differences between presence and absence of the lure ( $p = 0.813$ ,  $df = 8$ ). When split among the genera *Myotis*, *Eptesicus*, and *Lasiurus*, we did detect significant differences in capture rates between presence and absence of the lure for *Myotis* ( $p < 0.001$ ,  $df = 8$ ) and *Eptesicus* ( $p < 0.001$ ,  $df = 8$ ). For *Myotis*, the presence of the lure increased the capture rate, but for *Eptesicus*, the presence of the lure decreased the capture rate. Use of an acoustic lure may be a valuable tool to increase capture success of target species, but may bias results of inventory or monitoring studies.

### **USE OF BAT ECHOLOCATION AND CONSERVATION BIOLOGY TO TEACH THE PROCESSES AND CONCEPTS OF SCIENCE IN "FLIPPED CLASSROOM" UNDERGRADUATE COURSES**

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Bats have been used extensively in informal nature education in nearly every sort of setting, from National Parks, National Wildlife Refuges and US Forests, to many state and local nature centers, worldwide. Bat researchers regularly participate in these outreach events, hosting bat forays and demonstrations of the use of bat detectors. During the past 2 years, I have integrated bat echolocation and conservation biology into a variety of "flipped classroom" undergraduate courses and a graduate journal review seminar and report here on student learning outcomes. At Loyola University, we have developed an innovative introductory non-science majors course (replacing standard survey courses) that engages students in 4-6 week modules taught by different science faculty using active learning approaches. My module focuses on bat echolocation and its application to conservation biology. Students engage in Spallanzani's studies, the Griffin/Galambos studies, modern biosonar studies, as well as case studies of bat/moth jamming, bat/bat jamming, bat/frog predation, bat food habits and applications to assessing biodiversity and conservation status. They analyze ANABAT data sets and pose their own questions about seasonal occurrence and activity patterns. Pre- and Post-class SALG surveys showed significant increases in student self-assessment of understanding and skills of scientific experimental design and the role of peer review, as well as knowledge of animal echolocation, evolution, and ecology and their application to conservation biology. Several of the case studies have been used in courses ranging from non-science majors to graduate seminars demonstrating that active learning can be implemented at many different levels.



## **DETECTION AND CHARACTERIZATION OF MYOTIS LEIBII SUMMER ROOSTS IN VIRGINIA**

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The distribution and habitat selection of the eastern small-footed bat (*Myotis leibii*), an emergent rock roosting-obligate, is poorly known. To address this, we modeled detection probabilities and measured characteristics of *Myotis leibii* roosts. We compared detection probabilities of three survey methods (acoustic surveys with automated call identification, visual searching of emergent rock crevices, and mist-netting) at sites where *Myotis leibii* were historically present. Our results suggest that acoustic surveys with automated call identification perform poorly for documenting presence on talus slopes (detection rate of 0%) relative to visual searching or mist-netting. *Myotis leibii* are known to emit broadband, high frequency echolocation calls that are readily degraded by atmospheric attenuation, clutter, wind, and the directionality of the bat call. We hypothesized that these factors, plus signal reflection and lower echolocation rates over talus slopes limited acoustic survey success. In contrast to acoustic surveys, both mist-netting and visual searches of emergent rock have basal detection rates of at least 75%. Success during visual searches varied slightly among observers, but detection probability during visual searches increased with each additional site visit. *Myotis leibii* roosts we located were overwhelmingly within small rock crevices, but there was no apparent preference for horizontal or vertical crevice orientation. Mean roost entrance width was variable, but roost depth was consistently and substantially shallower than, and not correlated with, maximum crevice depth. Roost temperature consistently was within a narrow range, but was positively correlated with external roost temperature. Total volume of the rock used varied tremendously among our samples and may not be a major factor in roost selection. Although we did not quantify relative exposure of the roost above surrounding rocks, anecdotal observations suggest that this may play a role in roost site selection.

## **SEX-SPECIFIC FORAGING HABITS OF THE EVENING BAT (NYCTICEIUS HUMERALIS) IN THE OZARK REGION OF NORTH-CENTRAL ARKANSAS**

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Although many studies address the roosting ecology of forest-dwelling bats, little is known about the foraging habits for abundant, forest-dependent species. There is even less knowledge pertaining to behavioral differences between male and female bats. During summers 2013 and 2014, I thus monitored the sex-specific foraging habits of the evening bat (14 males & 10 females) in the Ozark National Forest, Sylamore Ranger District of north-central Arkansas. I used fixed kernel (FK) with least squares cross validation and minimum convex polygon (MCP) methods to estimate the space-use patterns of male and female evening bats during their nightly foraging bouts. Evening bats, primarily males, used multiple core foraging areas. Females exhibited larger FK foraging ranges ( $852 \pm 198$  ha) than males ( $332 \pm 85$  ha), likely reflecting differences in energetic requirements or habitat availability (i.e., female roosts). MCP estimates were not different between sexes but varied among years. Similarly, FK foraging range estimates were significantly larger in 2014 ( $739 \pm 163$  ha) than 2013 ( $323 \pm 106$  ha) possibly due to differences in annual precipitation and resource availability. Results suggest that differences in foraging habits between males and females do exist. Further research is needed to produce better informed habitat management decisions.

## **PRELIMINARY RESULTS OF THE EFFECTS OF UTILITY-SCALE SOLAR ENERGY PROJECTS ON BATS**

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Utility scale solar energy projects, primarily photovoltaic (PV) projects, are being built throughout much of North America and in many nations around the world, but little is known about their effects on bats. We present preliminary data from investigations of post-construction effects at an operating 250-MW solar photovoltaic (PV) project and a 337-MW concentrating solar project. Fatality surveys detected no bat fatalities during 24 survey months at the 250-MW PV project. Fourteen months of surveys at the 337-MW solar concentrating project detected no singed fatalities from exposure to solar flux or fatalities associated with heliostat collisions. Bat fatalities were detected at air cooled condenser units, but acoustic deterrents are expected to reduce these fatalities. At the 250-MW facility, we deployed 26 bat detectors from July 2012 through Dec 2013. We used general linear models to analyze the effects of operating arrays on the activity of bats as a group and for each bat species. All bats as a group, the Brazilian free-tailed bat, and the canyon bat had higher activity within operating arrays compared to preconstruction and conservation lands (0.80, SE= 0.167,  $P<0.05$ ; 0.43, SE=0.203,  $P<0.05$ ; and 0.41, SE=0.152,  $P<0.01$ , respectively). The pallid bat decreased its activity in array areas (-0.23, SE=0.078,  $P<0.01$ ). The resulting increases in activity may be due to the edge habitat created by the panel arrays, but the low flying pallid bat may avoid the arrays due to fencing.

## **BAT OCCUPANCY IN BOTTOMLAND HARDWOOD FORESTS MANAGED FOR WILDLIFE IN THE MISSISSIPPI ALLUVIAL VALLEY**

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Wildlife-forestry has been advocated for management of bottomland hardwood forests on public conservation lands within the Mississippi Alluvial Valley (MAV) and involves managing forests to achieve forest structure described as desired forest conditions (DFCs) for wildlife. Although songbirds may respond positively to management actions (e.g. timber harvests), little research has been directed at the effects on other species, including bats. To examine bat community response, we surveyed forest stands treated to achieve DFCs for wildlife and reference forest stands over two summer field seasons: 2013 and 2014. We conducted vegetation surveys to measure characteristics within stands and sampled bats using stationary full-spectrum acoustic recording devices over 6 consecutive nights. We identified echolocation calls to species using a combination of SonoBat™ software and manual verification of call sonographs. We used generalized linear mixed models to identify treatment effects on numbers of bat calls recorded. Results were mixed. In 2013, generally more big brown bat calls and silver-haired bat calls were recorded in treated units, while in 2014 more evening bat calls and eastern red bat calls were recorded in treated units.

## **SEEKING SILVER IN SOUTHEAST BRITISH COLUMBIA MINES: HIBERNATION ECOLOGY OF SILVER-HAIRED BATS**

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The silver-haired bat, *Lasiurus noctivagus*, is generally considered a ‘migratory-hibernator,’ migrating to areas where it overwinters with periods of dormancy. It is not known to what extent this bat is susceptible to White Nose Syndrome as its winter ecology is poorly known; however, this species has been found *Pseudogymnascus destructans* positive in the east. In B.C. Canada, it has long been hypothesized that this species may not be migratory given its year-round detection in the province; however, intra-provincial or short distance migrations could not be ruled out. I studied silver-haired bats at two mines in SE B.C. from 2009 – 2014. Using temperature-sensitive transmitters in winter, I documented the arousal patterns of both sexes, and of adults and young-of-year. I also determined that silver-haired bats hibernate in mines, rock-crevices, trees and snags, often switching roosts during the winter period. By banding individuals at these 2 mines in both summer and winter, I documented the first evidence of year-round residency at mines by male silver-haired bats. Recaptures of both males and females banded as juveniles and recaptured as adults in subsequent years confirms roost fidelity. Evidence of winter mating was found in some January and February captures. Patterned acoustic recordings by silver-haired bats at these two mine sites could be described as “songs” and may be associated with mating behavior given their predominance during fall and winter.

## **ADAPTIVE AUTOMATED BAT CALL FILE IDENTIFICATION FOR A MULTIPLE SPECIES OCCUPANCY PROJECT**

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Beginning in 2013, we initiated a multi-year occupancy modeling project in North Missouri targeting all nine bat species known to occur. The study area is composed of 120 sites sampled a minimum of nine times a year with multiple-microphone acoustic detectors (Wildlife Acoustics, SM2BAT+). This produces a large dataset of call files to be analyzed in an accurate and consistent manner. Additionally, each species affords unique challenges to identification, owing to their particular foraging strategies and echolocation parameters. To assess the efficacy of our data analysis methodology by species, we analyzed call files from a subset of our sites using multiple settings in automated call analyses software and compared to visual confirmation by a trained bat acoustic identifier. These sites were also mist-netted for bat presence to corroborate identification. Results varied depending on characteristics used to classify call files; both false positives and negatives occurred. However, species could be identified to a reliable degree of accuracy using individualized settings. To achieve quality, independently repeatable results from automated call analyses for a multiple species project, studies should use and report a combination of settings for identification catered to each expected species.

## **IMPACTS OF WHITE-NOSE SYNDROME IN KENTUCKY: SUMMER DEMOGRAPHICS OF BAT SPECIES PRE- AND POST-WNS**

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White-nose syndrome (WNS) has caused high mortality in cave-dwelling bats in the northeastern United States; however, impacts in more southern states are unclear. No signs of high mortality were observed in the first two years of known incidence of WNS in Kentucky; but fatalities were expected to increase in 2014. The purpose of our research was to determine if summer captures of the most common species, big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), northern long-eared bat (*Myotis septentrionalis*), and tri-colored bat (*Perimyotis subflavus*) differed pre- and post-WNS in Kentucky. We used statewide bat capture records from summer Indiana bat surveys conducted from 2007-2014 in Kentucky. We pooled data into two disease periods: pre-WNS (2007-2010) and post-WNS (2011-2014). Regression analyses indicated significantly more captures of *E. fuscus* and fewer captures of *M. septentrionalis* post-WNS. The proportion of male and female bats captured differed pre-post WNS, with capture frequency of

female *L. borealis* and *E. fuscus* being significantly greater post- compared with pre-WNS. The proportion of lactating females was significantly greater post-WNS for each species except *P. subflavus*. In contrast, juvenile recruitment appeared to decrease, with proportionately fewer juvenile *L. borealis* and *M. septentrionalis* captured post- compared with pre-WNS. To date, impacts of WNS on WNS-susceptible bat species in Kentucky appeared to be greatest for *M. septentrionalis*, with the number of captures and the proportion of juveniles being lower post-WNS. In contrast, total captures and the proportion of lactating females was greater post-WNS for *E. fuscus*. No measurable impacts occurred to date for *P. subflavus*. Our results suggested notable declines of *M. septentrionalis* in the summer landscape three years post WNS-detection in Kentucky, while other WNS-susceptible species, like *E. fuscus* and *P. subflavus*, increased or remained stable.

#### **MONTANA'S BAT ACOUSTIC SURVEILLANCE EFFORTS**

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Montana's bat species face a wide array of conservation issues that threaten the long-term viability of populations; the potential arrival of White-Nose Syndrome (WNS) may be the single greatest threat. A collaborative effort was initiated in the fall of 2011 to document year-round spatial and temporal activity patterns of Montana's bats prior to WNS arrival. In the last 3 and a half years, we have deployed a network of over 60 Song Meter ultrasonic acoustic detector/recorder stations programmed to record bat passes from sunset to sunrise year-round. Through January of 2015, these recording stations have resulted in more than 4.0 million full spectrum sound files containing around 12 terabytes of information. Processing and automated analyses have been completed for all sound files and all information is being managed in a single SQL database in order to facilitate call review and data summarization. Over 30,000 bat passes have been reviewed by hand using an updated Montana bat call characteristics key to definitively confirm the presence of species during each month of the year, identify the lowest temperatures at which individual bat species are active, and track overall bat activity at each station, regardless of species. Highlights to-date include: 1421 new records of monthly species presence throughout the state, numerous first records of species' activity during the fall, winter, and spring months, numerous first records of species in regions with previously limited bat survey effort, documentation of nightly activity patterns throughout the year with regular winter activity documented for a few resident species and documentation of the year-round presence of species previously considered migratory.

#### **NORTH AMERICAN BAT CONSERVATION ALLIANCE STRATEGIC PLAN**

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The North American Bat Conservation Alliance (NABCA) is an informal federation of groups interested in bat conservation in North America, including federal, state/provincial and local government agencies; industries; non-government organizations; individual scientists and biologists; and concerned members of the public. The role of the Alliance is to facilitate coordination and communication among parties; to develop and maintain a North American Bat Conservation Plan that identifies conservation priorities and strategies; and to prepare and guide Action Plans to implement the priorities identified in the Plan. NABCA is not a formal membership organization; rather, it is envisioned as a structure to enhance the effectiveness of existing organizations by encouraging open communication and cooperation among groups; by identifying continental conservation priorities and strategies to address them; and by creating a cohesive continental voice to enhance support for bat conservation. A brief history of NABCA will be presented, results of a conservation survey of >200 bat biologists across the continent will be summarized, and a draft of the North American Bat Conservation Plan will be introduced.

#### **HOME RANGE AND HABITAT USE OF FORAGING GRAY BATS (*Myotis grisescens*) FROM FOUR MATERNITY SITES IN NORTHERN ARKANSAS**

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Gray bats (*Myotis grisescens*) were listed as endangered in 1976 because of declining populations resulting from cave disturbance. The Gray Bat Recovery Plan recommends further study on foraging habits and home range. Yet, little data exist partly because gray bats have large home ranges, making ground-based tracking methods problematic. Accordingly, our objective was to assess gray bats' foraging habits using aerial telemetry. In 2014, two maternity sites (near Newark and Batesville, AR) were harp-trapped, and 50 adult lactating gray bats were radio-tracked from a Cessna 182 Skylane to gather 563 locations from June 15-July 15. Fixed-kernel density with least square cross validation was used to determine home range (95% of locations) and core foraging area (50% of locations) of a sub-sample of 14 individuals with  $\geq 15$  independent locations. Minimum Convex Polygon (MCP) was also used for comparative purposes with past published studies. Mean 95% home range was 362.2 km<sup>2</sup> (SE= 24.9 km<sup>2</sup>), 50% core foraging area was 83.2 km<sup>2</sup> (SE= 6.7 km<sup>2</sup>), average MCP was 171.6 km<sup>2</sup> (SE= 8.8 km<sup>2</sup>). For Newark (n=253 locations), home range was 349.3 km<sup>2</sup>, with a 44.3 km<sup>2</sup>-core foraging area, whereas MCP was 546.6 km<sup>2</sup>. At Bone cave, tracked later in the rearing period (n=310 locations), home range was larger (1006.9 km<sup>2</sup> with core foraging area of 146.2 km<sup>2</sup>; MCP was 1293.4 km<sup>2</sup>). Each individual used 1-3 core foraging areas.

Bats were often located over water, traveling by creek or river. With such large home ranges, management strategies for gray bats should go beyond protecting roost sites to include waterways and riparian areas for travel and foraging on sensitive aquatic insect species.

### **USING SIMULATED MICROSATELLITE LOCI TO TEST THE EFFICACY OF GENETIC METHODS TO DETECT POPULATION DECLINES**

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Having accurate and precise estimates of effective population sizes are crucial to making efficacious conservation decisions. Species at risk of decline face potential losses of heterozygosity, which can impair a species' ability to adapt to changing conditions. Eastern red bats (*Lasiurus borealis*) are experiencing ongoing population losses due to wind turbine collisions and other anthropogenic factors. To test the power of genetic studies in detecting recent population declines, simulated microsatellite loci data sets were created based on the characteristics of eastern red bats and then analyzed using MSVAR. Estimates of current effective population size, ancestral effective population size, time since decline, and mutation rates produced by MSVAR were compared to known parameters used to create the data. While the MSVAR software yielded highly accurate and precise estimates of ancestral effective population sizes, current effective population size was overestimated by an order of magnitude or more in nearly all simulations. M-ratios and theta determined for simulated data sets also failed to effectively detect population decline. Based on these results, we urge caution in using genetic data as a monitoring tool for populations experiencing recent declines, even when those declines represent the loss of a large proportion of the population.

### **ASSESSING BATS' USE OF SWIMMING POOLS AS AN ALTERNATIVE WATER SOURCE IN THE UNITED STATES**

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Anecdotal reports suggest that as clean natural water becomes scarce, bats are using man-made water sources to satisfy their drinking needs. Our aim is to determine the prevalence of bats' use of swimming pools as an alternative water source, the prevalence of bat mortality in swimming pools, if certain pool features make them more/less accessible to bats, if there are landscape and/or climate factors that influence both bats' use of swimming pools and bat mortality in swimming pools, and if management action is being taken to reduce wildlife mortality in swimming pools. We created an online survey with 29 questions for pool owners and users across the U.S. The survey was open in 2013 and 2014, with 575 responses nationwide by December 31, 2015. Most responses were from the eastern U.S. as well as the west coast and southern states, with gaps in northern Great Plains and Rocky Mountain regions. Many respondents observed bats around their pools, and of those observing bats, a majority have seen bats drink from their pool. Respondents have also reported finding drowned bats in their pool. As habitat loss and urbanization pressure bats to roost in or near human dwellings, swimming pools could become a main water source for these bats. If swimming pools have negative effects on bats, this could raise conservation concerns for species already at risk. Results will be compiled and analyzed to gain knowledge on this novel interaction between wildlife and urban society.

### **CONSERVATION GENETICS APPROACHES TO IDENTIFY POPULATION-LEVEL MOLECULAR DIVERSITY OF BATS AT CONTINENTAL SCALE**

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Bat diversity in North America is being rapidly exhausted due to direct and indirect consequences of human activity. As bat population decreases, loss of genetic diversity reduces their adaptability to changes in the environment. For most bat species we have no information of the genetic structure and diversity of their populations, and conservation genetic efforts in bats should be directed to prevent a lack of genetic adaptability and a potentially risk of extinction. Here, I made a review on published data, the use of novel genetic tools, and highlighted priorities on conservation genetics to understand patterns of population structure, assess growth or decline of local populations, and estimate evolutionary arrays in natural populations of bats. Results showed a lack of molecular studies in the most diverse country (Mexico), and excess of studies in the northern most countries. Mainly studies have been focused on population genetics studies (i. e. microsatellites, SNP's, or mitochondrial markers), but the use of the entire genome (i. e. transcriptomes, proteome, etc.) will be largely used in future researches. Conclusions directed that monitoring and managing bat populations, we must include genetics studies to maintain the pattern of genetic diversity in genes.

### **DIURNAL BAT FLIGHTS**

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Observations of bats travelling during the day are rare in the literature, and this is especially true for bats in North America. Research has focused on hypotheses that attempt to explain why bats would avoid flying during the day; however diurnal flights could pose some potential benefits. Here we report observations of Indiana bats (*Myotis sodalis*) and a northern long-eared bat (*Myotis septentrionalis*) taking diurnal flights in the Appalachian Mountains. From 2009 to 2014 we observed a total of 11 individuals taking daytime flights: ten Indiana bats (nine females and one male) in the Smoky Mountains and one male northern long-eared bat in central West Virginia. Is this sort of diurnal activity truly aberrant or is this a natural, though perhaps uncommon behavior that warrants further investigation? We present hypotheses that may explain this behavior, discuss data that may have bearing on the hypotheses, and provide direction for future research.

### **EFFECT OF PARTURITION DATE ON ADULT FEMALE SURVIVAL IN THE LITTLE BROWN BAT**

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The little brown bat (*Myotis lucifugus*) faces possible extinction due to white-nose syndrome. Like other animals with slow life histories, *M. lucifugus* population growth is strongly affected by adult female survival. Unfortunately, we know very little about the factors that impact adult female survival in this species. Previous studies indicate that juvenile survival is lower for pups born later in the season, presumably because they have less time to store fat before hibernation. We hypothesized that mothers who give birth later would also have lower survival, then conducted a four-year study at a maternal colony to test this hypothesis. We estimated parturition dates, banded and recaptured females, used program MARK to model survival, then ranked models using Akaike Information Criterion. Our results determine whether parturition date affects adult female survival, which provides a basis for development of management strategies that could help lower extinction risk for *M. lucifugus*.

### **LOCATING CAVES USING REMOTE SENSING – COLOR INFRARED VS THERMAL IMAGING**

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Management concerns pertaining to karst openings are multidisciplinary and range from water quality, water quantity, to the various animals that utilize them during their life cycle. But, in order to manage karst openings one first has to know where they are located. This presentation explores the possibility of using available satellite data to locate known springs compared to an airborne thermal imaging system. Locating caves in order to protect any troglobite or troglone species is a concern to fish and wildlife agencies. Using remote sensing may be a more effective means of finding karst openings than ridge walking or word of mouth. This may enable researchers to cover larger areas with less manpower. Non-traditional groups have recently begun searching for caves; these include the National Aeronautic and Space Administration (NASA) and the United States Department of Defense (DOD). Natural Resources Conservation Service (NRCS) infrared satellite imagery at a scale of 1m x 1m was used for testing. Multispec image analysis software, using a supervised classification, was employed to test the hypothesis at Blanchard Springs Caverns near Fifty-six, AR. A helicopter mounted FLIR thermal imaging system was tested to see if it could locate known caves with or without a spring emergence. The test flight was flown on January 7, 2014 over 3 known karst openings; ambient temperature was -13°C. Test results for the color infrared photography were promising using the supervised classification. However, the scale of 1m x 1m is too coarse to find smaller karst openings, this may improve as imagery at a smaller scale becomes available. The FLIR mounted thermal imaging system yielded better results for locating smaller karst openings. But, a better understanding of karst weather is needed to predict when the karst opening is “breathing”. However, either method may help direct ground crews searching for openings.

### **BEHAVIOR AND STRATEGIES OF MIGRATING INDIANA BATS (MYOTIS SODALIS)**

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Migration strategies vary between and among species groups and are influenced by ecological and physiological factors. In this study, we evaluated the migration strategy used by the federally endangered Indiana bat (*Myotis sodalis*), a regional migrant found throughout the eastern United States. During 6 spring migration seasons (2009–2014), we actively radio-tracked female *M. sodalis* from 5 caves in Tennessee, primarily using aerial telemetry to document the behavior of spring migrating bats, and to determine the location of maternity areas. The mean distance from hibernacula to summer grounds ( $n = 11$ ) was  $175.6 \pm 31.2$  km (range: 74.7 – 368.1 km). Mean traveling flight speed during migration for 9 bats was  $12.8 \pm 0.5$  km/hr which was significantly faster than mean foraging speed ( $4.5 \pm 0.6$  km/hr). Bats flew  $59.8 \pm 7.2$  km per night on average (range: 11.8 – 153.3 km) during which they stopped every  $1.4 \pm 0.2$  hrs (range: 0.1 – 7.8 hrs) to use  $3.4 \pm 0.4$  stopovers per night (range: 1 – 10). Stopovers were nocturnal foraging areas, single-day roosts, or multi-day roosts. Such variation was attributed to environmental conditions and feeding requirements. Nightly migration movement ceased completely once temperatures dropped below 10°C, indicating a minimum migration temperature for *M. sodalis*. Diurnal bat body temperature generally mirrored ambient temperature patterns indicating that bats entered torpor daily. On nights with inclement weather (low temperatures or rain), bats remained in torpor and did not migrate. Our findings indicate that *M. sodalis* uses a combination of multistep migration (stopping periodically en route) and torpor-assisted migration (entering diurnal torpor to reduce fuel consumption). Information about habitat use at stopovers is still lacking, but documentation of migration behavior will provide valuable information for future conservation and recovery strategies for this endangered species.

## **USING MULTISPECIES GENETIC LANDSCAPES TO INFORM THE SPREAD OF WHITE-NOSE SYNDROME**

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White-nose syndrome (WNS) is an epidemic affecting hibernating bats across eastern North America. As WNS spreads across North America, analyses of the phylogeography and genetic demography of known host species and other potential future hosts are increasingly important in providing baseline data regarding population size, demographic trends, patterns of population substructure, and estimates of gene flow. From these data, we may evaluate the importance of observed population declines from a historical perspective and infer likely paths of disease spread. For example, phylogeographic analyses of *Perimyotis subflavus* indicate that the predominant pattern of gene flow in the host mirrors the spread of WNS along and out from the Appalachians, suggesting that similar analyses in populations along and ahead of the disease front may allow us to predict future patterns of disease spread. Similar analyses in *Myotis lucifugus* indicate that landscape features such as the Allegheny Plateau may serve as semi-permeable barriers to gene flow among hibernating colonies, which might explain the delayed introduction of WNS into much of Ohio and Michigan. Several research groups are currently engaged in phylogeographic studies of individual species. While we agree that such analyses are important for understanding and predicting the impact of WNS, we argue that a multispecies approach is necessary for a better understanding of the spread of a disease that is remarkably broad in its host preference. Single-species analyses must be combined with information regarding multispecies roost behaviors and modes of fungal transfer to create multispecies epidemiological models. This approach is particularly important if WNS continues to spread across the continent and encounter novel host species. We encourage increased collaboration across research groups and urge the integration of ecological, behavioral, and genetic data to model both intra- and inter-specific transmission.

## **USE OF AERIAL RADIO TELEMTRY TO DETERMINE HOME RANGE FOR THE NORTHERN LONG-EARED BAT (*MYOTIS SEPTENTRIONALIS*) IN TENNESSEE**

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Although several past studies have investigated the roosting range of the northern long-eared bat, these studies were conducted in the northern portion of the species' range and few included foraging areas into an overall home range estimate. The objective of this study was to determine home ranges, including nightly foraging areas, for female northern long-eared bats on Arnold Air Force Base in Coffee County, Tennessee. To document foraging areas, bats were captured using mist-nets, fitted with radio transmitters, and tracked from the air using a Cessna 172 aircraft fitted with strut-mounted Yagi directional antennas. Foraging data were collected for three pregnant or lactating bats resulting in 126 individual foraging points. These foraging points were used to determine total foraging area (95% fixed kernel), intermediate foraging area (75% fixed kernel), and core foraging area (50% fixed kernel) for each bat and for all bats combined. The largest home range, which included four roost trees and three nights of foraging data, was 129.8 ha. Our study reports the first home range information, including roosts and foraging areas, for the northern long-eared bat in middle Tennessee. Collection of foraging behavior using aerial telemetry proved to be advantageous in the amount of data collected and efficiency compared to traditional ground based telemetry methods.

## **USE OF BRIDGE ROOSTS BY EASTERN SMALL-FOOTED BATS IN THE ARKANSAS OZARKS**

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The eastern small-footed bat (*Myotis leibii*) is rare in Arkansas with only 111 known records in 17 counties in the Ozark and Ouachita mountains. Prompted by a presentation at the 2013 SBDN meeting, a survey of bridges with concrete guardrails in the presumed range of the species was conducted April-October in 2013 and 2014. Small-footed bats were found in 21 bridges of this design in 8 counties. Bats were detected in 90% of occupied bridges on the first or second survey.

## **BAT ASSEMBLAGE AND SELECTION OF MATERNITY ROOSTS IN A POST-WILDFIRE FORESTED LANDSCAPE**

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Ponderosa pine (*Pinus ponderosa*) forests in the southwestern U.S. have increased in density over the last 100 years following EuroAmerican settlement and subsequent changes in fire suppression, logging, and livestock grazing. These changes dramatically increased the size, severity, and frequency of wildfires. Wildfires rarely kill animals, but can have immediate consequences to bat populations by altering vegetation and thus roosting and foraging opportunities. Because no studies in the Southwest documented effects of wildfire on bats, we studied roosts and water sources used by bats on the 217,721-ha Wallow Fire that burned in 2011. Our objective was to describe landscape- and microsite-level roosting habitat used by reproductive female bats 2- and 3-years post-wildfire. We captured bats at water sources and used radio transmitters to locate maternity roosts for 4 species. We identified 67 roosts for 55 bats. For ponderosa pine snag roosts (n = 50), we measured habitat characteristics and paired each roost with a randomly-selected comparison snag. Snag roosts used by bats had larger dbh, less bark, and were more decayed with exfoliating bark. Bats used

snags with up to 100% bole char, although one species, Arizona myotis (*Myotis occultus*), selected unburned ponderosa pine snags (<18% bole char). Microsite features appeared to influence roost selection more than landscape features. Some species may adapt to temporal changes caused by wildfire but others sensitive to high-severity fires, like the Arizona myotis, may decline. Species such as long-legged myotis (*M. volans*) that use fire-killed trees will encounter a pulse of roost structures for up to 10 years post-fire until snags fall; it may then take hundreds of years for forests to provide snags large enough for bat use. We suggest that in the long-term, habitat for bats will decline if we cannot manage large, high-severity wildfires in the Southwest.

#### **INSIGHTS FOR CONSERVATION OF NORTHERN LONG-EARED BATS (*MYOTIS SEPTENTRIONALIS*) DERIVED FROM A MULTI-YEAR STUDY AT FORT KNOX, KENTUCKY**

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With continuing population declines as a result of white-nose syndrome, and potential listing as a federally threatened species, it is increasingly important to consider conservation measures for northern long-eared bats (*Myotis septentrionalis*). Although the proposed 4d rule exempts forest management activities from US Fish and Wildlife Service oversight, other activities (e.g. military land use, mineral extraction) may require consultation and subsequent minimization and mitigation. Unfortunately, few data on appropriate conservation measures for the northern long-eared bat exist. We conducted a large scale, manipulative experiment on the impacts of roost removal for the northern long-eared bat at the Fort Knox Military Reservation, Kentucky that provides conservation insights for the species. In particular, our work shows that primary roost loss in the hibernation season will not cause maternity colonies to abandon roosting areas or cause a subsequent collapse in social structure the following year. Loss of ~25% of non-primary roosts does not apparently affect space use, but may have negative impacts on social structure. The intensive nature of our study also provides guidance for documenting maternity colony size, spatial extent, and the number of roosts used. Averaging across colonies that we tracked, the number of roosts located per bat was positively related to the number of days a bat was tracked, but tracking >10 bats generally did not add new roosts or show greater space use. Based on movements between sequentially used roosts while accounting for reproductive condition, and on colony roosting area size, our results suggest that the 4(d) rule proposed 0.25 mile buffer around any located roost may be insufficient to protect all roosts used by a maternity colony. Finally, analysis of multi-year roost selection with >200 roosts indicates that single year roost selection data is insufficient to adequately describe roost selection at a given site.

#### **A COMPARISON OF UPLAND TO LOWLAND ACOUSTIC DETECTOR SITES IN TWO STATE PARKS IN THE NATIONAL SCENIC RIVERWAYS**

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As part of a mammalian biodiversity survey, several Anabat II bat detectors were placed across Current River State Park and the newly established Camp Zoe State Park. Detectors were placed near rivers and ponds, in both upland and lowland areas. Calls were analyzed with BCID and Kaleidoscope using the default species settings. We compared the diversity of bat species detected at each site, and compared the abundance of calls and the average calls per day of sites in different habitats. We also analyzed how the composition of bat calls changed over time. Overall, the average number of calls recorded per day were higher at sites near sites with flowing water than sites near ponds. Gray bats were the most frequently detected species, this is likely due to the proximity of a major colony. By understanding the diversity, abundance, and phenology of bats in different habitats, we hope to understand how the bat community is utilizing the landscapes in our study sites, which will hopefully inform management decisions at two parks that are undergoing major renovation.

#### **NEW INSIGHTS ON THE DISTRIBUTION, ECOLOGY, AND OVERWINTERING BEHAVIOR OF THE LITTLE BROWN MYOTIS (*MYOTIS LUCIFUGUS*) IN ALASKA**

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We initiated the citizen science-based Alaska Bat Monitoring Project in 2004 to investigate the distribution, habitat use, and seasonal ecology of the Little Brown Myotis in Southcentral, Central, and Western Alaska. As of 2012, we received reports of bats from 252 unique locations across the focus area, including Kotzebue, White Mountain, Saint Michael, and the Semidi Islands, which represent significant range extensions for bats in the state. Ninety-seven percent of 111 roosts were located in human structures. Maternity colonies were identified in 48 locations, all in human structures. The majority of observations were reported in late July, August, and September, but we received observations every month of the year. We received reports of bats associated with buildings unless observed flying outdoors; no hibernacula in natural substrates were documented. Timing and locations of winter observations imply that bats in the most northerly areas are likely non-migratory and overwinter in human structures, while winter observations in Southcentral Alaska suggest both migratory and non-migratory behavior. Despite the limitations and bias inherent in the data set, these reports represent a significant contribution to our understanding of the distribution and ecology of the Little Brown Myotis in Alaska and provide a basis for future directed research efforts.

## **BAT ACTIVITY IN A POST-WILDFIRE LANDSCAPE**

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Frequency and size of wildfires have dramatically increased in southwestern ponderosa pine (*Pinus ponderosa*) forests in the U.S. These changes result from an increase in tree density since EuroAmerican settlement because of fire suppression efforts and increased livestock grazing. Changes in vegetation resulting from wildfires affect habitat use by bats but this is not well documented. We hypothesized that burn severity would affect bat activity and used the 2011 Wallow Fire (217,721-ha) in eastern Arizona as our study area. Previous studies examined the effects of prescribed fire on bats; we found 1 published study examining the effects of wildfire on bat activity in the western U.S. We collected echolocation calls from 21 sites randomly selected within the fire boundaries. At each site, we monitored bat activity in each of four burn severity classes (0% – 25%, 26% – 50%, 51% – 75%, and 76% – 100% basal area [BA] loss) using SM3Bat acoustic detectors (n = 84 locations). We sampled each location twice: during the dry (June-July) and wet (July-August) season in 2014. We used SonoBat 3.0 to classify calls to species and calculated an activity index by adjusting the calls per species by number of hours that calls were collected at each location. We grouped *Myotis* species because they could not always be identified to species; other species were examined separately (e.g., silver-haired bat [*Lasionycteris noctivagans*]). We conducted a multi-scale analysis of landscape structure, quantifying fire severity and vegetation around each location at a specified scale (e.g., from 100 m to 1000 m radius). Burn severity affected use. The *Myotis* group used low burn severity (0-50% BA loss) areas but silver-haired bats selected areas with high burn severity (>50% BA loss). In the short term, patchy forest landscape created by large, intense wildfires provided habitat for different species of bats.

## **THE NEWEST THREAT TO BAT CONSERVATION: SLOPPY ACOUSTIC MONITORING AND ANALYSIS**

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The species decisions generated by any echolocation auto-identification software program should be considered “suggested” classifications. Expert Manual Vetting is the only method to confirm bat presence from acoustic surveys. An “expert” is a qualified biologist with knowledge of bat echolocation call characteristics and the limitations imposed by species having overlapping echolocation call repertoires. With the increase in bat surveys that rely upon acoustic-only methods, Expert Vetting has exposed issues ranging from flawed detector hardware, auto-classifiers outputting obvious and absurd misidentifications, and researchers misinterpreting results. This leads to erroneous reports on species presence, stemming from: (1) misplaced trust in the automated process, and (2) inexperience with interpreting spectrographic content. The vital input from manually vetting echolocation calls is essential for accuracy in reporting acoustic survey results, but in the hands of a novice, it can do more harm than good, leading to serious management and mitigation problems. Novice acoustic analysts often attempt confident classification decisions for as many recordings as possible. Experienced users proceed more conservatively on species identifications. They have a greater appreciation of the unique call characteristics among species and can recognize atypical sequences or hardware issues that reduce confidence in classifications or encourage false-positive results. We reviewed a collection of full-spectrum recordings novices labeled “Species of Interest,” and our Expert Vetting could not confirm any of the species decisions. We use this information as a “case study” to present guidance on interpreting acoustic software outputs when performing file-by-file expert manual vetting for species-of-interest. We identify common pitfalls of manual vetting, and what each recording really represents and why. A more comprehensive version of this program is available at: <http://www.batmanagement.com/acoustichelp/acoustichelp.html>

## **SPECIES FROM FECES: A TOOL FOR GENETICALLY IDENTIFYING BATS**

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Bat guano is a relatively untapped reservoir of information, having great utility as a DNA source because it is abundant in caves and mines even when bats are not present, and is stationary and easy to collect. Three technologies have come of age that together enable species identity from guano: reliable DNA typing from feces, DNA barcoding (species-specific genetic identifiers), and bioinformatic analysis. Taking advantage of these advances, we have developed a mini-DNA barcode assay that targets a segment of mitochondrial gene cytochrome oxidase I that we have found to be highly discriminatory among Chiroptera globally, readily accommodates fecal DNA, and selectively targets bat but not prey DNA. We have successfully validated our system from feces of 25 bat species (e.g., identification of *Myotis septentrionalis*, *Eptesicus fuscus*, *Corynorhinus townsendii*), with aged fecal pellets (up to 3 months old), and with individual and pooled guano pellets, such that questions can target individuals (using specific fecal pellets) or populations and communities (long-term roost sites). Other benefits of our Species from Feces tool is in confirming field identification, especially of



morphologically similar species. In several instances our genetic approach revealed misidentification of mist-netted species. We are currently developing a searchable website that will allow users to determine the discriminatory power of our markers for species that interest them. Although our Species from Feces tool has immediate application in the U.S., where bats are under threat from White-Nose Syndrome, it is also a potentially powerful application worldwide. For example, it can be used to determine presence of bat species that are vulnerable or facing extinction.

#### **A TECHNIQUE TO ESTIMATE LOCAL POPULATION SIZE OF EASTERN SMALL-FOOTED BATS DURING SUMMER**

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Typical efforts to monitor bat populations in North America rely on winter hibernacula counts, but this method may be ill-suited for eastern small-footed bats (*Myotis leibii*). Observations suggest small-footed bats have been affected by white-nose syndrome but it is unclear to what extent the disease has impacted their populations. We piloted visual surveys on 3 talus slopes in Virginia as a technique to estimate abundance of Small-footed Bats during summer. Local population size was calculated using random circular quadrats during July of 2013 and 2014. In each quadrat, we counted the number of bats and suitable crevices present and estimated population size using two methods. Bats were easily documented with visual searches. Estimates from quadrats suggested the largest (3 ha) talus slope had a maximum population of 196–343 bats, depending on the model used. Estimates from 2013 were similar to those from 2014, suggesting the method is consistent. Monitoring of Small-footed Bats on rock outcrops during summer should be explored as a way to resolve uncertainty over population trends. This technique should be tested at suitable habitats in other parts of the range of Small-footed Bats as soon as possible.

#### **SPRING TIME ROOSTING ECOLOGY OF ENDANGERED VIRGINIA BIG-EARED BATS IN NORTH CAROLINA AND TENNESSEE**

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The southernmost population of the endangered Virginia big-eared bat (*Corynorhinus townsendii virginianus*) occurs in NC and TN. The state of NC first identified winter hibernacula for the species in the 1980s. However, prior to this study we had no information on locations and characteristics of maternity sites used by this population. Our goal was to locate maternity roosts and to identify factors important in roost site selection. From March–May 2013 and 2014, we radio-tracked 42 female Virginia big-eared bats to 27 roosts in NC and 6 roosts in TN. We recorded landscape and roost-scale characteristics for each roost. In 2013, we discovered the primary maternity roost used by this population, a cave 14 km NNW of the primary hibernaculum that is used by  $\geq 350$  adult bats. Across the landscape, bats roosted in spacious caves ( $n=13$ ), relatively open rock  $\pm 40$  m, range 658–1422 m) than the hibernaculum (1421 m), which was also used as a maternity site. Most roosts ( $n=27$ ) had multiple entrances. Size/complexity and airflow of natural rock roosts were important factors in maternity roost site selection for this population and, thus, these factors deserve investigation in future roost habitat studies for this species. Also, because Virginia big-eared bats roosted in buildings, it will be important to reach out to homeowners and developers in our study area. In NC, optimal roosting habitat for Virginia big-eared bats is a relatively large cave with stable internal temperature and little airflow, and located within southern Appalachian cove and oak forests. Identifying potential roost structures with characteristics similar to roosts we found and protecting known roost sites should enable managers to protect critical maternity habitat for Virginia big-eared bats in NC and TN.

#### **PREY SELECTION OF SEVERAL COMMON BAT SPECIES OF A BOTTOMLAND HARDWOOD FOREST IN EAST TEXAS**

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The most common methods for determining diet of bats include manual examination of fecal material for insect fragments and examination of discarded fragments under feeding posts or roosts. Both of these methods are biased to larger prey and/or prey with hard exoskeletons. Barcoding analysis of DNA from fecal samples reduces this bias. Our primary objective was to determine prey selection for several common bat species of bottomland hardwood forests by comparing dietary composition to prey availability at Old Sabine Bottom Wildlife Management Area. We extracted DNA from fecal pellets collected from bats captured during mist-netting between early June and early August 2013. We performed end-point polymerase chain reactions (PCR) using primer pairs developed for the cytochrome c oxidase subunit I (COI) gene. These PCR products were sequenced and resulting sequences were aligned and compared to reference sequences in the Barcode of Life Data System (BOLD) to obtain finest taxonomic designation (generally family or lower) for each sequence. We identified 9 species from 3 orders consumed by tri-colored bats (*Perimyotis subflavus*), 9 species from 4 orders consumed by Seminole bats (*Lasiurus seminolus*), 7 species from 3 orders consumed by evening bats (*Nycticeius humeralis*), and 11 species from only 2 orders consumed by Eastern red bats (*L. borealis*). Coleoptera was always the most abundant order available by biomass but was rarely consumed by Seminole or eastern red bats. However, it comprised a substantial

portion of prey identified from tri-colored and evening bat samples. A significant portion of prey identified from all species was lepidopteran, while only a small portion of the available biomass was of this order. Although dipteran species were a negligible portion of the available biomass, a large number of the prey identified in samples from all species were from this order.

#### **URBAN IMPACTS ON WHITE-TAILED DEER FAWN SURVIVAL**

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Urban populations of white-tailed deer (*Odocoileus virginianus*) are increasing in many areas throughout their range. Expansion of urban development and residential suburbs provide white-tailed deer with suitable habitat that is conducive to rapid increases in population growth along with increased risk of deer-vehicle collisions, personal property damage, and elevated incidences of zoonotic diseases. Assessment of fawn survival and cause-specific mortality is important for understanding the population dynamics in these areas. Comparisons between populations of fawn white-tailed deer in urban, suburban, exurban, and rural areas may provide additional insight about the factors that affect these populations. We captured and radio-collared 119 fawns (66 urban, 9 suburban, 8 exurban, 36 rural) in 2013 and 2014. Fawn survival was monitored during the first 6 months of life using radio-telemetry. Primary cause of mortality was vehicle collisions in urban areas, and coyote predation in suburban, exurban, and rural areas. We found that probability of survival increased as density of homes at birth sites increased. This information may help explain the population density differences in urban and rural areas, and help determine which management strategies may be the most effective.

#### **A COMPARISON OF URBAN AND EXURBAN BAT COMMUNITIES IN A POST WHITE-NOSE SYNDROME LANDSCAPE**

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Research on urban bats generally focuses on human-wildlife conflict and zoonotic disease, while little is known about bat ecology and habitat use in the urban landscape. Furthermore, the spread of White-Nose Syndrome (WNS) is fatally impacting many species, including urban-dwellers, across northeastern North America, and was first discovered in northern Illinois during winter 2012-2013. We sought to examine how species abundances and distributions differ within and between urban and exurban areas, to understand how urban ecosystems influence bat communities. From 2012 to 2014, we examined the presence and relative activity of bat species using passive acoustic monitoring systems in the Chicago metropolitan area. Acoustic monitors (SM2BAT+; Wildlife Acoustics) were deployed during two sampling periods (July/August and September/October) at 18 parks, golf courses and forest preserves in both urban Cook and exurban Kane counties. We detected a maximum of 7 species across sites in both urban and exurban landscapes, while golf courses and parks were among the most species diverse. Overall, we recorded more calls at urban sites than at exurban sites, and bat detections decreased in the later sampling session, likely because bats were beginning to migrate to their winter sites. We found substantial species differences across sites, both within and between treatment groups. Of species impacted by WNS, we observed greater activity levels in urban sites than in exurban sites, including *Myotis lucifugus*, one of the most heavily impacted species. As bat species in Illinois begin to face the potential impacts of this rapidly spreading disease, our preliminary results will inform future monitoring and conservation efforts of populations in the Chicago area.

#### **THE SIMULATED EFFECTS OF TIMBER HARVEST ON SUITABLE HABITAT FOR INDIANA AND NORTHERN LONG-EARED BATS**

B.P. Pauli, P.A. Zollner, G.S. Haulton, G. Shao and G. Shao. Department of Forestry and Natural Resources, Purdue University, West Lafayette, Indiana, 47907 (BPP, PAZ, GS and GS) Division of Forestry, Indiana Department of Natural Resources, Indianapolis, Indiana, 46204 (GSH).

Bat conservation in the eastern United States requires the ongoing production of important summer habitat for both diurnal roosting and nocturnal foraging and commuting. Forest management via silviculture can direct forest succession to retain and develop important habitat features. The large scale spatiotemporal effects of timber harvest on habitat for bats are not obvious but can be investigated with simulation models. We used a forest succession model (LANDIS-II) to simulate future forest conditions on Indiana State Forests under different harvest regimes. We simulated 9 harvest scenarios ranging from a complete cessation of timber harvest to intensive timber extraction. We applied previously created models of nocturnal and diurnal habitat occupancy for both Indiana and northern long-eared bats. We found that suitable nocturnal habitat was maximized for Indiana bats but minimized for northern long-eared bats under low intensity timber harvest scenarios. Among moderate intensity timber harvest scenarios, both species exhibited the greatest amount of suitable nocturnal habitat when timber harvest applications focused on regenerative openings. The quantity of suitable diurnal habitat trended in the opposite direction of nocturnal habitat with selection harvests favoring suitable roosting habitat. Overall suitable habitat was primarily driven by the degree of suitable diurnal habitat rather than nocturnal habitat for both species. This highlights the complex nature of managing multiple habitat needs for more than one species and illustrates the importance of understanding habitat requirements associated with different life history needs. Our results can inform forest management to preserve and encourage suitable habitat for multiple imperiled bat species.

## POSTER PRESENTATIONS

(in alphabetical order by last name of first author)

### ACTIVITY OF BATS AT MINNETONKA CAVE, IDAHO

B. Abel, M. Wackenhut, and D. Green. Idaho Department of Fish and Game, Pocatello, ID 83204 (BA and MW); Caribou-Targhee National Forest, Soda Springs, ID 83276 (DG)

Minnetonka Cave is Idaho's largest limestone cave, and Idaho's only show cave, with 33,000 tourists visiting each summer. Idaho Department of Fish and Game in cooperation with federal agencies, has initiated increased monitoring at important hibernacula in response to the threat of possible westward spread of White-nose Syndrome (WNS). Semi-annual hibernacula surveys have shown increasing trends in use by bats at Minnetonka Cave since the 1990's, and species include those that are potentially the most vulnerable to WNS. Beginning in 2011, we installed a long-term acoustic monitoring system outside the entrance of the cave to monitor activity of bats across seasons and verify species present at the site. We used Wildlife Acoustics SM2BAT bat detector, secured in weatherproof housing, to record ultrasonic vocalizations bats produce while in flight. We obtained 583,026 acoustic files over 21 months. Of those files, 358,187 (61%) were recordings of bats. We used Sonobat 3.1.1 software to automatically classify bat call files to species or genus groups. In addition to automatic classifications, we manually checked a random sample of bat call files and Sonobat-generated classifications of species whose presence at the site was unexpected. We documented acoustic activity of bats throughout the year. Activity levels were the highest during July and August, lowest from December through February. We documented calls indicating the presence of Townsend's big-eared bat, big brown bat, western red bat, hoary bat, silver-haired bat, Mexican free-tailed bat and long-eared myotis, little brown myotis, long-legged myotis and western small-footed myotis at the site. To reinforce our classifications of Myotis species, we captured bats with a harp trap inside the entrance of the cave in October 2014. We verified all acoustically detected Myotis species. Minnetonka Cave is a significant hibernaculum and will remain a high priority for bat conservation in Idaho.

### DEMOGRAPHICS AND ACTIVITY OF THE MEXICAN LONG-NOSED BAT, LEPTONYCTERIS NIVALIS (PHYLLOSTOMIDAE) IN BIG BEND NATIONAL PARK, TX, USA.

E. R. Adams\* and L. K. Ammerman. Department of Biology, Angelo State University, San Angelo TX, [eadams13@angelo.edu](mailto:eadams13@angelo.edu)

We initiated a pilot study using PIT tagging at a maternity colony of Mexican long-nosed bats (*Leptonycteris nivalis*) at Mount Emory Cave in Big Bend National Park, TX in 2014. This species is endangered throughout their range in the U.S. and Mexico. This colony is known to be largest in size during the peak of Agave flowering in the summer months but there is no information on the arrival and departure dates each year. Further, the frequency and duration of foraging bouts are unknown. Our objective was to detect seasonal occurrence, nightly activity, and demographic information about this species at their northernmost roost. We implanted 38 bats with PIT tags and used a Biomark IS1001 and cable antenna in a novel serpentine configuration to monitor the medium-sized cave entrance. We detected 61% of tagged individuals at least once from May-September (Adults=8, Juveniles=15). We hypothesize that the early season detection rate was low because some bats avoided the antenna. We calculated the maximum nightly activity for 13 bats over periods of one to eight nights in July and August. On average adults and juveniles were active for 7.85 hours. Pregnant females were captured at the cave much earlier than expected (26 April) and we detected a tagged juvenile male much later than expected (1 September). PIT tagging additional bats in this colony to increase our sample size and initiating PIT tag monitoring earlier in the upcoming season will continue to provide a more comprehensive understanding of the activity of this species.

### ROOST AND FORAGING RESOURCE SELECTION BY EASTERN RED BAT, (*Lasiurus borealis*)

S. K. Amelon, F. R. Thomson, III, J. J. Millsbaugh. USDA Forest Service, Northern Research Station, Columbia, MO 65211; University of Missouri, Columbia, MO 65211

Bat populations in North America are being impacted by various threats including human induced changes in habitat at multiple scales, climate, disease and wind power development. Migratory bat species are being particularly impacted by wind turbines. These declines emphasize the urgent need for understanding associations between bat populations and their habitats at critical periods. We examined the effects of site and landscape structure on the distribution and activity patterns of eastern red bats (*Lasiurus borealis*). Historically, the importance of foraging resource selection to conservation of forest bats has been viewed as secondary to importance of roost selection. We used resource utilization functions (RUF) and discrete choice modeling to test the hypotheses that a) site, landform and landscape factors affect both foraging and roosting resource selection by eastern red bats and b) selection varies by reproductive stage. We radio-tracked 53 females in early, mid and late lactation (n=18, 15, and 20). Individual home range size (99%) ranged from 202 – 3727 hectares (ha) (mean=1357; SE=122); smoothing (h) values used to compute the UD ranged from 30 – 591. Most bats had an area of high use near their roosts and multiple areas of lower use. Highest use was associated with open deciduous forest on ridges and upland drainages in areas close to non-forest edge and relatively high road density. Inter-individual variation in resource selection was high, even among demographically similar bats. The variability in individual responses to resource attributes suggests that factors at multiple landscape scales affect this species; therefore, management strategies that provide a range of composition and structural diversity are important to meet both roosting and foraging needs for *L. borealis*.

## **BATS AND PUBLIC SHELTERS: BIG BROWN BATS OF HAMMEL WOODS GET THEIR OWN CONDO**

J. Armstrong-Ullberg. Natural Resource Land Manager at the Forest Preserve District of Will County, Joliet, IL 60433 USA

Abstract: What would you do if a colony of big brown bats was hanging around one of your most popular picnic shelters? Offer the bats a condo building of their own, of course. That's what the Forest Preserve District did in September of 2014 when the Pennsylvania-based company, Bat Conservation and Management Inc. was hired to install a midsize bat condo about 75 feet north of the Shorewood Grove Shelter in Hammel Woods. The bat issue at Shorewood Grove Shelter has been on the District's radar for years because of complaints. Sometimes bats would uncharacteristically emerge during the day after becoming irritated by noise from picnickers and smoke from the shelter's fireplaces. Other times, picnickers were annoyed by the bats and the guano they left behind. So the condo was installed as an incentive for the bats to relocate.

## **THE EFFECT OF STREAM DEGRADATION ON RIPARIAN BAT DIVERSITY**

N. Buschhaus, C. Litton\*, R. Lowry\*, S. Peterson, and H. Whiteman. Department of Biological Sciences, University of Tennessee at Martin, Martin, TN 38238 (NB, CL, and RL); Watershed Studies Institute and Department of Biological Sciences, Murray State University, Murray, KY 42071, and The High Lonesome Ranch, De Beque, CO 81630 (SP and HW)

Stream ecosystems have been degraded throughout the Southern Rockies due to multiple perturbations. Kimball Creek, a 3rd order stream located on the High Lonesome Ranch near De Beque, Colorado, has experienced in-stream channel and riparian habitat degradation due to cattle, irrigation, extirpation of beaver, and high spring flows, resulting in deeply incised channel morphology and increased sedimentation. Plans are being implemented by the High Lonesome Ranch to restore Kimball Creek to a more natural hydrological pattern. The conservation and restoration of stream and riparian ecosystems depends upon an understanding of the ecological interactions between them. Bats, and the emerging aquatic insects upon which they feed, are important components of these inter-ecosystem interactions, which may have reciprocal cascading effects. As part of a larger study of Kimball Creek's pre-restoration ecology, we collected data to evaluate bat species richness and activity. During Summer 2013 and 2014 two Wildlife Acoustics SM2Bat+ bat detectors were placed at two sites on Kimball Creek that varied in altitude, vegetative structure, and degree of degradation for a total of over 60 acoustic sampling nights. During that time, over 40,000 bat passes were recorded, with approximately 20,000 bat passes per study site. We used SonoBat version 3.1 for full spectrum species identification, followed by post-identification review of bat calls and subsequent visual verification of species assignment. Bat activity and bat species richness at both sites was high. Both sites varied in the activity of each species, with greater evenness in species activity at the more degraded, open, lower-altitude site. Our continuing study of bat species richness and activity will help to elucidate the role of these terrestrial insect predators on the potential for inter-ecosystem trophic cascades in Kimball Creek and will add to the knowledge of bat conservation on the Western Slope of the Rocky Mountains.

## **BAT USE OF TIMBER HARVESTS AND ADJACENT FORESTS: A COMPARISON OF CALL ABUNDANCE ACROSS THE HARVEST-FOREST GRADIENT**

K. L. Caldwell\* and T. C. Carter. Department of Biology, Ball State University, Muncie, IN 47306-0440.

Increased bat use of timber harvests has been documented in multiple studies, yet questions remain regarding differences in species' use of areas within and surrounding timber harvests. Our objective was to compare echolocation call abundances for six species across a gradient relative to timber harvest treatments in a managed central Indiana forest. We recorded bat echolocation calls at clear cuts (n=6), shelterwood cuts (n=6), and patch cuts (n=12) during May-July, 2013 and 2014 and sampled 120 locations per season. Detectors were placed at five locations relative to each harvest: harvest center, harvest edge, 15 m into forest, 50 m into forest, and 100 m into forest. We classified bat calls into six species: *Eptesicus fuscus*, *Lasiurus borealis*, *Lasiurus cinereus*, *Perimyotis subflavus*, *Myotis septentrionalis*, and *Myotis sodalis/lucifugus*. We used a generalized linear model with year, harvest, and detector location as fixed effects to compare bat call abundances by species and used Akaike's Information Criterion to select the best models. We found greater call abundances at harvest center and harvest edge than all forest locations for *E. fuscus*, *L. borealis*, *L. cinereus*, *P. subflavus*, and *M. septentrionalis*. No differences were found in call abundance between forest locations, with the exception of *L. borealis*, which had lower call abundance at the 50 m forest location than the 100 m forest location. *Myotis sodalis/lucifugus* call abundance was greater at harvest edge than all other locations. *Eptesicus fuscus*, *M. sodalis/lucifugus*, and *M. septentrionalis* showed a trend for greater call abundance at harvest edge than harvest center. Despite morphological variance of the species sampled, greater use of locations within timber harvests than in forests adjacent to harvests was found. Identifying patterns in bat species' use of timber harvests and their surrounding forests is important for understanding the effects of silvicultural treatments on bat assemblages.

## **ATYPICAL AMERICAN BEECH TREE USED BY INDIANA BAT MATERNITY COLONY**

M. K. Caylor and J. J. Sheets. Environmental Solutions and Innovations, 4525 Este Avenue, Cincinnati, Ohio 45232(MKC); Orbis Environmental Consulting, P.O. Box 10235, South Bend, Indiana 46680 (JJS)

Two juvenile male Indiana bats (*Myotis sodalis*) were radio tracked to an American beech (*Fagus grandifolia*) during the summer of 2013 in Clermont County, Ohio. The American beech resulted in the most bats seen emerging across the five known roost trees discovered during the study and indicates that it may have been a primary maternity roost. There are few records in the literature of

Indiana bats using American beech trees as roosts and could influence how habitat assessments are conducted for potential Indiana bat roosts.

### **ASSESSING CLASSIFIER ACCURACY, KaPRO vs. SonoBat, SOUTH FLORIDA EDITION**

J.D. Chenger and J.D. Tyburec, Bat Conservation and Management, Inc., Carlisle, PA USA (JDC), Janet Tyburec Consulting, Tucson, AZ USA (JDT).

Bat-workers rely upon auto-classifiers to quickly summarize acoustic surveys. This process does not provide an error-free picture of bat occurrence. Instead it merely indicates maximum likelihood for bat presence. How much error is involved in the results depends upon the ability of the researcher to obtain high-quality recordings, and the ability of the classifier to accurately interpret the metrics available in the recordings. Little information has been published about current classifier accuracy rates, so there is very little guidance for applying different classifiers to acoustic surveys. This presentation illustrates how two classifiers are assessed for bat populations in Southwestern Florida, USA. Calls that are used to evaluate a classifier must be from known species, that is, either voucher calls collected from free flying bats, or passive recordings that were manually vetted to species by experts with 20+ years of call analysis experience. Using a formula to arrive at the accuracy and precision of automated classifications based on the true positives, false positives, false negatives and true negatives, we can quantitatively compare the performance of programs. Between December 2014 and February 2015, we expertly reviewed a collection of 5000+ quality full-spectrum recordings from 16 Pettersson D500x detectors that were distributed across the 80,000 acre Babcock-Webb Wildlife Management Area. These high-quality recordings were then evaluated by the most currently available versions of SonoBat and KaleidoscopePRO. Results from the auto-classification outputs were compared with the expert manual vetting to determine the relative accuracy and precision of the two programs, and hence their reliability for reporting on passive acoustic surveys. More information about this analysis is archived at: <http://www.batmanagement.com/acoustichelp/acoustichelp.html>

### **ASSESSING BATS AT EFFIGY MOUNDS NATIONAL MONUMENT IN EASTERN IOWA FOR EXPOSURE TO PSEUDOGYMNOASCUS DESTRUCTANS**

R.S. Cleary\*, K.M. McLaughlin, T.A. Kress, R.G. Mudalige-Jayawickrama, and G.L. Zuercher. Department of Natural & Applied Sciences, University of Dubuque, Dubuque, IA 52001

We were asked to evaluate the bats at Effigy Mounds National Monument (EMNM) for signs of White-Nose Syndrome (WNS). We sampled bats at eight locations within EMNM by using mist nets. All captured bats were weighed, measured, and examined. In addition, DNA samples were taken from the oral cavity and facial region using Isohelix® DNA swabs and sterilized cotton swabs; these samples were used to test for the presence of *Pseudogymnoascus destructans*, the fungus that causes WNS. Five bat species were captured in mist nets between mid-July and late September 2014 with Northern long-eared bats (*Myotis septentrionalis*) and little brown bats (*Myotis lucifugus*) being the most common. Big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasiurus noctivagus*), and eastern red bat (*Lasiurus borealis*) all were represented by single captures; all three are species that have historically yielded positive detections of the WNS fungus at different locations. All captured bats appeared healthy after physical examination and wing scores provide no evidence for prior exposure to the WNS fungus. We will present the results from a molecular analysis of the swabs.

### **MISSOURI BAT CAVE SURVEYS: THE PAST 30 YEARS AND WHAT THE FUTURE MAY HOLD**

S.N. Colatskie and A.G. Elliott. Missouri Department of Conservation, St. Louis, Missouri (SNC) and Missouri Department of Conservation, Kirksville, Missouri (AGE).

The Missouri Department of Conservation began conducting winter bat hibernacula surveys as early as the late 1950s at a few sites, such as Pilot Knob Mine, but the majority of the surveys began in the mid-1970s when both the Indiana bat (*Myotis sodalis*) and the gray bat (*Myotis grisescens*) were listed under the Endangered Species Act. While other species were noted, the focus of the surveys was on Indiana and gray bats before White-nose Syndrome (WNS) began to appear in the northeastern United States. Surveys post 2006 involved an increased effort to count all bat species present and WNS monitoring including: surveillance, collections for research or diagnostics, and various efforts to detect the causative agent. Because of the long-term Indiana bat monitoring protocol, we have survey data pre- and post-WNS on at least 25 caves. Continued cooperation with private landowners, caving organizations, NGOS, other agencies, and the general public, has assisted MDC in documenting several new major bat hibernacula and maternity caves of various species including what is currently the largest Indiana bat hibernaculum in its entire range.

### **CHANGES IN BAT COMMUNITY COMPOSITION DURING SEASONAL FALL MIGRATION IN NORTHWEST TENNESSEE**

G. A. Counts\* and N. Buschhaus. Department of Biological Sciences, University of Tennessee at Martin, Martin, TN 38238

Temperate bat populations fluctuate with changing temperatures resulting in a decrease in populations from early fall to early winter and an increase in late spring to mid-summer. In the fall, many bats either migrate to another area or hibernate in caves, leaf litter, or inside tree bark to survive the cold temperatures of winter. Since normal thermoregulation in insectivorous bats becomes inefficient as

temperatures drop, we predicted that species richness in northwest Tennessee would decrease during the fall as the temperatures decreased. We recorded bat calls at a rural pond in Weakley County, Tennessee, late August – early November 2014, using a Pettersson D500X. The full spectrum calls were analyzed with SonoBat version 3.1, followed by visual verification of species identification by N. Buschhaus. Bat species using this area varied during the study, with bat species richness first increasing then decreasing in the latter portion of the study.

#### **KOOTENAY COMMUNITY BAT PROJECT: A COMMUNITY-BASED APPROACH TO BAT CONSERVATION**

J. A. Craig, M. Sarell and L. A. Isaac. Silverwing Ecological Consulting, Nelson, BC (JC); Ophiuchus Consulting, Oliver, BC (MS); and Independent Consultant, Kimberley, BC (LI).

The Kootenay Community Bat Project (KCBP) was established in south-eastern British Columbia in 2004 as a community-based approach to bat conservation in buildings. The goals of the KCBP are to: 1) promote the conservation of bats in the Kootenay region, including species at risk and those at risk from White Nose Syndrome; 2) engage citizens in community-based bat stewardship; 3) conserve and enhance critical bat roost habitat; and, 4) monitor bat populations. This project incorporates outreach, inventory, and stewardship activities. KCBP is highly publicized, and encourages local participation in identifying and conserving bat roosts. KCBP also includes roost surveys of bats in buildings on private lands. Over 600 site visits have been conducted in the past 10 years and a total of 514 roost sites have been identified. Seven bat species were detected including Townsend's Long-eared Bat (*Corynorhinus townsendii*), Californian Myotis (*M. californicus*), Western Long-eared Myotis (*Myotis evotis*), Little Brown Bat (*Myotis lucifugus*), Yuma Myotis (*M. yumanensis*), Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasiurus noctivigans*) and Long-legged Myotis (*M. volans*). Over the past ten years, the project has provided 14 bat-house building workshops, 73 community programs and 182 school programs. Almost 450 bat-houses were constructed as a result of this project. An Annual Bat Count was initiated in 2012 to incorporate citizens in bat population monitoring and over 20 sites are being monitored annually. The involvement of community members in bat conservation holds great potential for the collection of long-term monitoring data. This project is the model for the province-wide BC Community Bat Project Network that was established in 2014.

#### **CREATION OF ROOST TREES FOR INDIANA BATS: EFFECTS OF TREE SPECIES, SIZE, AND SEASON OF HERBICIDE TREATMENT**

T.L. Derting and S. Martin, Department of Biological Sciences, Murray State University, Murray, KY 42071

Snags suitable as roost trees are an essential but ephemeral resource for the Indiana bat (*Myotis sodalis*). Production of roosting habitat ensures that maternity colonies have adequate primary and alternate roosts to rear their young. Our objective was to determine an effective approach to producing natural snags with sloughing bark suitable for Indiana bat roosting. We tested for effects of season of herbicide treatment (Triclopyr® 3a), tree size, and tree species on rate of tree decay and production of sloughing bark. The tree species injected were green ash (*Fraxinus pennsylvanica*), shagbark hickory (*Carya ovata*), silver maple (*Acer saccharinum*), and white oak (*Quercus alba*). Small (<16" DBH) and large (≥16" DBH) trees of each species were injected during summer or winter. Rate of tree death differed significantly among species. Two years post-herbicide treatment, most of the green ash and white oak trees were dead; but 90% of the silver maples and 70% of the shagbark hickories were still alive. Tree size was associated significantly with tree death; with larger trees taking longer to die than smaller ones. The rate of production of suitable bark was slow. No tree reached a level of high suitability (> 25% sloughing bark) as a bat roost tree and most trees were in still in the not-suitable category (0% sloughing bark) in the third year of the study. Rate of production of suitable bark was associated significantly with tree species, but not tree size category, DBH, height, crown class, or season of herbicide treatment. Shagbark hickories and silver maples were more likely to have a higher level of suitable bark compared with other species. Based on results to date, the shagbark hickory was the species of choice for production of standing roost trees for Indiana bats.

#### **INCIDENTAL CAPTURES OF EASTERN SPOTTED SKUNK IN A HIGH-ELEVATION RED SPRUCE FOREST IN THE SOUTHERN APPALACHIANS**

C.A. Diggins\*, D.S. Jachowski, J. Martin, and W.M. Ford. Department of Fisheries and Wildlife Conservation, Virginia Tech, Blacksburg, VA (CAD); School of Agricultural, Forest, and Environmental Sciences, Clemson University, Clemson, SC (DSJ); U.S. Forest Service, George Washington-Jefferson National Forest, Marion, VA (JM); U.S. Geological Survey Virginia Cooperative Fish and Wildlife Research Unit, Blacksburg, VA (WMF).

The Eastern Spotted Skunk (*Spilogale putorius* L.) is considered rare in the southern Appalachian Mountains and throughout much of its range. We report incidental captures of 6 spotted skunks in a high elevation Red Spruce (*Picea rubens* Sarg.) forest in southwestern Virginia during late February and March, 2014. These observations are the highest elevation records for this species in the Appalachian Mountains at 1520 m. They are also the first known records of Eastern Spotted Skunks using Red Spruce forests in the southern Appalachians. These observations highlight new information on the distribution and habitat use of this species, which are both important for conservation of this declining carnivore.

## **IMPORTANCE OF COMPLIANCE MIST-NETTING SURVEYS FOR NON-TARGET SPECIES, ESPECIALLY OZARK BIG-EARED BATS IN ARKANSAS**

K. N. Edmonds\*, P. R. Moore, and T. S. Risch. Arkansas State University, Department of Biological Sciences, State University, AR 72467

For over 15 years the Ozark-St. Francis National Forest in northern Arkansas has been conducting compliance mist-netting within several five-mile buffers of known Indiana bat (*Myotis sodalis*) hibernacula, following the guidelines of the Endangered Species Act. Indiana bat monitoring since 2011 has resulted in a considerable number of Ozark big-eared bat (*Corynorhinus townsendii* ingens; COTO) captures. In 2011 three males were captured. Pregnant females were captured both in 2013 and 2014, bringing the total captures to eight individuals in the Boston Mountain Ranger District. Although most captures were near known COTO bachelor sites and minimally used hibernacula, the capture of two pregnant females was not. Deciding radio telemetry was too invasive, directionality and timing was used to isolate probable maternity roost locations. A roost was located in a large talus area in July in close proximity to the location of the pregnant females captured in 2014. This location is a suspected maternity roost, but was not confirmed in order to minimize disturbance. The location was re-checked in January and was not being used as hibernacula. The 2013 capture was 4.8 km from the newly discovered roost and ongoing searches are planned for 2015. As the Ozark big-eared bat is difficult to detect with acoustic monitoring devices, our captures indicate that mist-netting is an invaluable tool for collecting data on 'non-target' bat species while conducting compliance mist-netting.

## **HIBERNATING BAT COUNTS IN NEW MEXICO CAVES**

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Information on habitat and stability of the bat population is important in cave and wildlife management, especially now with the threat of White Nose Syndrome (WNS). For more than 15 years, volunteer cavers have conducted hibernating bat counts in several caves within the Roswell NM BLM district and for five years in the Lincoln National Forest. Historical data on hibernacula including temperatures and humidity has been collected for some caves as far back as the late 70's. Information to be presented in this poster will include historical count data and a brief analysis of some of the hibernacula characteristics of New Mexico caves. The hibernacula caves are located in lava, gypsum, and limestone. One cave is only about 150' long, and one hibernacula is located in the entrance of a 31 mile long cave. The most common bat species inventoried include *Myotis velifer*, *Myotis ciliolabrum/californicus*, and *Corynorhinus townsendii*. One cave hibernaculum has had variations between 300 and 14000 bats counted due to unknown reasons. The most populous cave hibernacula roosts in New Mexico vary between 30 and 48 f and 29-59% humidity. In general, our hibernating bat roosts vary significantly from year to year.

## **PRELIMINARY RESULTS OF A LONG-TERM MARK-RECAPTURE STUDY OF SMALL MAMMALS OF PRAIRIE RIDGE ECOSTATION, A RESTORED NATURAL AREA IN URBAN, CENTRAL NC**

L. J. Gatens, B. M. Hess, and A. Parsons. North Carolina Museum of Natural Sciences, Raleigh, NC 27601

With a history of heavy use, first as a military training site, then in agriculture, in 2004 the North Carolina Museum of Natural Sciences began converting a 38.5 acre tract to what is now Prairie Ridge Ecostation. Most recently, the majority of the tract was comprised of fescue fields and used for cattle grazing. The area has been partially transformed into native tall grass prairie, bottomland forest and arboretum, ponds, and a stream. Though undeveloped forest and pastures exist nearby, four-lane roads lie just to the west and south edges of Prairie Ridge and commercial and residential development are encroaching on all sides. In the summer of 2011 we began a long-term mark-recapture project to monitor small mammal populations of Prairie Ridge. We established three permanent grids of 50 traps each in three distinct field types: bottomland, fescue, and switchgrass. Trapping occurs seasonally, with trapping sessions conducted in January, April, July, and October. To date, 1166 uniquely numbered ear tags have been applied to hispid cot rats (*Sigmodon hispidus*), 67 to white-footed mice (*Peromyscus leucopus*), 19 to house mice (*Mus musculus*), 16 to eastern harvest mice (*Reithrodontomys humulis*), and 3 to woodland voles (*Microtus pinetorum*). Additionally, 30 southern short-tailed shrews (*Blarina brevicauda*) were captured but not tagged. Findings are preliminary and both the study and analyses are ongoing. We are seeing seasonal variation and significant difference among field types ( $p < 0.05$ ).

## **SHORT-TERM EFFECTS OF WILDFIRE ON BAT ACTIVITY**

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Bats are important components of forested ecosystems. Most bat species depend on forest habitats for roosting or foraging, and are also beneficial to forests (e.g., insect suppression). In the American Southwest, large and unprecedented wildfires are occurring more frequently. Although wildfires can be beneficial to bats (i.e., fires weaken trees and stimulate flowering plant growth, attracting wood-boring beetles, pollinators, and other prey insects; and create roost sites and thin cluttered forests), the relationships between bats and forest fires are still not well understood. In particular, we have a limited knowledge of how increasingly common wildfires may influence bat activity and community composition. The focus of this study is to determine how bat activity is influenced by wildfire, and more specifically, how burn severity and vegetation type affects activity levels in the years immediately post-fire, at a landscape-

level scale. Acoustic surveys were conducted at the Valles Caldera National Preserve, New Mexico from June-October in 2013 and May-July in 2014 at four study sites within each treatment: unburned, the Las Conchas Wildfire (2011), and the Thompson Ridge Wildfire (2013). Six sites were randomly surveyed each night. Mean bat activity levels were correlated with proportions of burn severities and vegetation types around each study site using a series of buffers. Bats were found to be more active in burned areas than in unburned areas. Within burned areas, activity levels were higher in areas that burned at lower severities, and lower in those that burned at higher severities. Bats also tended to be less active in particular vegetation types, while being more active in others. A mosaic of burn severities and vegetation types across the landscape appears to most beneficial for bats. These patterns are hypothesized to be a result of prey availability, but further analyses are needed to better understand these relationships.

### **SEASONAL SEX RATIO VARIATION OF GRAY BATS (MYOTIS GRISESCENS) NEAR A HIBERNACULUM IN SOUTHWEST MISSOURI**

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Sex ratio data of a *Myotis grisescens* population at a single large hibernaculum were studied across the winter and following fall and spring hibernating season by month. During the fall of 2013, a trend was observed skewing the expected 1:1 sex ratio. The ratio of males in early fall outnumbered that of females by 2:1 in September (N=40) and then reversed one month after in October to a 1:5 ratio (N=48). The previous hibernating season, December 2012-February 2013, the ratio of males to females was close to a 1:1 ratio and remained that way until early spring. From March to April of 2014 a trend of declining male presence was observed, changing from 4:1 in March (N=22) to 1:4 sex ratio in April (N=27). This trend suggests that males arrive first in fall in order to have first male advantage to breed, and leave first in order to establish territory in male summer and reduce competition with females for spring resources.

### **NOT ON THE SAME BAT CHANNEL: CHALLENGES IN COMMUNICATING ABOUT BATS**

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Although bats are endearing to us, they not as universally appealing as babies or kittens, so talking about them through conventional and social media is challenging. Even well-researched coverage sometimes sends inadvertent messages, like when a national news anchor repeatedly says she is “creeped out by bats” or when photo editors attach pictures of vampire bats to stories about white-nose syndrome. This poster shows examples of headlines, stories, posts and tweets about bats and white-nose syndrome to show what people are saying and how messages can sometimes literally get lost in translation. It also shows positive results of coordinated messaging and campaigns and suggests ways to achieve success by coordinating messaging and leveraging partners, for example through the White-Nose Syndrome Communications and Outreach Working Group.

### **USE OF MULTIPLE METHODS TO VERIFY BAT SPECIES OCCUPANCY IN NORTHERN ILLINOIS**

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Increased concern for bat populations due to the arrival of white-nose syndrome, reductions in available habitat, and the disturbance of roost locations has stimulated a growing need for information on bat habitat use. Our research goal was to verify species presence in the McHenry County Conservation District (MCCD) properties and examine capture data to validate acoustic recording detections. We sampled at 15 sites in the summer of 2013 and repeated five of those sites in the summer of 2014 using mist nets and acoustic recorders. We captured 109 bats in wooded, riparian areas including big brown, eastern red, hoary, little brown, northern long-eared, and silver-haired bats. Approximately 37,515 acoustic files were recorded near the mist net locations using SM2BAT+ detectors and are being verified using Sonobat 3.2.1. Combining capture and acoustic data will provide a robust analysis of occupancy patterns to relate to land cover parameters in future analyses. Additionally we conducted a roost count in the Glacial Park barn of approximately 1,229 bats and later confirmed with the use of a harp trap that the majority were little brown bat females. This information along with future analyses will assist land managers with decision making when considering bat habitat protection and survey methods.

### **THE MAN IN THE MOON: BATS' MORTAL ENEMY? AN EXPLORATION INTO BATS AND MOONLIGHT AVOIDANCE**

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The purpose of this study was to explore a novel approach in evaluating whether bats change their behavior based on the illumination of the moon, specifically if bats are less active during periods of bright moonlight to avoid predation by sight-based nocturnal predators. It is important to examine this potential behavior in bats because it is a largely unstudied area and could have fascinating consequences in the field of bat behavioral studies. We hypothesized that if bats avoid moonlight then bats should begin to emerge from their roosts later on brighter moonlit nights. Data were collected from March to October 2003-2014 as part of a larger project monitoring a population of endangered Indiana bats (*Myotis sodalis*). Bat data used for this analysis consisted of emergence begin and end times and were collected at known Indiana bat roosts 2-3 times/week over this period. We used >2500 observations in this analysis, with counts ranging from 0-220 bats/roost/night. Environmental data were collected from a nearby weather station, while sun and moon data were collected from the U. S. Military. When considering only moon-phase illumination and emergence time there



seems to be very little correlation ( $r = 0.03$ ), but there was a significant negative correlation between colony size and emergence time ( $r = -0.21$ ;  $p < 0.0001$ ). This data suggests they neither seek out, nor avoid moonlight, but that colony size is the largest factor determining emergence time. We were not able to reject our null hypothesis, that there is no relationship between emergence times and moon illumination. However, there many other interacting environmental factors that have not been considered yet, but will be addressed in the future.

#### **SURVEILLANCE OF VIRAL PATHOGENS FROM ALASKAN BATS**

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Recent advances in molecular virology have led to the identification of many different mammalian (or related) viruses in diverse species of birds and bat species—and even apparently healthy bats are now known to carry pathogens that are virulent in humans (“zoonotic disease”). The high potential for wide-spread dispersal of rabies (and other pathogenic viruses) by bat populations is high due to their unusual immune system that allows persistent infection and shedding of viral pathogens for months, their ability to fly and migrate, their gregarious social structure (which contributes to the amplification of viruses in bat colonies) and the known close association of bats with human habitation. We report the initial results of single sample pan-viral assays for the detection of RNA viruses of wildlife and human concern: Coronaviruses, Orthomyxoviruses (Influenza A), Orthoreoviruses, Paramyxoviruses, and Lyssaviruses (Rabies). We have focused on Coronaviruses, which are ubiquitous viruses in wildlife (and especially insectivorous bat) populations. Recent and ongoing population surveys by us and other researchers have identified significant populations of *Myotis lucifugus* (Little Brown Bats) in southeastern Alaska, but it is unclear at present whether they are migratory or resident. We discuss how the use of pan-viral surveillance assays allow us to gather the type of data needed to study bat ecology, bat conservation, and infectious disease ecology using a systems approach.

#### **NORTHERN LONG-EARED BAT ROOST SITE SELECTION IN A MANAGED FOREST AND TRANSMITTER RETENTION TIMES**

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The northern long-eared bat (*Myotis septentrionalis*; MYSE) is proposed to be federally listed under the Endangered Species Act in April of 2015 due to the spread of white-nose syndrome and subsequent population declines. Listing of this species will have implications for land managers since MYSE use forested landscapes for summer roosting and foraging. Therefore, understanding summer roost selection is essential to effectively integrate this species needs into current forest management practices. Our study was conducted on the Hardwood Ecosystem Experiment (HEE) located in Morgan Monroe State Forest and Yellowwood State Forest in southern Indiana. We hypothesized that adult females would congregate in maternity colonies within crevices or cavities or under exfoliating bark of living and dead trees. During the summers of 2012-2014, 55 female MYSE were fitted with radio transmitters and tracked to their day roosts (143 roosts). Northern long-eared bats were tracked for an average of 4.79 days which was about half as long as simultaneously tracked Indiana bats. Characteristics of all roost trees were recorded. Preliminary results show that female MYSE tended to select live trees with oak, sassafras, and maple species being most common. Roost trees had an average DBH of 29.4 cm. Northern long-eared bats selected cavities almost twice as often as crevices or under bark. Data suggest that in southern Indiana, MYSE are roost generalists for many roost tree characteristics when compared to other *Myotis* species and may tolerate some forest management practices as long as adequate roost trees remain available on the landscape.

#### **EXPLORING THE RELATIONSHIP BETWEEN ECOLOGICAL NICHE BREADTH & DISPERSAL AMONG PACIFIC NORTHWEST BATS: A PRELIMINARY REPORT.**

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Habitat loss and fragmentation represent two of the greatest threats to bats worldwide. While it is generally assumed that bats are highly mobile across fragmented habitats, recent research has challenged this assumption. Dispersal patterns vary significantly among bat species, and may be linked to traits such as social organization, roosting, and dietary ecology. We present preliminary data testing this hypothesis in bat communities of the San Juan archipelago in the Pacific Northwest. The known geological history and proximity to the mainland make this region an excellent model to investigate the consequences of habitat fragmentation. The aims of this study are to: 1) assess the distribution of bat species throughout the archipelago, 2) characterize the dietary and roosting ecology and the population genetics for a subset of species and 3) evaluate whether ecological needs influence patterns of population connectivity/dispersal between the islands and the mainland. Between July and September 2014, we deployed mist nets and harp traps on various sites located on the coastal mainland of Washington State, Vendovi, San Juan, and Orcas Islands. For each bat, we collected morphometric data, wing biopsies and fecal samples for functional, population genetics, and dietary analyses. Additionally, roosts were surveyed using a newly developed method that employs scent detection dogs to locate bat roosts. Across sites, we documented at least seven species of bats. *Myotis californicus*, *M. yumanensis*, and *M. lucifugus* were most commonly captured, and *Eptesicus fuscus*, *Corynorhinus townsendii* *M. keenii/evotis*, and *M. volans* most rarely. Roosting sites were successfully located by scent detection dogs, highlighting the potential of this technique for future studies. Using this sample, we provide a preliminary

assessment of San Juan bat communities, and how their population structure and gene flow may be affected by natural habitat fragmentation.

### **CITIZEN SCIENTISTS COLLECT BASELINE DATA ON BAT DISTRIBUTION, HABITAT USE, AND SEASONAL ACTIVITY IN SOUTHEAST ALASKA**

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Little is known about the ecology of bats in Southeast Alaska. The Alaska Department of Fish & Game's Wildlife Diversity Program initiated a citizen science program in the summer of 2014 to collect baseline information on the distribution, habitat use, and seasonal activity of bats in the region. Southeast Alaska is an island archipelago, and most communities are accessible only by boat or plane, making it logistically challenging and expensive for biologists to collect data at multiple locations. In Southeast Alaska, public libraries connect the community members to local events and serve as a 'hub' for information sharing. We partnered with public libraries in 2 communities to establish a citizen science acoustic survey project. The libraries served as centers for advertising the project and recruiting citizen scientists and librarians were responsible for checking out the equipment and downloading and submitting the data. A total of 30 community members participated in 15 driving surveys that covered specific survey routes and followed standardized protocols. Through this citizen science effort, we were able to identify which species are present in these remote communities, as well as the habitats they are using. These data will also be contributed to a new national database for monitoring bat population trends. The successful partnership established between ADFG biologists and community libraries will enable us to continue monitoring bat populations in these remote communities.

### **DETERMINING SPECIES DIVERSITY AND POPULATION SIZE OF BATS AT THE REMAC MINE, PEND D'OREILLE VALLEY, BC**

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In Canada, the greatest species diversity of bats occurs in British Columbia (BC). Little is known about bat ecology in the province, particularly in winter. Bats play a critical environmental role and now face unprecedented threats due to White Nose Syndrome (WNS). Of urgency is to locate hibernacula, so that potential mitigation can be strategized and overwintering habitat secured. We focused on a mine in southeastern BC, called Remac. Preliminary investigations suggest it may be the most populous and diverse hibernaculum in the province. Our goal was to quantify the number of bats and species using this hibernaculum. Bats were acoustically monitored at mine entrances to determine species identification and patterns of activity. Free-flying bats were captured using mistnets strung across accessible mine portals from September 2012 – November 2014, with emphasis on late fall and winter. Bats were banded to allow individual identification upon recapture. We captured four species in winter: Californian Myotis, Silver-haired Bat, Townsend's Long-eared Bat and Big Brown Bat. The former 3 species were most commonly captured. In fall and winter, unusual acoustic patterns attributed to Silver-haired bats suggest a 'mating song'; the presence of females, and males with stored sperm for all 3 common species supports the hypothesis that mating is occurring here. We have banded >200 bats and continue to catch many unbanded individuals, suggesting this hibernaculum is large relative to other western hibernacula. Recaptures confirm roost fidelity within and between years, and have provided the first evidence of year-round residency of Silver-haired bats at a mine.

### **COMPARISON OF DNA COLLECTION METHODS TO IDENTIFY BAT SPECIES**

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Bat species can usually be identified by visual morphological analysis in the field; however in some cases, bats are difficult to identify visually. For species where visual identification is difficult, DNA is collected to confirm species identification. Wing punches can be used to collect DNA but this technique can pose risks to individual bats and requires hands on training and experience to ensure it is done properly. To decrease the chance of injury, a less invasive protocol to collect DNA, dry swabbing was tested to see if sufficient DNA for species identification could be collected using this method. To test this method, 43 wing punches and 44 wing swabs were taken from individual bats captured as part of a baseline data collection program. DNA was isolated from each sample and amplified using three different methods. Overall, 35 of the 38 (92%) of the swab samples produced sequence-able amplification products that aligned to species in the NCBI database from at least one of the three amplification methods, and 50% of the wing swabs produced sequence-able amplification products from all three methods. All 35 of the sequence-able samples matched both the field identification and the previously obtained wing punch DNA identification. This is compared to 43 out of 43 wing punch samples (100%) that were able to produce a sequence-able product from all three amplification methods. A concern about using wing swabs was that the swab may give an inconsistent identity from skin cells transferring between bats during contact. This study saw no evidence of this transfer; of the 35 samples for which a species identification was obtained, all 35 matched both the field identification and the wing punch identification.

## **BATS INITIATE STRONG AND SURPRISING TROPHIC INTERACTIONS IN A COSMOPOLITAN AGROECOSYSTEM**

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In agroecosystems worldwide, insectivorous bats are voracious predators of crop pests, and may provide a service to agriculture worth billions USD. However, we currently lack knowledge about the role of bats in agricultural systems. Using large enclosures in corn fields, we show that bats exert sufficient top-down pressure on crop pests to suppress larval densities and damage in this cosmopolitan crop. Additionally, bats suppress pest-associated fungal growth and mycotoxin in corn. Corn not genetically modified to express insecticidal properties, like that used in this experiment, is an essential crop for farmers on over 100 million hectares worldwide. A conservative estimate values the suppression of such damage by insectivorous bats at hundreds of millions USD globally on this crop alone. Bats face a variety of threats globally, but their relevance as predators of insects in ubiquitous corn-dominated landscapes underlines the economic and ecological importance of conserving biodiversity.

## **TRASH TO TREASURE: ASSESSING VIABILITY OF WING BIOPSIES FOR USE IN BAT GENETIC RESEARCH**

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The outbreak of white-nose syndrome in North American bats has resulted in massive data collection efforts to characterize the fungus, *Pseudogymnoascus destructans*. Wing biopsies routinely are collected from live bats, placed in agar media to culture the fungus, and ultimately discarded. We tested whether these discarded tissues represent a viable source of host bat DNA. We found no difference in DNA concentration and no reduction of DNA quality between samples that were extracted immediately compared to samples placed in agar for fungal culture. Although recovered DNA quantities were low, concentrations increased using a clean up kit. Our study suggests samples collected from live bats can be leveraged across disciplines to further our understanding of bat genetics and the impact of white-nose syndrome.

## **MONTANA'S BAT ROOST SURVEILLANCE EFFORTS**

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Since 2006, White-Nose Syndrome (WNS), caused by the cold-adapted soil fungus *Pseudogymnoascus destructans*, has spread westward to states along the Mississippi River corridor as well as the province of Ontario. With at least 9 of Montana's 15 known bat species facing potentially devastating increases in mortality from WNS, a collaborative effort between state and federal agencies and caving groups was initiated in the fall of 2011 to centralize information on both winter and summer roost sites used by Montana bats. In to document the species composition, number, degree of clustering, and roost temperatures and humidities of bats winter roosting in caves and mines. To-date, collaborators have surveyed over 450 bridges and buildings potentially used as summer roosts and over 50 caves and mines with the highest likelihood of bat use. We have deployed over 40 temperature and relative humidity data loggers near winter roosting bats and most known bat hibernacula in Montana are now being monitored. Most caves and mines surveyed to date support only small numbers of winter roosting bats; typically less than ten roosting in isolation or clusters of two to three. A handful of caves have 50-1750 winter roosting bats with clusters of up to 40 individuals. Many of the caves that have been surveyed have temperatures and humidities that appear to be capable of supporting *P. destructans*, but PCR-based testing of bat and substrate swabs have tested negative for its presence so far. The majority of Montana bats apparently winter roost away from mines or caves that are accessible to, or known by, humans and these roosts need to be located and assessed for their ability to support *P. destructans*.

## **DETERMINING THE BAT COMMUNITY AT EFFIGY MOUNDS NATIONAL MONUMENT IN EASTERN IOWA THROUGH ACOUSTIC SURVEYS**

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We were asked to evaluate the bat community at Effigy Mounds National Monument (EMNM) along the Mississippi River in northeastern Iowa. Three objectives were prioritized: 1) describe the bat community throughout the park, 2) determine the status of Federally Endangered Indiana bats (*Myotis sodalis*), and 3) determine the status of the Proposed Endangered Northern long-eared bats (*Myotis septentrionalis*.) We conducted twelve acoustic surveys at eight locations within the park. Acoustic sampling was accomplished through a combination of equipment: Titley Scientific Anabat-2, Wildlife Acoustics SM-2, and Wildlife Acoustics EM-3. Acoustic recordings were examined for bat calls using equipment specific software. Bats were successfully detected on each sampling date. Eight species were documented through acoustic recordings with Northern long-eared bats, little brown bats (*Myotis*

lucifugus), each being recorded at seven of eight locations. Tricolored (*Perimyotis subflavus*) bats also were commonly recorded. Acoustic recordings suggest the presence of Indiana bats. These results will be used to plan for a thorough effort in 2015.

### **WHY IS THE RED BAT RED?**

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Eastern red bats (*Lasiurus borealis*) are remarkable among insectivorous bats in that they are relatively brightly colored, and they have been described as sexually dichromatic. Fur color in red bats and other lasiurine bats is thought to reduce predation by visually oriented diurnal predators, but this idea has not been tested. Moreover, variation in fur color of red bats is surprisingly understudied. We used digital images to quantify fur color of 251 museum specimens of eastern red bats collected across their range, and modeled variation in fur color using Geographic Information Systems. Analysis of direct measurements suggested fur color varied with longitude, elevation, and due to deterioration of specimens over time; however, no relationship was detected between fur color and sex, time of year, or latitude. A Kriging model suggested fur color followed a geographic pattern and analysis of predicted color values indicated appearance was linked with climatic variables and elevation. Bats exhibited wide color variation at low elevation sites and those with relatively dry and hot summers; whereas, variation in color was constrained at high elevation sites and those with relatively wet and cool summers. These results may support the notion that fur color is related to crypsis, but color also could influence thermoregulation and both ideas warrant more testing. Studying fur color in bats is worthwhile because it can uncover aspects of their biology that would be difficult to detect using other techniques.

### **USING TECHNOLOGY TO INCREASE PARTICIPATION IN CITIZEN SCIENCE BAT PROJECTS**

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Citizen science projects are becoming an increasingly important component of data collection and monitoring programs for state agencies. The Georgia Department of Natural Resources often uses volunteers, students and collaborating scientists to collect data and requires submission of either hard copy data sheets or database files sent by email. In the past, we have been collecting data from Anabat routes and bat roost emergence counts with hard copy forms that are returned to us at the end of the field season. Recently, more options have become available for providing instructions and entering data online or using mobile applications. We have developed an online form for surveys of bats in bridges and are in the early stages of testing the use of this form on mobile devices. We will discuss the advantages and limitations of simple interactive websites, downloadable forms, online forms and mobile applications for bat projects we are currently using or planning to use in Georgia. Many of these products should be applicable for use in other states and may be helpful for states without the ability to develop similar products. We will have examples and are seeking comments and suggestions for changes to improve the products and make them applicable for a wider audience.

### **HANDHELD BAT DETECTORS AS A TOOL FOR MIST NET SITE SELECTION AND PUBLIC OUTREACH**

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Handheld bat detectors are excellent tools for observing bats in real time. Unlike passive acoustic recorders, handheld detectors allow for active monitoring and can help observers cue in on nearby bats. I received a handheld bat detector, the Wildlife Acoustics Echo Meter EM3+, as a Bob Berry Award recipient and have used the Echo Meter in my own research, as well as to engage others during public outreach events. My doctoral dissertation research seeks to elucidate how bats interact with agricultural landscapes. I use diverse methods, including capturing bats with mist nets, to address my research questions. Of the 22 species in the California Central Coast region, I focus on *Myotis yumanensis*, a common species in the study area. To select sites for mist-netting, I use active monitoring with the Echo Meter to identify areas of high *M. yumanensis* activity and to recognize *M. yumanensis* flyways. The Echo Meter translates bat calls into the range audible to humans in real time, often allowing an observer to locate bats flying nearby. The Echo Meter is also a great way to help non-scientists understand echolocation and observe bats in the wild. At the 2014 National Park Service/ National Geographic BioBlitz at Golden Gate National Parks, CA, I used the Echo Meter to help complete a bat inventory at Muir Woods. Bioblitz events bring together scientists and community volunteers to complete a 24hr biological survey, and provide an opportunity to engage the public in conservation. In addition to our survey, I worked with a team of volunteer bat biologists to teach bat biology and echolocation, and the EchoMeter allowed everyone to view sonograms of the bats that we captured.

### **SELECTION OF TREE ROOSTS BY MALE INDIANA BATS DURING THE AUTUMN SWARM IN THE OZARK HIGHLANDS**

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We quantified 162 roosts for 36 male Indiana bats across 3 study areas in the Ozarks of northern Arkansas during the fall swarm. Bats utilized 14 tree species and the most utilized (29%) substrate for roosting was shortleaf pine snags. Five roosts were also located in utility poles. Tree and snag diameter used for roosting was 7.8 to 68.6 cm dbh, but bats used trees  $\geq 20$  cm dbh more than their availability. Roosts were located in a number of different forested habitats, included pine stands, hardwood stands, and mixed pine-

hardwood stands. Shelterwood and group selection stands that had undergone partial harvesting were also used. Roosts in 2 of 3 study areas showed no differences in proportional use of forest habitat classes versus availability of those habitats. However, in one area, mature forests ( $\geq 50$  years old) that had been burned multiple times were used more than their availability and mature forests that were not burned were used less than their availability. Providing forest stands  $\geq 38$  years of age and abundant snags  $> 20$  cm dbh may help provide adequate roost sites for male Indiana bats during fall.

#### **RESPONSE OF HIBERNATING TRICOLORED BATS TO SMOKE EXPOSURE FROM FOREST BURNING**

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Prescribed burning during the winter in the vicinity of caves is commonly restricted due to potential entry of smoke into caves where bats hibernate, which is believed to cause bats to arouse from hibernation and consume vital fat stores. However, because of their low metabolism and oxygen intake, mammals in hibernation are resilient to oxygen deprivation and high levels of noxious gasses compared to non-hibernating individuals. Therefore, we evaluated the effects of 2 levels of smoke (carbon monoxide levels of 100-200 ppm and 300-400 ppm) at three hibernacula temperatures ( $\sim 5^{\circ}\text{C}$ ,  $\sim 10^{\circ}\text{C}$ , and  $\sim 15^{\circ}\text{C}$ ) in a laboratory setting to determine if exposure to smoke from forest burning caused 21 tricolored bats (*Perimyotis subflavus*) to arouse from hibernation. Bats were exposed to smoke for 20 minutes in environmental chambers and monitored for 80 minutes for visual signs of arousal. Skin temperatures were measured using iButtons attached to bats. No bats aroused from hibernation at the low smoke levels at any temperature. Under the higher smoke levels, a single bat at the  $\sim 5^{\circ}\text{C}$  temperature exhibited visual signs of a slight arousal with skin temperature increasing by  $4^{\circ}\text{C}$ . No full arousals (skin temperatures of  $21\text{-}26^{\circ}\text{C}$ ) occurred in response to smoke exposure. In general, we found hibernating tricolored bats exposed to smoke did not arouse from torpor.

#### **TRANS, TRANS-FARNESOL FROM CANDIDA ALBICANS CAN KILL OR INHIBIT PSEUDOGYMNOASCUS DESTRUCTANS**

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Bat white-nose syndrome, caused by the psychrophilic fungus *Pseudogymnoascus destructans*, has dramatically reduced the populations of many hibernating North American bat species. The search for effective biological control agents targeting *P. destructans* is of great importance. We report that the sesquiterpene trans, trans-farnesol, which is produced by the yeast/fungus *Candida albicans*, prevented in vitro conidial germination for at least 14 days and caused cell death in hyphal fragments of 5 *P. destructans* isolates in filtered potato dextrose broth at  $10^{\circ}\text{C}$ . Depending on the inoculation concentrations, both spore inhibition and hyphal cell death occurred upon exposure to concentrations as low as  $15\text{-}20\ \mu\text{M}$  trans, trans-farnesol. In contrast, 3 different *Pseudogymnoascus* isolates were less sensitive to the exposure of trans, trans-farnesol. Isolate 05NY09 demonstrated dramatic reduction of hyphal growth and increased hyphal branching when exposed to  $100\ \mu\text{M}$  trans, trans-farnesol, while another isolate (LJ177) demonstrated no reduction in growth at  $100\ \mu\text{M}$  trans, trans-farnesol, but displayed out growths reminiscent of secondary conidia at  $300\ \mu\text{M}$ . The growth of a yeast-like isolate (LJ130) appeared unaffected by  $300\ \mu\text{M}$  trans, trans-farnesol. Our results suggest that some *Candida* isolates may have the potential to inhibit the growth of *P. destructans* and that the sesquiterpene trans, trans-farnesol has the potential to be utilized as an environmental control agent.

#### **BAT ASSEMBLAGE ACROSS THE SUMMER LANDSCAPE OF KENTUCKY, OHIO, PENNSYLVANIA, AND WEST VIRGINIA**

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CEC completed a multi-state mist-net survey along a 704-mile long transect through four states during the summer of 2013. This survey, the largest single mist-netting effort of its kind, was triggered by portions of the transect passing through known Indiana bat (*Myotis sodalis*) habitat. In total, 4778 bats, comprising ten species were captured at 739 mist-net sites. Analysis of the bat assemblage within this four-state area included species diversity, reproductive timing, and sex ratios. Through mist netting, radio-telemetry, and emergence observations, additional Indiana bat and northern long-eared bat (*Myotis septentrionalis*) life history and behavior, including use of novel roosting structures, was identified.

#### **VIABILITY OF P. DESTRUCTANS AT ROOM TEMPERATURE**

V.G. Rojas, J.H. Cox III\*, A.K. Chamberlain, J.M. O'Keefe. Department of Biology, Indiana State University, Terre Haute, IN 47809.

*Pseudogymnoascus destructans* (Pd), the causal agent of white-nose syndrome (WNS) in bats, is a psychrophilic fungus capable of surviving in caves even in the absence of bats. Previous research has shown that the fungus is transmitted from bat to bat, and spores may be transported by humans on their gear. Decontamination protocols state that clothing, footwear or equipment used in a WNS-affected region should not be used in an unaffected region in order to prevent the spread of fungal spores by humans to new locations.

Following protocol, gear and clothing are to be decontaminated between bat surveys and cave visits in WNS-affected regions. The focus of our research was to investigate the capability of Pd to survive at room temperature (25°C) on a substrate devoid of the required nutrients for growth. We inoculated an agar plate, cotton fabric, rubber segment, and plastic Petri plate with Pd isolate using a sterile swab for each sample (SUB25 plates hereafter). We sterilized each substrate prior to inoculation and placed the fabric and rubber on plates. All SUB25 plates were sealed with paraffin film and incubated for 14 days at 25°C. Every 24 hours for 14 days, we aseptically inoculated nutrient-rich Sabouraud Dextrose Agar (hereafter SDA7) plates with Pd by rolling a swab across each of the SUB25 substrates. Next, we incubated the sealed SDA7 inoculations at 7°C, the optimal temperature for our Pd isolate, and checked daily for growth. We replicated each trial. We observed growth on SDA7 plates after 8 days, but not on the SUB25 substrates. Our preliminary results suggest that Pd can survive without nutrients at 25°C for > 1 week. Further, when returned to favorable conditions, Pd will begin to grow again. Our results substantiate the importance of following strict decontamination protocols in an attempt to lessen the spread of the fungus and the impacts of white-nose syndrome on bats across North America.

### **CHARACTERIZATION OF ROOST TREES OF THE SOUTHEASTERN MYOTIS IN THE BOTTOMLANDS OF ARKANSAS**

S.A. Schratz\*, V. Rolland, and T.S. Risch. Department of Biological Sciences, Arkansas State University, State University, AR 72467

Little is known about the roosting ecology of the southeastern myotis (*Myotis austroriparius*) on the Cache River National Wildlife Refuge, which is one of the largest continuous tracts of bottomland forest in the Mississippi Alluvial Plain. Accordingly, the objective of this study was to describe characteristics of roosts selected by southeastern Myotis. We affixed transmitters to 14 bats, 1 juvenile male and 1 juvenile female, 6 adult males and 6 adult females and tracked bats daily to their roost trees for the life of the transmitter. Roosts were discovered from 7 bats and some bats used multiple roosts. Nine of the 12 roost trees were water tupelos (*Nyssa aquatica*) with large basal hollows; the other trees included a black tupelo (*N. sylvatica*), red maple (*Acer rubrum*) and an American sweetgum (*Liquidambar styraciflua*). All roost sites were in living trees. We conducted emergence counts at 6 roost trees: with 3 containing 300 or more bats. We harp-trapped a known roost-tree twice over a one-month period to determine roost occupancy composition. At each roost tree, we measured diameter at breast height (DBH), tree height, canopy coverage and basal area. Roost trees had a larger DBH, higher basal area and higher canopy coverage as compared to random trees.

### **WHITE-NOSE SYNDROME: AN OVERVIEW OF THE COORDINATED RESPONSE IN CANADA**

J. L. Segers, S. McBurney, P. Zimmer, and C. Stephen. Canadian Wildlife Health Cooperative, University of Prince Edward Island, Charlottetown, PEI C1A4P3 (JLS and SM), Canadian Wildlife Health Cooperative, University of Saskatchewan, Saskatoon, SK S7N5B4 (PZ and CS).

Bat White-Nose Syndrome (WNS) is a disease caused by the fungus *Pseudogymnoascus destructans* and has killed over six million bats in eastern North America. First discovered in New York in 2006, it has since spread to 24 additional states and five Canadian provinces. The Canadian Wildlife Health Cooperative (CWHC), a national organization embedded primarily in Canada's five veterinary colleges, coordinates Canada's national wildlife health surveillance programs. Specifically, CWHC was tasked to direct an organized Canadian response to WNS and has worked through a WNS inter-agency committee to provide this service since 2012. Five technical working groups (TWG) (i.e., population monitoring, surveillance and diagnostics, and mitigation which are supported by communication and outreach, and data management) were created to achieve this goal. In the last two years, the TWG have developed several essential protocols to manage the Canadian response to WNS, including best management practices for decontamination, bat necropsies, and fungal culture. Work currently in progress includes a feasibility assessment for captive management of bats and best management practises for safe removal of bat colonies from buildings. The approach has been to facilitate communication and collaboration amongst universities, nongovernmental agencies and federal, provincial and territorial governments so that current information is available for management decisions and accurate messaging is given to the media and general public. The Canadian TWG work closely with the U.S. WNS working groups, as well as participate in international bat conservation initiatives, such as the North American Bat Monitoring program and the North American Bat Conservation Alliance to ensure a consistent continental approach to WNS. The CWHC will continue to be actively involved in surveillance for and management and mitigation of WNS to best position those responsible for the recovery of Canadian bat populations affected by this devastating disease.

### **INTERDISCIPLINARY BAT RESEARCH: A TOOL TO FACILITATE COLLECTION OF FIELD AND LABORATORY BIOPSIES OF BAT PATAGIA**

B. C. Shock, S. A. Lucero, and M. K. Keel. Department of Pathology Microbiology and Immunology, School of Veterinary Medicine, University of California, Davis, Davis, CA 95616 (BCS and MKK); TEAM lab, Department of Biomedical Engineering, University of California, Davis, Davis, CA 95616 (SAL)

Patagial biopsies are conducted in the field on many different bat species for both genetic studies and to diagnose infection with *Pseudogymnoascus destructans* (Pd) and other pathogens. In the laboratory, we use biopsies in an explant model of bat skin for study of Pd, but we needed a tool to facilitate collection of the explants. Because the pagatium is extremely thin and elastic, it has to be adhered to a tissue support before it is cut. Our primary challenges in developing a biopsy tool were registration of the blade to the tissue support to ensure a complete and accurate cut, and the ability to quickly change biopsy punches. In addition, current sampling

procedures in the field require multiple personnel to handle the bats, lights, biopsy punches and cutting boards. We sought to develop a device that could enable a single person to simultaneously restrain a bat and collect a patagial biopsy, even in inclement conditions. Such a device was subsequently developed in conjunction with the TEAM (Translating Engineering Advances to Medicine) facility and the student chapter of the Biomedical Engineering Society at the University of California Davis. The tool is manufactured via a combination of laser cutting, machining, and 3D printing technologies. It has many features to facilitate biopsy collection in the laboratory and field, such as interchangeable biopsy punch holders for punches sized 2 mm, 6 mm, 10 mm, and 12 mm, and UV LED lights. The device can be used with one hand, is light, durable and can be sterilized. The washers utilize 3M surgical grade transfer adhesive to keep the skin adhered during transport in media or ethanol. We believe this device will become an essential tool in bat studies and plan to make it widely available for bat research.

## **EFFECTS OF GATE DESIGN ON BAT USE AND BEHAVIOR AT ABANDONED MINES IN THE SOUTHWESTERN U.S.**

A. Tobin\* and C. L. Chambers. School of Forestry, Northern Arizona University, Flagstaff, AZ 86011

Abandoned mines provide roosting habitat for bats but can pose risks to humans. Often, gates are installed at entrances of abandoned mines to protect humans and bats, but gates may negatively affect bat use. We evaluate how gate design affects bats in the southwestern U.S. by examining use (e.g., activity level, type [maternity, night, day]) and behavior (e.g., circling, fly retreat) of bats as they encounter gates. At 11 mines, we use internal and external surveys in a before-after-control-impact (BACI) study to monitor changes following gate installation. We also use BatLogger II acoustic devices to monitor daily bat activity; we use this relatively new approach to characterize bat activity at these mines. Using an ANOVA, we observed significant differences in activity levels between most mines and roost types ( $p < 0.001$ ). To determine which of the measured variables influenced bat use prior to gate installation we used linear regressions and identified top models using an Akaike's Information Criterion (AIC). The best fit model variables included number of entrances, slope of portal, and presence of maternity colony and explained 31% of the variability in bat activity as measured by the BatLogger II ( $p < 0.001$ ,  $F_{3,48} = 8.84$ ). Three competing models included a combination of the variables above as well as number of rooms. These measured variables do not explain most of the variability in bat activity and so other unmeasured variables must be influencing activity. It is important to consider these variables when assessing post-gating changes in bat use. Most behaviors documented prior to gate installation included circling, passing in front, and passing directly through the portal. We will continue this research through summer 2015 to assess post-gating changes in bat use and behavior. Our study will provide information useful in guiding management strategies aimed at conserving and protecting southwestern U.S. bat species.

## **ESTIMATING GEOGRAPHIC EXTENTS OF SOURCE POPULATIONS OF EASTERN RED AND HOARY BATS KILLED AT A CENTRAL ILLINOIS WIND FACILITY**

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Individual bat mortality due to wind turbines is a growing conservation concern, but its impact on bat populations is difficult to estimate. Wind facilities in Midwest agricultural fields can kill an estimated 4.45-7.14 bats per turbine per year, and Eastern Red (*Lasiurus borealis*) and Hoary (*Lasiurus cinereus*) bats comprise between 0.2-60.9% and 9.0-88.1% of fatalities respectively nationwide. We have little understanding of the impact of this mortality on these species' population persistence, in part because we have poor knowledge of their migration pathways and hence the source populations for individual mortality. The use of stable isotopes of body tissues is an increasingly successful method for elucidating geographic patterns. In this research, we sampled 75 bats that were salvaged from a central Illinois wind facility and used deuterium ratio ( $\delta D$ ) analysis combined with ecological niche modeling (GARP: Genetic Algorithm for Rule-set Prediction) and a web-based isotope modeling program (Isomap: Isoscapes Modeling, Analysis, and Prediction). The goal was to determine whether the bats being killed at a single wind facility are coming from a large portion of their summer geographic range or from a small segment. The GARP summer range models accurately predicted the presence of Eastern Red bats 96.85% and Hoary bats 98.93% of the time, and we found that the geographic extents of individuals from both species covered over 50% of their predicted summer ranges. This shows that one wind facility can affect bat populations from across their summer range. While it could be argued that this dilutes the overall impact on the bat species, if other facilities show this pattern, they could have a cumulative and far reaching effect.

## **OCCUPANCY OF VARIOUS BAT SPECIES IN NORTH MISSOURI: A BASELINE STUDY FOR IMPENDING CHANGE**

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Bats throughout the Midwest of the United States are confronted with an uncertain future. They face collision with wind turbines (especially migratory bats), the disease white-nose syndrome (especially cave hibernating bats), and the uncertainty of climate change. Though North Missouri poses the potential for wind farm development, there have been few constructed. Further, white-nose syndrome is only beginning to affect colonies of cave hibernating bats in Missouri. These threats emphasized the importance of assessing the current status of bat species living in Missouri for better precision when evaluating the effects of these stressors. Since

obtaining population estimates of bats can be problematic, we decided to estimate occupancy. We divided our study area into high and low wind-farm development potential, and further divided these areas into locations we predicted would have high versus low bat activity. We then used acoustic bat detectors (Wildlife Acoustics SM2BAT+) to monitor bat activity for three nights, during each of three seasons (late spring, summer, and early fall). This study was conducted during 2013 and 2014, and we plan to continue for another 3 years. For this presentation we estimated detection probabilities, local extinction and colonization probabilities, as well as occupancy estimates using robust occupancy estimation in MARK, for the hoary bat, red bat, Indiana bat, and northern myotis. Detection probabilities and occupancy varied extensively depending on season, area, species, and year. For hoary bats occupancy ranged from 0.60 to 0.99, for red bats 0.77 to 0.99, for Indiana bats 0.38 to 0.91, and for northern myotis 0.44 to 0.94.

#### **VARIATION IN BAT SPECIES RICHNESS DURING SPRING MIGRATION AT A RURAL POND IN NORTHWEST TENNESSEE**

T. Walker\* and N. Buschhaus. Department of Biological Sciences, University of Tennessee at Martin, Martin, TN 38238

Tennessee bats that utilize caves as winter hibernacula most likely return to their summer roosts in the northwest Tennessee area beginning in mid March and continuing throughout April. We predicted that bat species richness at a rural pond would vary from early April to late May due to some bat species temporarily using the aquatic resource while other bat species remain as residents throughout the study. We used acoustic monitoring to record bat calls by deploying a Wildlife Acoustics SM2BAT+ near a rural pond in Weakley County, Tennessee, 31 March - 31 May 2014. Full spectrum calls were analyzed using SonoBat version 3.1, followed by visual verification by N. Buschhaus. Our results demonstrated that bat species richness did vary at our study site during the study period, most likely due to some bats remaining as summer residents while other bats only used the pond as a temporary resource during migration.

#### **NATIONAL BAT BLITZ 2015**

M.D. Whitby, K. Morris, E. Brinley Buckley, and SBDN Bat Blitz Committee. Nebraska Cooperative Fish & Wildlife Research Unit, School of Natural Resources, University of Nebraska- Lincoln, Lincoln, NE 68583 (MDW and EBB); Wildlife Resources Division, Georgia Dept of Natural Resources, Nongame Conservation Section, Social Circle, GA 30025 (KM).

In 2015 the Southeastern Bat Diversity Network organized a nationwide bat blitz in lieu of its annual group blitz event. The committee encouraged biologists to organize a group or individual netting effort in their study area September 4-10th, 2015. Thirty-two events in nineteen states registered for the effort, with 375 expected participants. We will summarize results of that effort and discuss the benefits of organizing similar events in the future.

#### **SOUTHEASTERN BAT POPULATIONS AFFECTED BY WHITE-NOSE SYNDROME: A REPORT FROM THE SOUTHEASTERN BAT DIVERSITY NETWORK**

E. V. Willcox, L. E. Dodd, K. E. Gillies, G. Graeter, T. S. Risch, and P. L. Roby. Department of Forestry Wildlife and Fisheries, University of Tennessee, Knoxville, TN 37996 (EVW); Department of Biological Sciences, Eastern Kentucky University, Richmond, KY 40475 (LED); Bat Conservation International, Austin, TX 78716 (KEG); North Carolina Wildlife Resources Commission, Asheville, NC (GG); Department of Biological Sciences, Arkansas State University, Jonesboro, AK 72467 (TSR); Copperhead Consulting, Paint Lick, KY 40461 (PLR)

In the U.S., cave-hibernating bats are facing a conservation crisis of unprecedented magnitude as a result of White-nose Syndrome (WNS), a disease caused by the fungus *Pseudogymnoascus destructans* (Pd). This disease causes mortality in bats by increasing the frequency of arousal from torpor, resulting in the consumption of energy reserves that bats need to survive the winter. Mortality also appears to result from disruption of physiological process such as water balance and gas exchange. White-nose syndrome is currently known to affect seven cave hibernating bat species. Mortality rates > 90% have been reported for some species in hibernacula in the Northeastern U.S. and the disease is currently estimated to have killed more than 5.7 million individuals nationwide. Since its discovery in a NY cave during the winter of 2006-2007, WNS has spread to 25 U.S. states and 5 Canadian provinces. In the Southeast this includes: AL, AR, GA, KY, NC, SC, TN, and VA. Most recently Pd was discovered in MS, although WNS has not yet manifested in the state. It has been suggested that due to warmer winter temperatures, WNS might not have as devastating an effect in the Southeastern U.S. However, 2014 bat populations in some states appear to have exhibited increased mortality from the disease following an unusually cold winter. We present population trends by species across states in the southeast and highlight differences in mortality by state. In addition, we discuss priorities for southeastern bat and cave conservation.

#### **PSEUDOGYMNOSCUS DESTRUCTANS AND THE COMPOSITION OF MICROBIAL COMMUNITIES IN THE SOILS OF ILLINOIS BAT HIBERNACULA**

A. C. Yannarell, Y. Lou, E. J. Heske, A. N. Miller, J. F. Merritt, N. Mateus-Pinilla, and S. J. Taylor. Department of Natural Resources and Environmental Sciences, University of Illinois, Urbana IL 61801 (ACY, YL); Illinois Natural History Survey, Prairie Research Institute, University of Illinois, Champaign IL 61820 (EJH, ANM, JFM, NMP, SJT)



*Pseudogymnoascus destructans* (Pd), the causative agent of bat White Nose Syndrome, is an invasive fungus that can persist in low-temperature soil communities in cave ecosystems. We hypothesized that the arrival of Pd in cave ecosystems may change the composition of microbial communities. We performed high-throughput DNA sequencing (Illumina MiSeq) on microbial communities from the soil of Illinois caves used as bat hibernacula in 2012-2014. We used permutational multivariate ANOVA to analyze changes in microbial community composition among caves and across years. Cave soil community composition varied significantly across caves, years, and locations within caves, with significant cave-by-year and cave-by-location interactions. Some of these interactions may relate to the arrival of Pd. For example, we detected Pd in Blackball Mine for the first time in 2013. Whereas the bacterial communities at the entrance of Blackball Mine changed very little from 2012 to 2013, soil communities of interior cave locations changed substantially. In these locations, the arrival of Pd coincided with an increase in the proportion of Proteobacteria and Acidobacteria, largely at the expense of Actinobacteria, Bacteroidetes, and Firmicutes. In contrast, Actinobacteria and Firmicutes increased their relative abundances in the hibernaculum of Equality Cave, where Pd was not detected in 2013. These changes provide clues about the ecology of Pd establishment in microbial communities, and further analyses may reveal antagonistic interactions that can be used to combat this fungus.

## History of Mammal Colloquium and SBDN Meetings

Colloquium	SBDN	Year	Location	Host
25 <sup>th</sup>	20 <sup>th</sup>	2015	St. Louis, MO	
24 <sup>th</sup>	19 <sup>th</sup>	2014	Nacogdoches, TX	Chris Comer
23 <sup>rd</sup>	18 <sup>th</sup>	2013	Fall Creek Falls, TN	Brian Carver
22 <sup>nd</sup>	17 <sup>th</sup>	2012	Louisville, MS	Darren Miller
21 <sup>st</sup>	16 <sup>th</sup>	2011	Louisville, KY	Tim Carter & Brooke Hines
20 <sup>th</sup>	15 <sup>th</sup>	2010	Asheville, NC	Mary Kay Clark
19 <sup>th</sup>	14 <sup>th</sup>	2009	Jonesboro, AR	Tom Risch & Blake Sasse
18 <sup>th</sup>	13 <sup>th</sup>	2008	Blacksburg, VA	Michael St. Germain
17 <sup>th</sup>	12 <sup>th</sup>	2007	Destin, FL	Jeff Gore
16 <sup>th</sup>	11 <sup>th</sup>	2006	Chattanooga, TN	Tim Carter & Troy Best
15 <sup>th</sup>	10 <sup>th</sup>	2005	Paris Landing, TN	John Nelson
14 <sup>th</sup>	9 <sup>th</sup>	2004	Helen, GA	Steven Castleberry
13 <sup>th</sup>	8 <sup>th</sup>	2003	Mississippi State, MS	Darren Miller
12 <sup>th</sup>	7 <sup>th</sup>	2002	Clemson, SC	Susan Loeb
11 <sup>th</sup>	6 <sup>th</sup>	2001	Memphis, TN	Michael Kennedy
10	5 <sup>th</sup>	2000	Guntersville, AL	Troy Best
9 <sup>th</sup>	4 <sup>th</sup>	1999	Wytheville, VA	Rick Reynolds
8 <sup>th</sup>	3 <sup>rd</sup>	1998	Hot Springs, AR	David Saugey
7 <sup>th</sup>	2 <sup>nd</sup>	1997	Black Mountain, NC	Mary Kay Clark
6 <sup>th</sup>	1 <sup>st</sup>	1996	Somerset, KY	Mike Lacki
5 <sup>th</sup>		1995	Cookeville, TN	Michael Harvey
4 <sup>th</sup>		1994	Athens, GA	Joshua Laerm
3 <sup>rd</sup>		1993	Mountain View, AR	Gary Heidt & Rick McDaniel
2 <sup>nd</sup>		1992	Guntersville, AL	Troy Best
1 <sup>st</sup>		1991	Memphis, TN	Mike Kennedy

# BAT BLITZ

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MARY KAY CLARK  
mkcmoonlight@gmail.com  
www.sbdn.org (2015 Bat Blitz details)

2015 SBDN Bat Blitz, July 26-30



The 2015 Bat Blitz, sponsored by the Palmetto Bluff Conservancy, will be held in Beaufort and Jasper Counties in coastal South Carolina.

Survey areas include Pinckney Island National Wildlife Refuge, Savannah National Wildlife Refuge, Victoria Bluff Heritage Preserve, Honey Horn Plantation and Palmetto Bluff.

And we've added another partner, Spring Island!

Housing for the 2015 Bat Blitz will be at the University of South Carolina Beaufort's Hilton Head Gateway Campus in Bluffton, SC. Details on lodging can be found at [uscb.edu/campus](http://uscb.edu/campus).

These are four bedroom suites with a full kitchen and two bathrooms.

On Sunday we'll host a bat education event with local speakers, outside events and a live bat presentation by (Rob Mies, <http://www.batconservation.org/education/live-animal-programs/live-bat-programs-with-rob-mies>).

Early Sunday evening the Palmetto Bluff Conservancy will host a cookout and social for the group.

Blitz registration ends 1 June 2015.

The Palmetto Bluff Conservancy is a not-for-profit 501 (c) (3) organization dedicated to the conservation of the natural and cultural resources of Palmetto Bluff.

For more information about the Conservancy, go to [Palmettobluff.com](http://Palmettobluff.com).





# Items of Interest

## A 7 YEAR TELEMETRY PROJECT

Josh Campbell, Chris Simpson, Dustin Thames, and Cory Holliday

Since 2009, the Tennessee Wildlife Resources Agency (TWRA) has partnered with the USFWS and contracted work to Copperhead Environmental Consulting to discover locations of Indiana bat maternity colonies in Tennessee. These maternity colonies were located through tracking Indiana bats from wintering hibernation caves to summer roosting sites. Biologists entered caves with hibernating Indiana bats plucking individuals in torpor from the cave walls. Copperhead biologists attached transmitters to bats and took the primary lead during tracking efforts, while all other partners, agencies and biologists assisted with these efforts. Once located, Wildlife Diversity personnel from TWRA and other researchers continued working to determine habitat characteristics, preferences, and what might be lacking on the landscape for this species to persist.

Early in the project, caves on the northern Cumberland Plateau were selected in hopes the bats would migrate south, east and west across the state. Attempts were made to track individual bats from these northern sites across the state. Telemetry during the infancy stages of the project proved valuable as our technique for tracking evolved and the needs for such an ambitious project were determined and met. In 2010, Rose Cave was selected as the hibernation cave where telemetry would initiate. We also increased the number of transmitters placed on Indiana bats in attempts to increase the percentage of transmitters recovered and potential roosting sites by the end of the project. During 2010, a single Indiana bat was tracked from Rose Cave into north Alabama, but radio contact was lost before the bat reached a maternity area. A second Indiana bat was tracked from a hibernation cave in Fentress County, Tennessee into central Kentucky where a new maternity colony was found, 231 km from the point of release.

In 2011, Indiana bats were tracked into both north Alabama and Georgia, but were subsequently lost due to inclement weather. The following year, 2012, more success was had as bats were tracked again into Alabama and Georgia, confirming a maternity area on the Talladega National Forest, and a maternity colony near Elijay, Georgia. This maternity area in Georgia represented the first confirmed sighting of the species in the state since 1966.

In 2013, our goal was finally reached four years following the initiation of the project as maternity colonies were located in multiple locations in Wilson County, Tennessee and one maternity colony was located in McNairy County, Tennessee. Also in 2013, Indiana bats were again tracked to the Talladega National Forest to trees previously used by other bats in the project. The most amazing find for the project during this year was an Indiana bat that was tracked from Rose Cave in Tennessee to a newly found maternity colony within Holly Springs National Forest in Mississippi. This one migration occurred over the course of 9 nights, that included a four day layover in Noah, Tennessee, and five nightly migration distances that ranged from 21.2 km to 153.2 km. The straight-line distance of this one migration was 368.1 km!

Further work during the spring of 2013 by TWRA Wildlife personnel proved extremely valuable. While mist netting located roost trees to attach new transmitters for further tracking, a banded Indiana bat was captured. Data associated with this recovered band showed the Indiana bat was banded at Rice Cave in Tennessee during the winter of 2010. This indicated that one maternity colony in Wilson County was inhabited by bats from at least two different caves.

The project proved to be even more fruitful in 2014. We expanded the start of our telemetry from one cave to two caves. Starting from Blowing Cave in Hickman County, we tracked bats to Benton County, Tennessee and into southern Kentucky, where colonies of Indiana bats were located. Once again, telemetry from Rose Cave showed bats migrated to Wilson County, Tennessee and the Talladega National Forest in Alabama.

In 2015, we expanded the project again in hopes of learning even more about land use in Tennessee by Indiana bats. First, we intended to attach transmitters to Indiana bats from a cave in southern middle Tennessee. Unfortunately, the Indiana bats that hibernated there had moved on prior to our arrival. Next we moved our efforts to Hubbard's Cave, owned and managed by the Nature Conservancy of Tennessee. We were able to attach transmitters to 30 female Indiana bats. The next night, we moved our efforts to Rose Cave once again. Thirty-five transmitters were attached to female Indiana bats. We were tracking bats simultaneously from two different caves! Then, the unpredictable spring weather moved into Tennessee. Wind, rain, low ceilings, fog, and low temperatures kept our planes grounded for several days over the course of two weeks. Many of the bats with attached transmitters did not move much during this time. With breaks in the weather, our planes were able to track some of the migrating bats. One Indiana bat was tracked to an area near Cornersville, Tennessee where it was eventually lost as the result of losing aerial support due to weather. Bats from both Rose Cave and Hubbard's Cave migrated to previously identified maternity areas in Wilson County, Tennessee and the Talladega National Forest.

During 2015, we attached coded transmitters to sixty of the sixty-five female Indiana bats that were radio-tagged. The coded transmitters allowed us to identify individual bats on the landscape, something that we had not previously been able to accomplish. By using this technology, we hoped to determine how many Indiana bats migrated to each of the known maternity areas from each of the caves selected for telemetry. The coded tags allowed us to determine of the sixty bats tagged in 2015, five individuals from Rose Cave and four individuals from Hubbard's Cave migrated to Wilson County, Tennessee, two bats from Rose Cave migrated to McNairy County, Tennessee, one bat from Rose Cave migrated to Holly Springs National Forest in Mississippi, and six bats from Rose Cave and six bats from Hubbard's Cave migrated to maternity areas in the Talladega National Forest in Alabama. We are hopeful the unrecovered transmitters from the remaining Indiana bats represent more unidentified maternity colonies across Tennessee and surrounding states.

With experience and lessons learned, our telemetry project proved more successful this year than in previous years. We located a total of 29 transmittered individual bats by the end of the 2015 primary tracking phase, most of which were in maternity areas previously identified. This includes bats tagged with coded and standard transmitters. Three individuals were located, but eventually lost prior to the discovery of a maternity tree. But what makes this a successful year is having learned that bats from at least two different caves make up the maternity colonies in areas previously identified in Wilson County, Tennessee and the Talladega National Forest. When combining these efforts with those of previous years, we have made connections from three different caves in the maternity areas in Wilson County Tennessee, and have located seven different maternity areas, most of which contain multiple colonies of Indiana bats, all in areas not previously known to have maternity colonies. The most significant find of the project was learning Indiana bats actually migrate south!

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## MISSISSIPPI BAT WORKING GROUP

### **Annual Meeting**

The Mississippi Bat Working Group (MBWG) held their annual business meeting on February 12, 2015 at the Mississippi Museum of Natural Sciences in Jackson, Mississippi. Presenters covered a range of topics including Rafinesque's big-eared bat use of an abandoned seismography building and adjacent constructed roost, bat occupancy of managed bottomland hardwood forests, and using DNA from guano to identify bat species. The group also received updates on white-nose syndrome and cave/culvert monitoring in the state as well as information on the current status of northern long-eared bats in the state.

During the meeting, the group held elections for officers and board members. Below are the current standings:

Chair: Becky Rosamond	Board Member: Shea Staten
Vice-chair: Kathy Shelton	Board Member: Scott Rush
Secretary/Treasurer: Amber Breland	Board Member: Kris Godwin

Awards were presented to the following members:

Chester O. Martin Award (the group's highest honor): Stephanie Steele  
Publication Award: Kathy Shelton  
Research/Conservation Award: Cody Jordan  
Education/Outreach Award: Robert Simpson  
Billy Goat Gruff Award\*: Shea Staten and Cody Jordan

\*The Billy Goat Gruff Award is a new award presented to the member(s) with the best "story from the field" for the year. Shea's and Cody's account of "The Billy Goat Gruff" appeared in the Dec. 2014 edition of Nightwing News.

### **Education and Outreach**

- The MBWG manned booths at NatureFest at the Mississippi Museum of Natural Sciences on April 11 and at the Natchez Trace Wildlife Festival in Tupelo on April 18. The booth featured information on species found in Mississippi and an interactive display on bat research methods.
- Vice-Chair Kathy Shelton, Board Member Kris Godwin, and members Mike McDowell, Eric Guillory, and Rob McKay hosted a public meeting in Woodville, MS to provide information to residents on bat life history, health concerns, and exclusion from buildings.

### **Raf Roost Renovation**

Cody Jordan, Shea Staten, Deb Waz, and Ken, Becky, Natalie, Thomas, and Ben Rosamond began renovation of the seismography building on March 7. The seismography building is home to a maternal colony of Rafinesque's big-eared bats and is in the process of losing its roof. Participants removed debris (including several live trees) from the roof of the building, trimmed sapling and vines along the base, and covered several large holes in the roof with sheets of plywood. The next step in the plan is to build a new roof above the existing roof. The group hopes to conduct this work in the fall, once the pups are volant. The temporary measure of covering the holes with plywood has allowed the bats to move back into section of the building they had previously abandoned.

### **Upcoming Mist Net Event**

The Mississippi Bat Working Group will hold its twelfth annual mist net event September 15 - 17 near Rolling Fork, MS. Please contact the group at [msbats@hotmail.com](mailto:msbats@hotmail.com) for more information.





Before



After



Thomas (l) and Ben (r) clearing limbs.



Clearing the roof.



One of the 4 large holes in the roof.

## THE CENTER FOR BAT RESEARCH, OUTREACH, AND CONSERVATION

The Center is beginning another field season in Great Smoky Mountains National Park in April 2015. Using mistnetting, radio telemetry, and acoustics, we aim to document the distribution of bats across the Park, with special attention to two declining bats: the northern long-eared bat and the Indiana bat. In 2014, we observed a >90% decline in capture rates for both species, but we did detect some survivors and also a new distribution record for Indiana bats in North Carolina. In 2015, we will again partner with the Southern Research Station of the USFS to study bat populations across the Park. We'll also be conducting acoustic surveys to gain a better understanding of the overall distribution of the bat community in the Great Smoky Mountains.



Photo shows Zack Fry searching for a bat (top left), Eric Winters taking data on a roost tree (top right), Bronson Curry setting up mistnet poles (bottom left), and Twentymile Ranger Station, our haunted field house (bottom right).

## PHOTO OF ISU BAT CENTER STUDENTS AND DIRECTORS



**Back row (left to right):** Joey Pettit (PhD, '15), Tim Divoll (Phd, '19), Jordan Holmes (BS, '15), Rob Arndt (PhD, '17), James Cox (BS, '14'), Joy O'Keefe (Director), Vanessa Rojas (PhD, '18), Julia Hoeh (MS, '17), Joey Weber (MS, '15), Brianne Walters (Assistant Director)

**Front row (left to right):** Scott Bergeson (PhD, '17), Kristina Hammond (MS, '13), Caroline Byrne (MS, '15)

### ATTENTION STUDENTS

The Southeastern Bat Diversity Network (SBDN) established an annual Student Travel Award in 2006 to financially assist one student attending the North American Symposium on Bat Research (NASBR). If you are a student enrolled in a university in the Southeastern US and are planning to give an oral or poster presentation at NASBR in 2015 ([www.nasbr.org](http://www.nasbr.org)), you are qualified to apply for a student travel award from SBDN. Information on the award and the application process are available at: [http://www.sbdn.org/files/SBDN\\_Student\\_Award.pdf](http://www.sbdn.org/files/SBDN_Student_Award.pdf). **DEADLINE for 2015 applications will be in July 7, 2015.** Send applications to Stephen Burnett via email ([sburnett@clayton.edu](mailto:sburnett@clayton.edu)) or snail mail (Stephen Burnett, Department of Natural Sciences, Clayton State University, 2000 Clayton State Blvd, Morrow GA 30260). E-mail submissions are preferred. Contact Stephen Burnett ([sburnett@clayton.edu](mailto:sburnett@clayton.edu)) if you have questions.

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# FUTURE MEETINGS

**26<sup>th</sup> Mammal Colloquium  
and  
21<sup>st</sup> SBDN Meeting**

Lake Guntersville State Park,  
Alabama  
February 18 – 19, 2016

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**Wildlife Society  
22<sup>nd</sup> Annual Conference**

Winnipeg, Manitoba  
RBC Convention Centre  
October 17-21, 2015.

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**45<sup>th</sup> North American Symposium of Bat Research**

Annual meeting  
October 28 – November 1, 2015  
Monterey, California

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**95<sup>th</sup> Annual Meeting of the American Society of  
Mammalogists**

June 12 - 16, 2015

Hyatt Regency Jacksonville Riverfront  
Jacksonville, Florida

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**14<sup>th</sup> GREAT LAKES BAT FESTIVAL**

Cranbrook Institute of Science  
Bloomfield Hills, Michigan

26 September 2015  
10am to 5pm

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**11<sup>th</sup> Annual Austin Bat Fest  
Ann Richards Congress Avenue Bridge**

4 pm - Midnight  
Austin, Texas  
22 August 2015

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**9<sup>th</sup> Annual Indiana Bat Festival  
&  
Bat Science Night**

Indiana State University  
Terre Haute, Indiana  
10am to 4 pm  
19 September 2015

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**FROM THE EDITOR:**

I think we have another great Newsletter.

As always I couldn't do any of this without all your help in sending in your information.

I have always said "if you send it in, I will put it in the Newsletter."

A very big "**Thank You!!!!**" to everyone that provided pictures from the meeting.

I hope everyone has a very productive survey/research season.

I look forward to seeing what you have all been doing and what you have accomplished in the Fall issue.

**"THANK YOU ONE AND ALL."**



\*\*\*As always take good notes and be safe out there no matter what you are doing.\*\*\*

**Have Some Fun!**