

ECHOLOCATOR

Volume 9, Issue 1
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WISCONSIN
BAT PROGRAM



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Photo credit: Tonie Rocke, USGS

USGS' Susan Smith, left, and Heather Kaarakka of DNR's Wisconsin Bat Program, use a pipette to deliver a dose of vaccine to a bat in fall 2019. The field trials represent the first vaccinations in the wild to help fight white-nose syndrome. Researchers wear protective clothing to avoid transferring the causative fungus from one location to another.

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Echolocator is an annual publication of the Wisconsin Bat Program, part of the Wisconsin Department of Natural Resources Natural Heritage Conservation Program. DNR conservation biologists statewide monitor, research and inventory Wisconsin's eight bat species in collaboration with other state and federal agencies, universities, conservation groups, other non-governmental groups, and hundreds of volunteers.

Echolocator presents bat conservation work and research relevant to Wisconsin and welcomes ideas for future articles and featured groups. Please contact Jennifer.Redell@Wisconsin.gov to share your suggestions.

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RECENTLY PUBLISHED ARTICLES

Abbott, R. C., L. Saindon, E. A. Falendysz, L. Greenberg, L. Orciari, P. S. Satheshkumar, and T. E. Rocke. 2019. [Rabies Outbreak in Captive Big Brown Bats \(*Eptesicus fuscus*\) Used in a White-nose Syndrome Vaccine Trial. *Journal of Wildlife Diseases*.](#)

Hoyt J. R., K. E. Langwig, J. P. White, H. M. Kaarakka, J. A. Redell, K. L. Parise, W. F. Frick, J. T. Foster, and A. M. Kilpatrick. 2019. Field trial of a probiotic bacteria and a chemical, chitosan, to protect bats from white-nose syndrome. bioRxiv 567826; doi: <https://doi.org/10.1101/567826>

Huebschman, J. J., S. A. Hoerner, J. P. White, H. M. Kaarakka, K. L. Parise, and J. T. Foster. 2019. [Detection of *Pseudogymnoascus destructans* during Summer on Wisconsin Bats. *Journal of Wildlife Diseases*.](#)

Rocke, T. E., B. Kingstad-Bakke, M. Wüthrich, B. Stading, R. C. Abbott, M. Isidoro-Ayza, H. E. Dobson, L. dos Santos Dias, K. Galles, J. S. Lankton, E. A. Falendysz, J. M. Lorch, J. S. Fites, J. Lopera-Madrid, J. P. White, B. Klein, and J. E. Osorio. 2019. [Virally-vectored vaccine candidates against white-nose syndrome induce anti-fungal immune response in little brown bats \(*Myotis lucifugus*\). *Scientific Reports* 9:6788.](#)

White, J. P., G. E. Nordquist, and H. M. Kaarakka. 2019. [Longevity Records of Five Male Little Brown Bats \(*Myotis lucifugus*\) in Northwest Wisconsin. *Northeastern Naturalist* 26: N1-N4.](#)

REFLECTIONS FROM THE EDITOR

Gains and Losses After 10 Years of White-Nose Syndrome

By Jennifer Redell

DNR Conservation Biologist, Bat Program Cave and Mine Specialist

Ten years ago, Wisconsin and several other states received our first U.S.

Fish and Wildlife Service funding to

respond to the

newly emerging

disease of bats

known as white-

nose syndrome.

We didn't know

where the vast

majority of our bat

hibernation sites

were located, nor

what numbers

and species

hibernated

there. Similarly, we had almost no

information on summer maternity

colonies. Acoustic surveys were just

being introduced as a citizen science

opportunity.

We responded to the news of the rapidly spreading disease by listing the state's four cave bat species as threatened in Wisconsin, protecting them from threats like direct killing from improper exclusion or vandalism.

We launched an all-out effort to document our bat populations in their winter hibernacula, and recruited hundreds of citizens to help count bats emerging from their roosts and in the summer skies before the disease arrived. Working with U.S. Geological Survey Wildlife Health Center and University of Wisconsin wildlife experts, we helped seek ways to treat bats infected with the disease or prevent them from getting the fungus.

As a result of these efforts, we now know Wisconsin is home to 200-plus suitable hibernation sites that include natural caves and historic



mines but also beer aging cellars and abandoned rail tunnels. Hundreds of summer roost sites have been located and bats counted in attics, barns, bat houses and bridges. And volunteers on foot, in canoes and in cars have used acoustic detectors to record bat calls, helping identify where and how many of which species of bats are present during summer nights.

A decade later we find ourselves on the other side of white-nose syndrome, banding and monitoring surviving bats both underground and above ground. In this issue you'll learn how we continue to work with federal wildlife health officials and UW-Madison researchers, developing and testing vaccines to help bats survive WNS. Encouragingly, this fall partners conducted the first field tests in the wild for a treatment, successfully dribbling vaccine through a pipette into the mouths of little brown bats as they entered hibernation.

“ We launched an all-out effort to document our bat populations in their winter hibernacula, and recruited hundreds of citizens to help count bats emerging from their roosts and in the summer skies before the disease arrived. ”

We've witnessed an outpouring of caring and concern for bats, from girl and boy scouts building bat houses to roost owners who battle clouds of mosquitoes to count their bats, to the thousands of Wisconsinites who have attended our bat festivals or have signed up to receive our periodic updates on bat news. We couldn't be more grateful for the support and enthusiasm we've seen from the public over the past decade. A tremendous thank you goes to our hundreds of bat monitoring volunteers. We invite you to read this issue for a snapshot of where things stand today and the work that lies ahead.

We thank you for the amazing work and support in the first decade of the Wisconsin Bat Program and look forward to our next 10 years together.

White-Nose Syndrome Spreads Nationally

Wisconsin Finds Surviving Bats

By J. Paul White
DNR Mammal Ecologist,
Bat Program Lead

Since its discovery in 2007 in New York, white-nose syndrome has spread rapidly across the continent and is estimated to have killed up to 6.7 million bats. In total 33 states and seven Canadian provinces have confirmed WNS in their bat populations and five more states, including California and North Dakota,

By the Numbers

6.7
million

WNS has
killed an
estimated
6.7 million
bats.

destructans – Pd) without signs of disease. In Wisconsin, white-nose syndrome has been confirmed in four

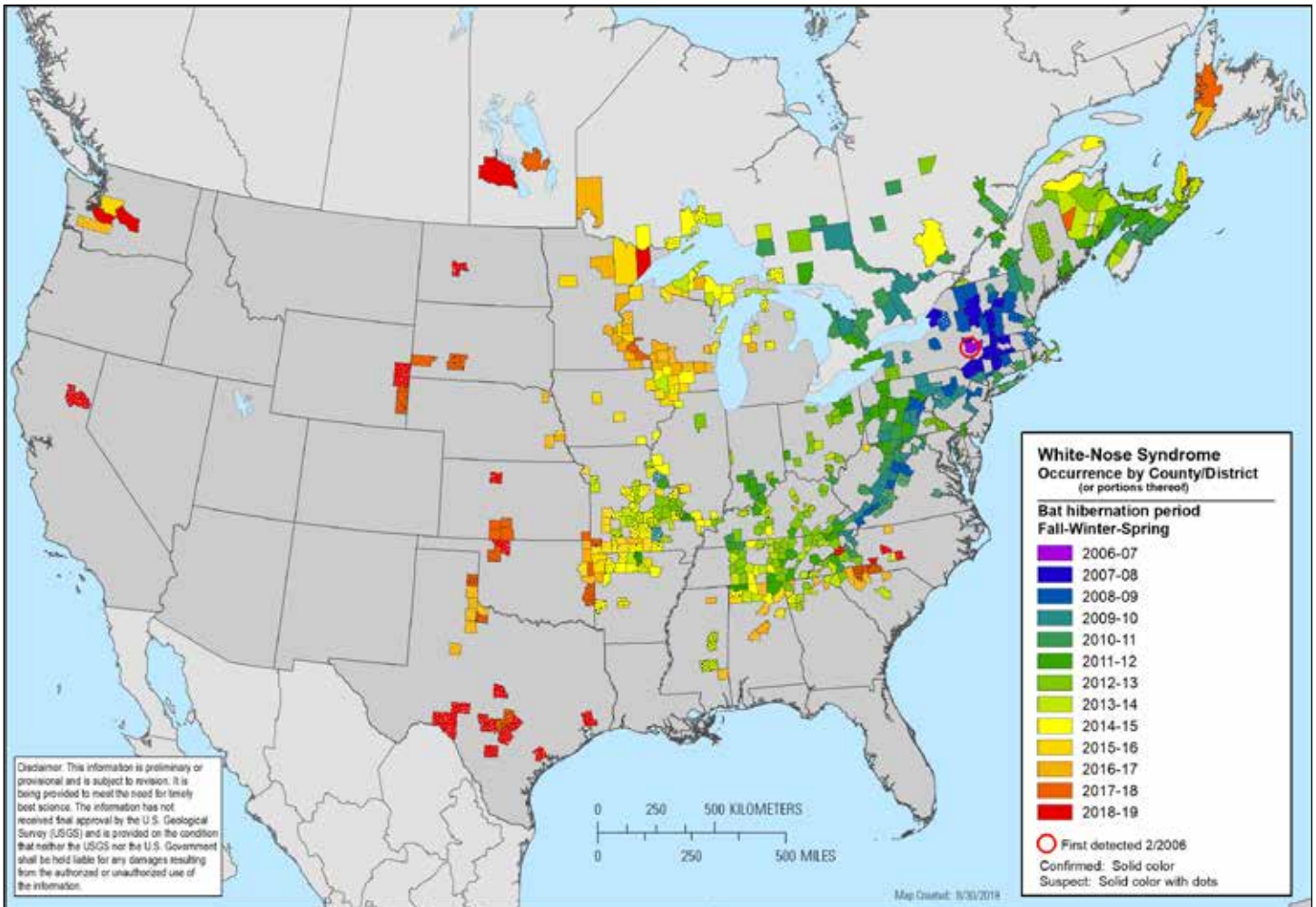
have just detected the causative fungus.

In the United States, 13 bat species have been confirmed with the disease and eight other species have been identified as carrying the fungus (*Pseudogymnascus*

hibernating bat species and the state is entering its seventh hibernation season since the fungus was first detected in Wisconsin in Grant County. Winter hibernacula surveys in 2019-2020 showed that white-nose syndrome is now widespread in Wisconsin and continues to decimate bat populations.

Wisconsin Bat Program biologists visited 59 hibernacula from November 2018 – March 2019 and found all sites were infected with the disease and that many hibernation sites that began with smaller populations decreased

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to zero bats. Numbers at other sites dropped 72% to 97% from their average pre-WNS populations.

DNR Banding Helps Reveal Bats Surviving the Disease

We did see some encouraging signs in their winter surveys, however, as well as in summer 2019 surveys. Across some sites, regardless of the size of population reduction, there is some growing evidence of year-to-year survival for some bat species, including little brown bats, despite WNS infection. The Wisconsin Bat Program and partners like Virginia Tech and University of California Santa Cruz scientists have been marking (banding) individuals in hibernation sites to understand year-to-year survival, disease infection and site fidelity.

In 2019, we observed previously marked individuals in a few sites. These bats are somehow finding a way to survive with the fungus, perhaps choosing hibernation sites that are colder and less hospitable to the fungus or finding some other strategy. Also encouraging, summer roost surveys found that little brown bat populations at some roost sites have similar numbers to previous years, which is good news for a species hard hit by white-nose syndrome. Find specific results in articles in this issue on acoustic surveys, and bat roost surveys.

First Vaccine Given to Bats in the Wild as Life-Saving Treatments Advance

For years, the USGS National Wildlife Health Center, the University of Wisconsin-Madison and DNR have been racing to develop and test oral vaccines to save bats from white-nose syndrome. This fall, our partners took an important step forward in developing a life-saving treatment when, with our help, they tested the first vaccine administered in the wild.

Our group vaccinated free-ranging little brown bats in two hibernacula



Photo credit: Joe Hoyt

A sign of hope: The blue tag on this little brown bat indicates it's been vaccinated against white-nose syndrome as field trials get underway in Wisconsin.

“ **This fall, our partners took an important step forward in developing a life-saving treatment when, with our help, they tested the first vaccine administered in the wild.** ”

and temporarily outfitted the bats with a tiny external tag known as a PIT tag, short for Passive Integrated Transponder. Electronic readers at the entrances to the hibernacula continually scan for PIT tags and record tagged bats as they fly through.

Understanding winter bat activity and in particular, when a bat leaves the hibernaculum, can speak to whether a bat has survived and leaves the hibernaculum in the spring as usual, or whether a bat likely emerged too early in the winter months and likely succumbed to extreme weather conditions and/or lack of adequate food and water. We hope to have good news to report in the coming months.

The work is funded in part by a grant Wisconsin DNR was awarded in fall 2019 by the U.S. Fish and Wildlife Service, which has continued to support state-initiated management actions, priority research and development of treatments for white-nose syndrome. The grant is to focus on conservation and recovery efforts for WNS-affected bat species and to work with collaborators to develop techniques and protocols for mitigating the population effects of white-nose syndrome.

Acoustic Monitors Document the Sound of Silence

Volunteers Overcome Weather, Balky Equipment

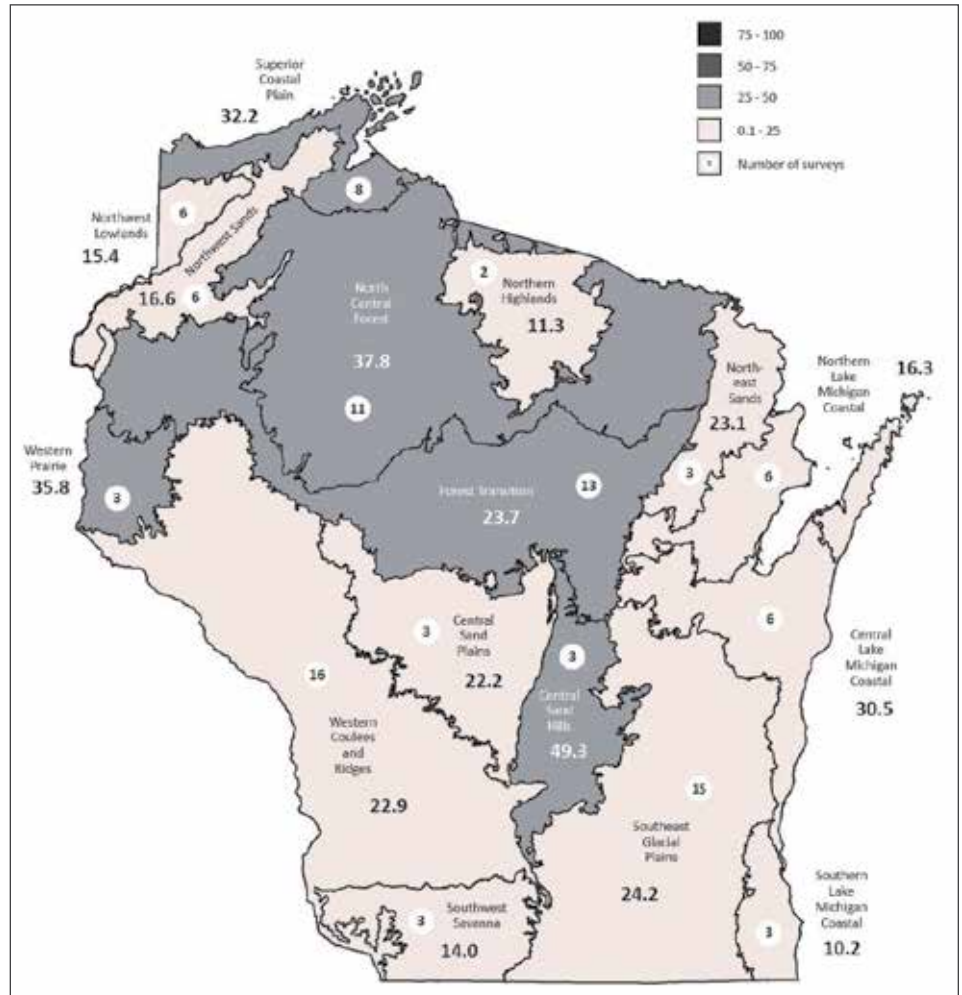
By J. Paul White
DNR Mammal Ecologist,
Bat Program Lead

Volunteers using acoustic detectors to record and listen for bat activity on summer nights continued their impressive survey efforts by foot, car and kayak in 2019, but found fewer bats in the night skies overall, no northern long-eared bats and only a handful of detections of eastern pipistrelles.

Back to back years of cold and wet spring weather once again reduced the number of acoustic bat surveys conducted in April and May. And rightfully so, since the below-average temperatures also put much of bats' food resources in a holding pattern, or in some cases, a week and a half behind average, according to UW-Madison Extension Entomologist PJ Liesch. Despite these hazardous conditions, this resilient group of animals arrived at their bat houses, attics and roost trees...and our dedicated acoustic surveyors were there to record them, providing valuable information to help monitor Wisconsin cave bat populations in the wake of white-nose syndrome.

Surveys Covered More Than Two-Thirds of Counties

In total, volunteers completed 376 acoustic bat surveys in 50 of 72 counties, or 69.4%. Of that total, 135 were driving surveys, 128 walking, and 113 paddling. At least 393 volunteers participated on one or more surveys with 70 surveys coming from Vilas County alone. The average number of detections per survey was 46.8, well



Map of 2019 acoustic driving surveys showing mean bat calls per detector hour. Central Sand Hills had the highest mean, 49.3.

down from the 2015 analysis of 84.6. The highest number of detections came from a 4.2-mile survey completed by surveyors Anna Hall, Tom Kocourek, Betsy Kocourek, Kelly Herfendal and Jessica Johnsrud from Woodland Dunes Nature Center. The five surveyors recorded 424 bat detections on the West Twin River in Manitowoc County on Aug. 1, 2019. Statewide, nine surveys did not detect any bats and 10%, or 36 routes, had 100 or more bat detections. Compare these numbers to surveys from 2015 in which 22% of routes had 100 or

more bat detections and the highest number of detections was 855. Those impressive totals came from a route on the Fox River in Green Lake County on June 27, 2015.

Radio Silence from Two Hibernating Species

So, what are we finding? Of the cave bats, big brown bats were detected the most, having been found on 77% of surveys. Little brown bats were detected on 62% of completed surveys. Very similar to last year's

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results, the northern long-eared bat was not detected acoustically this season (one was detected in 2018) and the eastern pipistrelle was found on just four surveys (8 in 2018). Tree bat detections remained consistent with previous years' totals, with hoary bats detected on 67.8% of surveys, eastern red bats on 55.9%, silver-haired bats on 29.7%, and evening bats on 0.3%.

Unfortunately, many surveyors experienced GPS connectivity issues which caused the usual angst with our aging fleet of detectors. The source of the problem is still a mystery, but a GPS satellite reboot in spring 2019 may have been the culprit. Some of the equipment was retired and replaced with an external GPS setup that connects directly into the detector. Some surveyors persevered with the intermittently functioning models -- we appreciate your patience! -- and

others were able to use a few new systems sponsored by DNR or local donors. There are many upsides to transitioning to these smaller, more versatile units, their lower cost and ease of use among them. Sadly, we've also experienced some GPS issues with these systems, so we are still working out how best to ensure the data collected is encoded with locational information. Please feel free to contact us if you think your system needs updating or maintenance.

Lastly, for a project that started with 18 surveys in 2007 to have volunteers, WBP staff and partners conducting 20 times that number in 2019 speaks volumes. Volunteer-based acoustic bat surveys have built an understanding of where bats are found in the state (and their densities) before and after the arrival of white-nose syndrome, giving us an irreplaceable dataset. The project's long-term success is due to a passionate and dedicated group of volunteers and

“ **Volunteer-based acoustic bat surveys have built an understanding of where bats are found in the state (and their densities) before and after the arrival of white-nose syndrome, giving us an irreplaceable dataset.** ”

regional coordinators that put bat conservation ahead of other work and life priorities, and for that I am forever grateful. THANK YOU!



One if by Land, Two if by Sea

We know the detection percentages vary naturally by survey type.

For example, walking routes only detected little brown bats on 51 of 128 surveys (39.8%), while little brown bats were detected on 90 of 113 surveys (79.6%) of paddling routes. These discrepancies can

be traced in part to differences in habitats surveyed: water vs. land and open prairie vs. forest interior. Travel speed, driving 20 mph vs. walking 5 mph, and distance, also made a difference.

Bridging the Roost Knowledge Gap

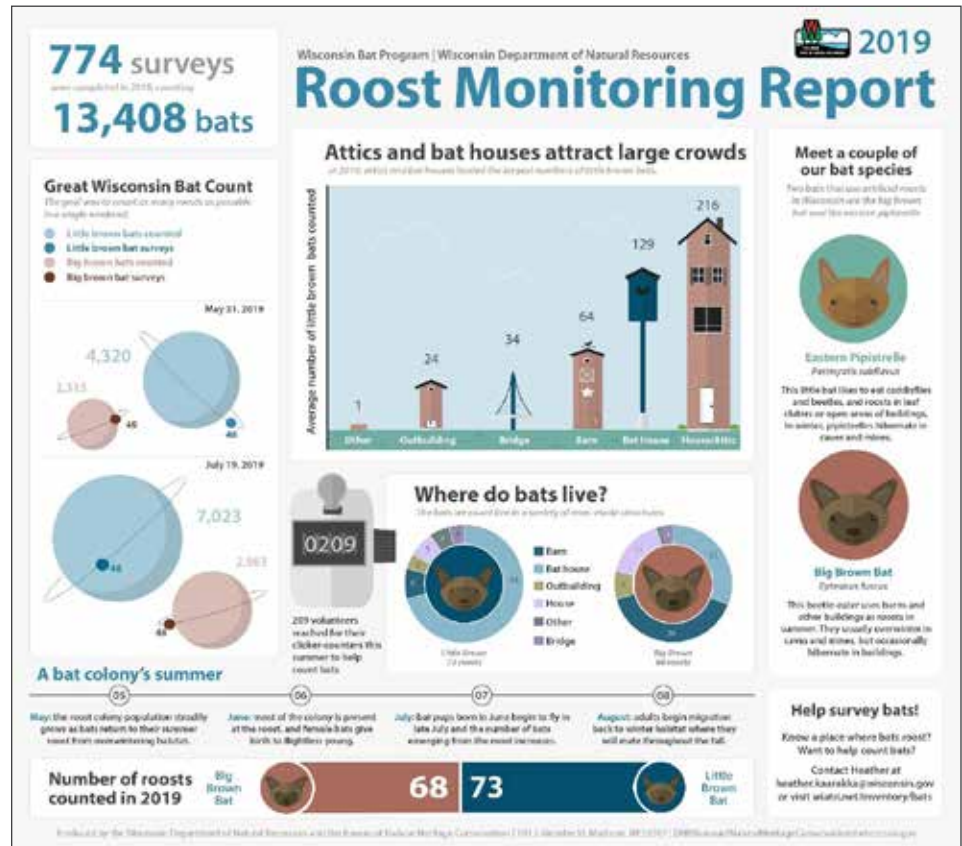
By Heather Kaarakka
DNR Conservation Biologist,
Bat Program Roost Monitoring
Coordinator

With over 200 surveyors, 159 roosts monitored and almost 800 emergence surveys completed, 2019 was one of the most successful roost monitoring seasons yet! Wisconsin's residents continue to help us add new roosts to our database and gather important information about bats and their roosting behavior around the state.

This year closely resembled last year in numbers and behavior, indicating that we are quite possibly in a stabilization period post white-nose syndrome. Some roosts have bottomed out with very few or no little brown bats especially early in the season, while other little brown bat sites seem to have stabilized at lower population levels.

We are eager to learn about other persisting colonies and why some populations remain while others have winked out, and roost monitors are one of the keys to continuing these investigations. Summer emergence counts are the main way we identify these critical roost sites and in 2020 we are looking forward to potentially learning why bats are persisting by tagging surviving bats to track their movements from summer sites to winter hibernacula. We hope to answer questions including whether survival depends only on where bats are hibernating or whether summer habitat quality also plays a role.

Of the species monitored through the roost project, little brown bats and eastern pipistrelles have been hit the hardest by white-nose syndrome. Echoing results from acoustic surveys in summer, little brown bats have

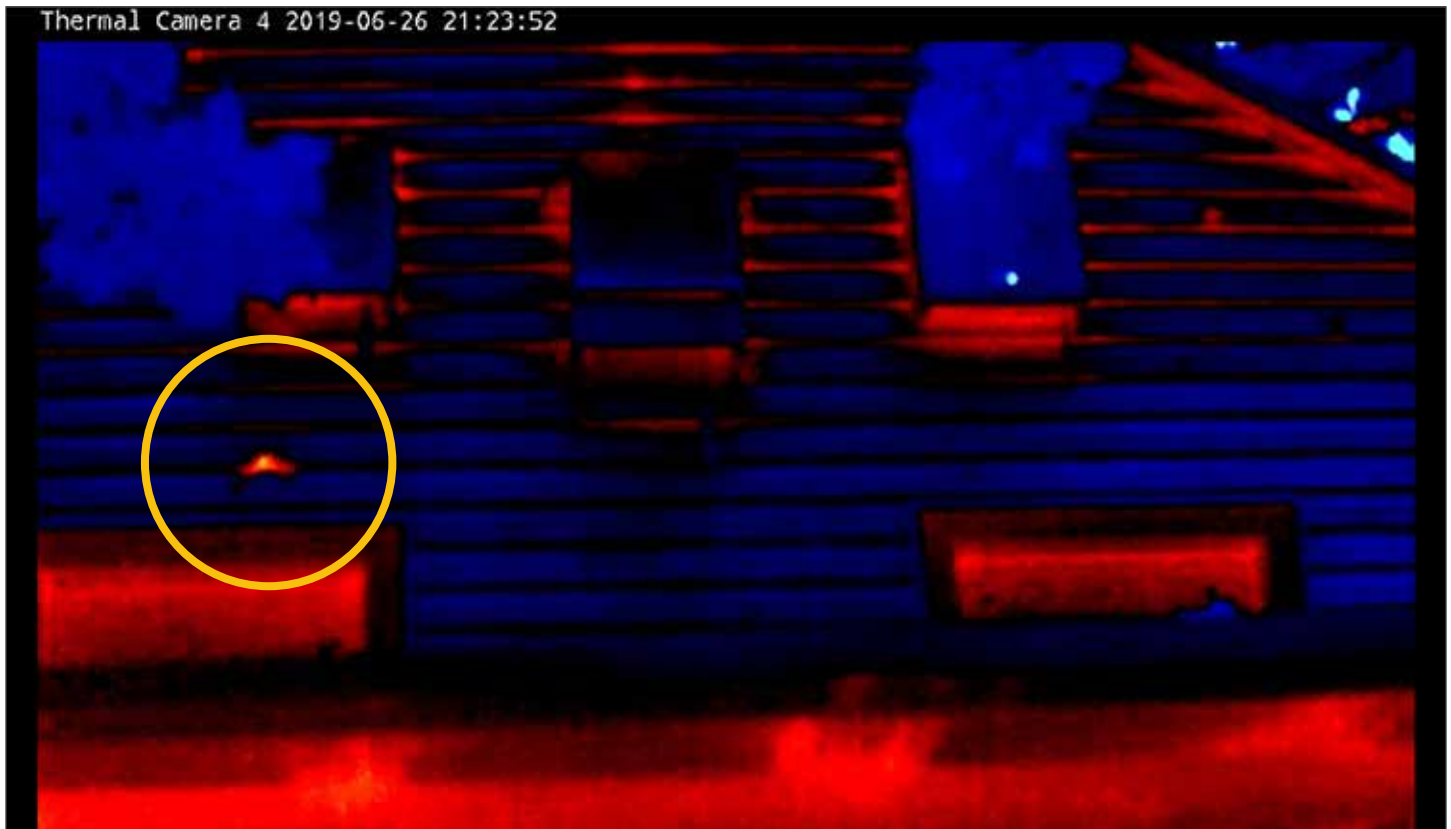


Top: 2019 saw a record level of volunteer effort to monitor bat roosts. [Read more in the annual report.](#)

Bottom:
Photo credit: Heather Kaarakka. A colony of big brown bats discovered roosting under a bridge in Lafayette County.

declined considerably at most roost sites and eastern pipistrelles have all but disappeared at the few sites we monitor. Big brown bats, however, are not as affected by WNS and seem to be doing well at monitored summer roost sites. Results from

the 2019 Great Wisconsin Bat Count showed most volunteers monitored big brown bat roosts and recorded larger numbers of that species.



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Thermal Cameras Reveal Bat Emergence Habitats

In 2019 we were able to set up thermal cameras at persisting little brown bat colonies to automatically record bat emergence each night. These cameras allow us to look at how the number of bats emerging changes over the season. We also can look at the behavior of emerging bats, including how long after sunset bats begin to fly out and whether they are returning early to the roost. Weather also could play a role in when and how many bats emerge, especially early in the season when it can be cold at night. We are still analyzing the footage, but thanks to bat roost monitors and landowners gathering information and reporting roosts, this is one of many projects we have been able to undertake and continue at roost sites around the state.

Bridge Surveys Document Bats' Use of These Structures

Another roost project we completed in 2019 was looking under bridges

for bats. We have known bats use bridges in Wisconsin for a number of years, but this year we investigated how widespread the bridge roost phenomenon is in the state. Surveying bridges for bats entailed visually checking cracks and crevices under bridges and measuring roost cracks and likely roosts. Bats were present under 24 of the 96 bridges surveyed in 35 counties. Most occupied bridges had fewer than five bats roosting but several bridges hosted large colonies of little brown bats and big brown bats. At several bridges we also observed several species roosting at the same time, including some that host little brown bats, big brown bats and eastern pipistrelles. We hope to look closer at the data over the winter to determine any differences between bridges occupied by bats and those not used as roosts. We plan to share our results with transportation officials to help inform the timing of bridge repairs and other maintenance to avoid disturbing maternal bat colonies.

Thank you to everyone who conducted an emergence count, reported a roost

Top: A bat can be seen flying out of the left of three bat houses in Sauk County in this thermal image. Red is warm and blue is cool.

Bottom: Photo credit: Heather Kaarakka. Wisconsin Bat Program staff visually inspecting bridges for roosting bats.



or participated in bat roost monitoring in any capacity this year! Volunteers and surveyors are what makes the roost monitoring project and the Wisconsin Bat Program successful. You can read more about 2019 bat roost monitoring in the [annual report](#).



*Photo credit:
Jennifer Redell
Door County's
Corporation Counsel
and Cave Manager
Grant Thomas
introduces a tour
group to the cave
before entering
Horseshoe Bay Cave.*

Bat Talks and Other Outreach on Hold in 2020

*By Jennifer Redell
DNR Conservation Biologist,
Bat Program Cave and Mine Specialist*

We've always enjoyed responding to requests for programs and outreach but the high and growing demand for bat talks and changes in our team's capacity make it unfeasible for us to answer all of these requests and still carry out our most critical bat conservation responsibilities. As time and workload allow, we will host our own bat outreach events including a handful of coming experiences detailed below. However, we will no longer be able to accept invitations to provide general public bat talks and similar outreach events.

Also figuring into this decision was the advanced age of Rafiki, the straw-colored fruit bat (*Eidolon helvum*) who



*Photo credit:
Heather
Karakka
Happy retirement
Rafiki! Thanks for
your many years
of ambassadorship
with the Wisconsin
Bat Program!*

served as our education ambassador. His charismatic presence has provided thousands of kids and adults with the experience of meeting a mega-bat face to face, dispelling myths and misconceptions, and winning hearts and minds along the way. However, at 18 years old and with more than

10 years of serving as the star of bat talks at state parks, libraries, schools, zoos, and nature centers, Rafiki is now entering a well-deserved retirement from public life.

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Education Trunks with Bat Materials Still Available for Loan

Despite no longer accepting invitations for in-person general public talks, Wisconsin Bat Program staff will continue to support bat education behind the scenes. Our program houses and loans out the free [HYPERLINK](https://batslive.pwnet.org/edubat) (<https://batslive.pwnet.org/edubat/trunk.php>) education trunk, conducts unique Natural Resources Foundation Field Trips, and will continue to occasionally conduct our own bat education talks and events for the public. Sign up to receive updates from our program about these and other bat issues at <http://wiatri.net/inventory/bats/contact.cfm>

Summer Field Trips with Wisconsin Bat Program Staff

There are a few chances to catch up in-person with Paul White, Heather Kaarakka and myself in 2020. Here's a sneak preview of our upcoming bat-themed Natural Resources

Foundation of Wisconsin field trips for 2020! Space is limited and to register you'll need to become a member of the foundation now and register online on their website when field trip registration becomes available in April. Find their website at Wisconservation.org.

- **To the Bat Cave! Tour Kickapoo Caverns (Saturday, July 25, 2020)**

Venture into Kickapoo Caverns, one of Wisconsin's largest caves, to experience a bat hibernaculum nestled in the scenic Driftless Region. Join DNR bat biologists for an exclusive tour detailing the site's history, geology, ecosystem and importance. Fundraiser for bat conservation. Ages 8+

- **Survivor's Swarm at Neda Mine Bat Hibernaculum (Friday, Aug. 28, 2020)**

Some bats survived white-nose syndrome and still hibernate at Neda Mine in Dodge County. Now, five years after the site was initially infected DNR biologists continue to monitor the bats' health and population. Join

us to view the pre-hibernation and mating behavior known as "swarming" at mine entrances, listen to bat echolocation calls using bat detectors, and see live bats up close as biologists use harp traps to capture bats at the mine entrances. Fundraiser for bat conservation. Ages 10+

- **Horseshoe Bay Cave Crawl (Saturday, Aug. 8, 2020)**

Prepare to get wet and muddy venturing inside the state's longest wild cave with State Cave & Mine Specialist Jennifer Redell and William Schuster, former County Conservationist/head of the Door County Soil & Water Conservation Department. Crawl to areas of the cave normally inaccessible to the public to experience the Niagara Escarpment from the inside out. In winter this cave serves as an important hibernaculum for bats and also is home to a number of other animals and invertebrates. Participants must be able to army crawl 50 yards. Fundraiser for bat conservation & Friends of Door County Parks. Ages 10+

Cave and Mine Catalogue Update

By Jennifer Redell

DNR Conservation Biologist, Bat Program Cave and Mine Specialist

For cavers and visitors to caves, following best practices to avoid potentially spreading white-nose syndrome and other diseases to new caves is very important. Good news in 2019 is that the [National White-Nose Syndrome Response Team Disease Management Working Group](#) on which I serve has recently released [White-nose Syndrome Show Cave Guidance](#) along with other resources for cave visitors. In Wisconsin, commercial caves have already been helping protect bats by following similar guidelines for the past decade; we are glad that caves across the country will now have these precautions in place to help protect remaining bats.



Photo credit: Eric McMaster

Gear stored in a special locker room for use by cavers only at Crystal Cave. Keeping caving gear dedicated to one hibernaculum helps prevent accidental spread of the WNS fungus to other caves.

Snug as a Bat in a Snag

Research Shows Value of Dead Trees as Habitat

*By Heather Kaarakka
DNR Conservation Biologist,
Bat Program Roost Monitoring
Coordinator*

The northern long-eared bat has been particularly hard hit by white-nose syndrome across North America, so managers and biologists continue to look for ways to bolster remaining populations in winter and summer. Managing for important habitat such as summer roosts where bats give birth and raise their young may be a potential option to help bats surviving white-nose syndrome.

Unlike the closely related little brown bat which roosts in bat houses and buildings in summer, northern long-eared bats use live and dead trees, known as snags, as day roosts. In order to raise young and form maternity colonies, these bats seek out cracks in the trunk and branches of deciduous trees and tuck in under peeling bark. Such peeling bark and cracks tend to be common in dead and dying trees, so there may be some potential to provide this critical habitat for northern long-eared bats by retaining snags.

To investigate whether density of roost trees, specifically snags, plays a role in how many northern long-eared bats are found in an area, we related the number of bats captured at a site to the abundance of snags surrounding the location. We used netting locations from our first year tracking northern long-eared bats, NLEB for short, to roost trees. To see how many snags were present within 1 kilometer of netting sites, i.e. what we considered as trees available to the bats, we used aerial images and classification software to identify snag patches in the images. See page 14 for an example



Photo credit: Heather Kaarakka

A northern long-eared bat roosted in a crevice (yellow circle) in this stump about 9 feet off the ground in Black River State Forest. Would you pick this spot to hang out for the day?

of a classified map used to identify snags in one of our study sites at Sandhill Wildlife Area. Snag patches in the map are orange.

From each of the maps we extracted metrics such as the number of snag

patches, their size, and how close they were to the netting location. We could then relate how many northern long-eared bats were captured to these metrics through a process called modeling. Results from modeling

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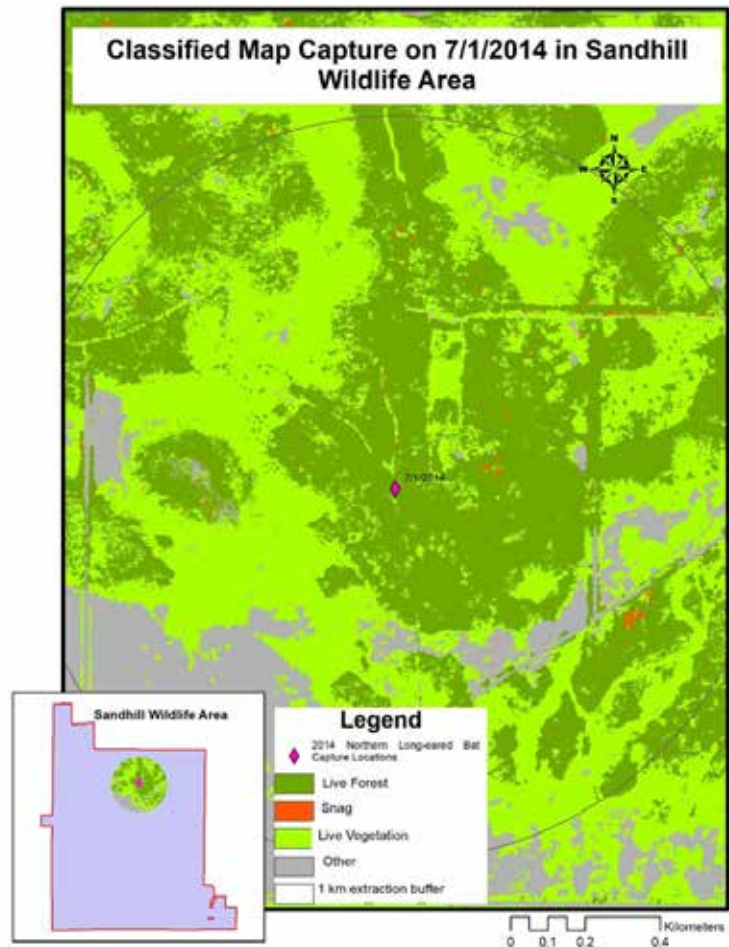
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showed that the probability of capturing a NLEB increased by 0.04% for each snag patch that was added to the landscape. The effect of adding snag patches was very small but begins to hint at the potential importance of availability of roost trees. The very small impact of increasing snag patches on abundance of NLEB also could be due to the fact that these bats roost in live trees in addition to snags.

Snug as a Bat in a Snag

Though there are some caveats with this modeling, this project helped add to research looking at how we can help bats recovering from WNS. It points at how snags may be important for bats in summer as they are for other animals like woodpeckers, chickadees and wrens, and that retaining snags when possible can help a host of birds, bats and other animals. In the future we hope to add more netting locations to the model to increase its ability to assess the relationship between bat abundance and roost tree availability.

Right: Oak snags are common in Sandhill Wildlife Area.



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BENEFITS NON-GAME WILDLIFE

Photo by Heather Kaarakka

Eastern Pipistrelle Bat



TO PROTECT

WISCONSIN'S

NATIVE SPECIES

Search for White-Nose Syndrome Vaccine Advances



Photo credit: Ariel Leon
Two different oral vaccines were tested.

Right: Photo credit: Tonie Rocke
Ariel Leon, left, and DNR's J. Paul White, right, affix a tiny PIT tag to the fur of a vaccinated bat.

Field Trials Underway this Winter in Wisconsin

*By Ariel E. Leon, Ph.D.,
USGS National Wildlife Health Center*

After years of developing and testing vaccines against white-nose syndrome, the devastating fungal disease affecting bats, Wisconsin partners are hopeful they've made a breakthrough that can help save bats in Wisconsin and elsewhere.

This fall, little brown bats at two sites in Wisconsin were orally vaccinated against WNS with two of the most promising vaccine candidates. These bats will be monitored through the winter and into early spring to determine how well vaccination protects them from the effects of WNS.

A Milestone for Bats but More Work Ahead

Researchers and managers from the USGS National Wildlife Health Center, the Wisconsin Department of Natural Resources and the University of Wisconsin-Madison have been developing and testing vaccines against white-nose syndrome for several years. The goal of this project has been to provide bats with protective immunity against the disease in the same way vaccines in people protect them from diseases such as polio and measles.

Studies in captive bats over the last few years have demonstrated vaccination against white-nose syndrome to be safe and effective in reducing disease in a highly susceptible bat species, little brown bats. Captive experiments are an important step in vaccine development, but to determine if

any treatment is effective in wild bats, it is important to test the vaccine under natural conditions. After registering potential vaccine candidates with the USDA Center for Veterinary Biologics and preparing an environmental risk assessment, the Center in 2019 issued a Finding of No Significant Impact authorizing researchers to conduct field testing. This authorization allowed bats to be vaccinated in the field without being brought into captivity and to test vaccines under truly natural conditions.

This fall, partners gathered at the two field test sites just as little brown bats were returning to hibernate. Partners trapped bats and directly vaccinated them by putting drops of vaccine into their mouth with a pipette. The bats were banded and a tiny passive integrated transponder (PIT) tag was

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attached to their fur to aid in future tracking.

Capitalizing on Bats' Grooming Habits to Vaccinate Them

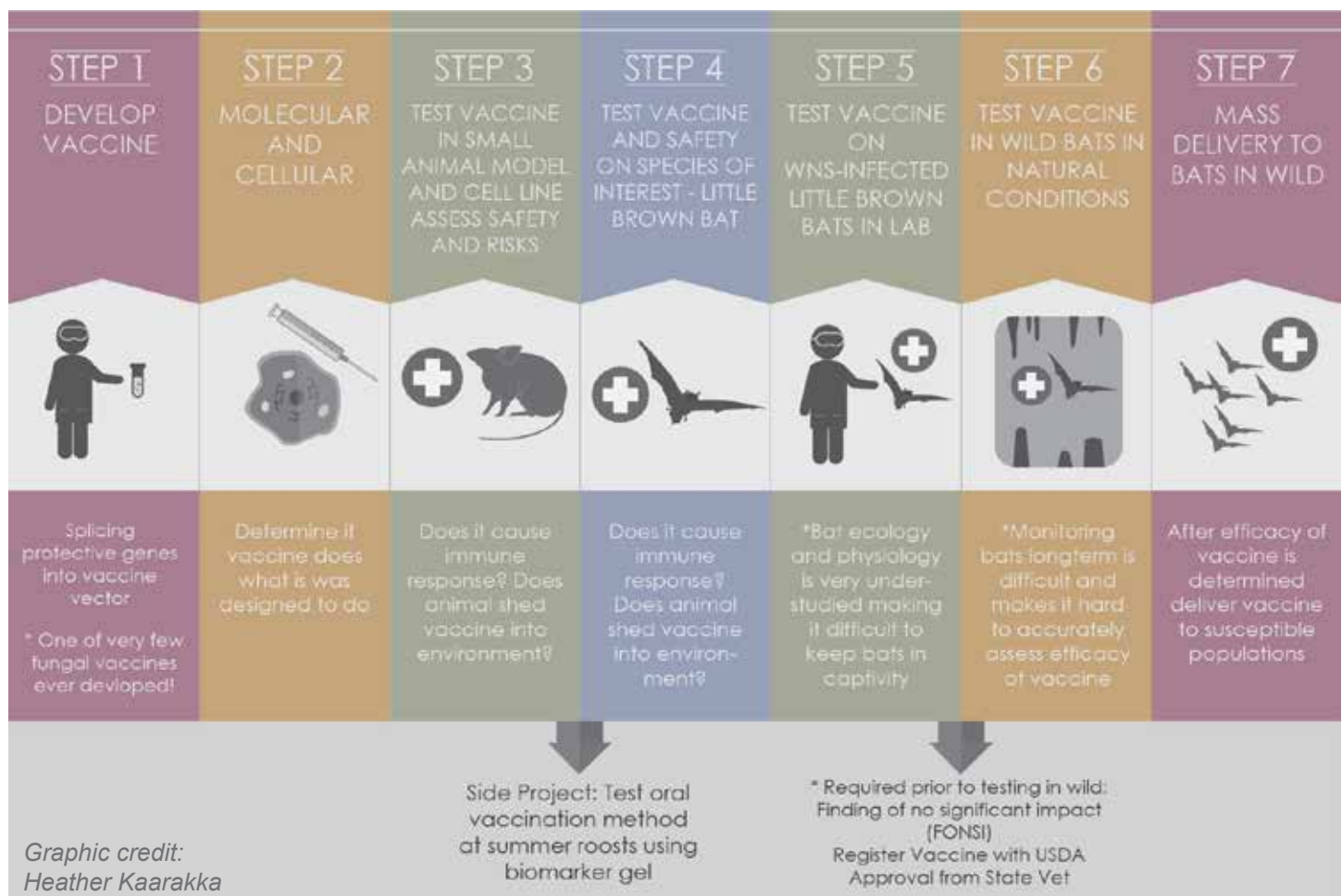
If the vaccine candidates are found to be effective in the field, an important next step is to develop vaccine delivery systems for bats. While people will (somewhat) willingly come to a clinic or doctor's office to receive a shot, wildlife aren't likely to do the same. Putting vaccines in baits won't work because bats susceptible to WNS are insectivorous, meaning they eat flying insects. So researchers have focused on taking advantage of bats' natural grooming behaviors to deliver the vaccine. If a topical gel is applied to the wings of bats they

“ **While people will (somewhat) willingly come to a clinic or doctor's office to receive a shot, wildlife aren't likely to do the same.** ”

readily consume it while grooming. Substantial effort has already gone into developing this method of vaccination in bats, but certain aspects such as delivery dose and volume still need to be refined. Part of the work we are planning for 2020 will be focused on finalizing these methods while also

working with collaborators to develop aerosol delivery devices for the large-scale non-invasive vaccination of bats.

While great strides have been made, this work has not been without its challenges. Bats are understudied animals, making it difficult to keep them in captivity, recapture them in the field and assess their immunological responses to vaccination. An additional challenge is producing a vaccine against a fungal pathogen; currently few fungal vaccines are in use in humans or domesticated animals. This work is truly novel, and its findings may potentially protect bats against WNS. This research is also helping us to understand bats more generally, providing insight and tools for managing bat health globally.



Graphic credit:
Heather Kaarakka

Temperature Determines Which Bats Survive or Die from White-Nose Syndrome

*By Skylar Hopkins,
Virginia Tech Post-Doctoral
Researcher*

Little brown bats infected with the fungal pathogen that causes white-nose syndrome are more likely to survive hibernation in relatively cold hibernacula, shifting regional bat distributions, according to a new study led by researchers at Virginia Tech.

Like most organisms, the WNS fungus grows at variable rates depending on environmental temperatures. Temperature-dependent fungal growth was first demonstrated in a petri dish in the laboratory in 2012. Now researchers have confirmed that the rate that the fungus grows on bats during hibernation also depends on temperature.

In the relatively warm mines where the fungus grows the fastest, bat mortality rates are the highest. As a result, bat populations in the warmest mines have mostly disappeared. Compared to pre-disease distributions, bats across Michigan and Wisconsin are now roosting in sites that are almost 1°C colder, with more bats using relatively cold mines that serve as “thermal refugia” from disease.

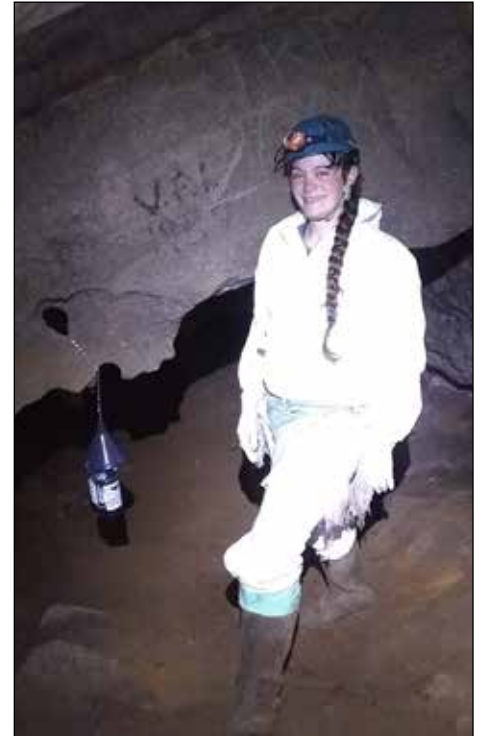
However, not all bats are using the cold mines where survival rates are higher. Most bats are still choosing relatively warm mines. These bats appear to be erroneously preferring to hibernate in places that seem suitable, but which are actually the worst habitats for surviving fungal infection.

Kate Langwig and Joseph Hoyt, assistant professors at Virginia

Tech, spent years leading efforts to count and swab thousands of bats in mines in Michigan and Wisconsin to understand how microclimates inside mines were affecting bat survival. They started this project in 2013, after the fungus had invaded the United States but before it had to spread the Midwest.

“The new analysis of our long-term survey data, led by Dr. Skylar Hopkins, provides significant insight into which bat populations will survive with white-nose syndrome. These results help to explain why some bats can persist with disease while other bats cannot,” said Langwig, who has spent most of her career studying this disease and its effects on North American bats. Now that they understand how temperature affects bat survival, the Virginia Tech team is leading a new project to study how humidity impacts white-nose syndrome. Humidity has long been suspected as another important microclimate variable, but researchers could not conduct the necessary studies because commercial equipment for measuring humidity levels was too inaccurate in high humidity bat hibernacula.

After designing a new, high accuracy tool to measure humidity — a wet bulb psychrometer — the team collaborated with state partners across the eastern United States to measure humidity in dozens of Indiana bat hibernacula this winter. By combining their humidity and temperature analyses, they hope to pinpoint the hibernacula where bats will be most and least likely to survive with white-nose syndrome in the future.



*Photo credit: Stuart Robertson
Skylar Hopkins deploys a data logger to record temperature and humidity conditions in a cave.*

In addition to Langwig, Hoyt and Hopkins from Virginia Tech, collaborators on the project include Paul White, Heather Kaarakka, and Jennifer Redell of the Wisconsin Department of Natural Resources; John DePue and William Scullon of the Michigan Department of Natural Resources; and Marm Kilpatrick from the University of California-Santa Cruz. This work was supported by the National Science Foundation and the U.S. Fish and Wildlife Service.

Research Hones in on Summer Bat Habitats and Activity

By Brian Heeringa

*Chequamegon Nicolet National Forest
Wildlife Biologist and Joel Flory,
Northern Research Station Wildlife
Biologist*

A network of acoustic bat detectors are helping reveal bat habitats and habits in remote forests, as USDA Chequamegon-Nicolet National Forest and Northern Research Station scientists continue to collaborate and work with federal, state, and tribal partners to better protect and understand bats and the important habitat they rely on.

Over the last year the Chequamegon-Nicolet National Forest has monitored bat populations by continuing to use acoustic detection methods prescribed under the North American Bat Monitoring Program (NABAT). NABAT is not only being used on the Chequamegon-Nicolet, but also all national forests and grasslands within the Eastern Region as well as many other Forest Service units across the United States.

These local, regional and national efforts are a critical component to better understand impacts to bats, population trends and bat conservation. The hope is that over time, NABAT will help inform conservation, research, and management by providing long-term distribution and abundance data.

Acoustic Detectors Provide 24/7 Picture of Bats in Remote Areas

One example of bat acoustic research being accomplished by Wisconsin staff actually took place in the Upper Peninsula of Michigan. The Forest Service Northern Research Station's Institute for Applied Ecosystem Studies in Rhineland is leading an



Photo credits: A USDA Forest Service Forest Service wildlife biologist installing acoustic detection and recording devices on the Ottawa National Forest in Michigan.

Landscape use surrounding the hibernaculum likely varies by season of use, so we are modeling bat activity with several biotic and abiotic parameters. In addition to forest types and topography, we have begun to use light detection and ranging (LiDAR) equipment to map the forest structure surrounding the microphone detector locations. This will allow us to more accurately represent canopy structure and compare bat activity to the overall forest structure.

While white-nose syndrome was detected in this area during winter 2017, bat activity continues and we are analyzing the 70,000+ files recorded to help shed light on how these individuals are using the landscape. Such information can help shape management efforts to support the conservation and restoration of bat populations into the future.

In addition to this project, other acoustic work looking at data collected through the NABAT protocol has been completed in collaboration with the Chequamegon-Nicolet National Forest. These data serve as a baseline from which to measure future bat activity in the same NABAT survey areas as Forest Service management actions take place on the landscape. It will take many years for management actions to occur and for the resulting impacts on bat activity to become evident, but for now we have the baseline data to help the Forest Service in evaluating and managing bat habitats in the future.

effort to better understand patterns of bat activity and habitat use surrounding important hibernation sites.

While bat biologists have a pretty good handle on bat ecology during winter hibernation and on maternity grounds during summer, we're increasing efforts to understand bat ecology after bats emerge from hibernation and before they return to hibernate. Northern Research Station staff began deploying acoustic bat detectors around a hibernaculum on the Ottawa National Forest in the Upper Peninsula of Michigan in 2016. The goal is to help understand patterns of bats' emergence from hibernation, as well as where and how they use the surrounding landscape.

Acoustic bat detection has become increasingly popular as a technique to evaluate bat habitat use across the landscape without the high levels of effort required to capture and process bats by hand. Although deployment of 13 detectors in a remote area before spring emergence is not necessarily all that easy, the detectors can work 24 hours a day once we get them out there.

Big Brown Bats Get the Boot But Have Other Roosts in their Repertoire

*By Jennifer Summers
Wisconsin Center for Wildlife Program
Development Specialist &
Monae Taylor,
University of Wisconsin-Stevens Point
senior*

Good news for homeowners who want bats removed from their home but worry the bats won't have any place to go: research underway at the University of Wisconsin-Stevens Point is revealing that big brown bats appear to be aware of multiple roosts and will move to them after being evicted from a home.

We humans are exceptional at building comfortable, temperature-controlled homes for ourselves, protecting us from the blistering cold and searing heat alike. As unintentional as it may be, our homes can provide perfect shelter for bats too. In fact big brown bats (*Eptesicus fuscus*) often find themselves unwelcomed house guests throughout the year. Big brown bats especially enjoy hot attics in summertime for raising their young, but occasionally will hibernate in attics too. While many people understand bats are both beneficial and legally protected, many homeowners don't want to share their homes with them (or their guano!).

Luckily, there is a humane way to evict bats from, and prevent them from re-entering, your home. Hiring a professional wildlife control operator to perform an exclusion is one way to accomplish this task. The operator will install devices that allow bats to leave but not re-enter a home. Such exclusions force bats to find someplace else to roost; the state



*Photo credit: Wisconsin Center for Wildlife
Monae Taylor, left, and Jennifer Summers, right, apply wing bands and radio tags to big brown bats before the bats are evicted from a home.*

“ **While many people understand bats are both beneficial and legally protected, many homeowners don't want to share their homes with them (or their guano!).** ”

Wisconsin Center for Wildlife is a University of Wisconsin-Extension organization within the College of Natural Resources at the University of Wisconsin-Stevens Point. Center staff are committed to engaging students, landowners, professionals and the public in sustainable wildlife management through research, education and outreach.

allows exclusions to be conducted after August 16 and before June 1; that warm weather time period is when bat mothers give birth to young and nurse the pups.

Where Do These Bats Go After Eviction?

Our study in August and September

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2019 attempted to answer this question. We radio-tracked a total of 22 big brown bats from three different colonies that were evicted from homes. The first home was in a rural area (House 1, eight bats), the second was in a residential neighborhood (House 2, six bats), and the third was located in a semi-rural community (House 3, eight bats).

At each site, we tagged bats five days before the exclusion. All but seven of these tagged bats left the original

roost and did not return after capture. In rural areas, bats roosted mostly in trees; in residential areas, they moved to buildings including houses, barns, and one commercial building. They used each new roost an average of three nights, switching

roosts an average of 2.2 times during the study.

After the night they were captured for our study, most bats left the original roost, separated and went to different roosts. However, several bats reconvened with one another; at least four bats from House 1 moved to the same tree, and at least three bats from House 3 came together in a barn. These same roosts were confirmed to have many other bats in the same roost with the tagged individuals. Altogether, the bats in the study used their chosen roosts repeatedly, often leaving and returning a day or two later.

These observations suggest that big brown bats know of multiple alternative roosts, natural or human made, within a given area, and will regularly move



Photo credit: Wisconsin Center for Wildlife

A big brown bat carries a tiny radio tag to lead researchers to alternate roost sites.

“ **These observations suggest that big brown bats know of multiple alternative roosts, natural or human made, within a given area, and will regularly move between them.** ”

between them. Considering that bats often moved to roosts that housed other bats, it appears bats often move to established roosts as opposed to colonizing new properties.

We are currently working to secure funding to continue the project in 2020 and hope to radio-tag and track 30 big brown bats evicted from homes. We will investigate characteristics of

chosen roosts and explore differences in roosting behavior between adults and juveniles, and between males and females.

Measures to Take if you Need to Evict Bats from your House

There are measures you can take if you need to evict bats from your house. Consider putting a bat box on, or near your home. Although bat boxes can take time to attract bats, they can potentially provide an alternative roost to evicted bats, especially if it's put up a year or more before the eviction. Regardless, if the exclusion is thorough, big brown bats appear to be aware of other suitable roosts.

Special thanks for this project goes to Dr. Scott Hygnstrom of Wisconsin Center for Wildlife at UWSP, Jaden Kerkhoff, Emma Meyer, Paul White and Heather Kaarakka of the Wisconsin Department of Natural Resources, and especially to the wildlife control operators and the homeowners who contributed to this project.

By the Numbers

2.2

Bats in the study switched roosts about 2.2 times.

Hiring a Bat Exclusion Professional



Photo credit: J. Paul White
A little brown bat roosting in an attic.



Photo credit: Dave Bree
Dave Bree, president of Wisconsin Wildlife Control Operators Association, at work.

*Interview with Dave Bree,
President of Wisconsin Wildlife Control
Operators Association*

Bats in Wisconsin roost in many different places in summer including attics and homes. While the goal of the Wisconsin Bat Program is to protect bats and bat habitat, we understand that bats don't need to share living spaces with humans.

We strive to provide accurate and useful information about effectively and safely excluding bats from buildings while considering the biology of the species and what time of year bat exclusion is best done. We provide information on how to do an exclusion yourself, and providing alternate habitat, however we realize many people prefer to hire a wildlife control operator to exclude bats from their home. Dave Bree, president of the Wisconsin Wildlife Control Operators Association, answered some of the most common questions homeowners have about bat exclusion.



1. What is the usual process operators follow to exclude bats from a building?

In most instances, a phone interview with the property owner provides some valuable information. How long have they owned the property? How long have they known they've had a bat problem? Have any bats been getting into the living quarters of the home? What type of home do they have, ie: ranch, 2-story, split-level, etc.

An on-site inspection is the next step. During the inspection we look for two things. First, we want to know the location of the "primary entry point(s)"—where bats are gaining access into the home. It could be one entry point or multiple entry points. Once we have identified the primary entry point(s) we look for areas where a bat could get beyond the exterior of the home if it wanted to. Any gaps or holes as small as a quarter-inch wide could allow a bat to squeeze through. We refer to these areas as "secondary

entry points." At this point, an estimate for sealing up the home and excluding the bats can be provided.

During a bat exclusion, the secondary entry points are sealed up first. Once we're certain bats can't find a different way into the home we can address the primary entry points. The primary entry points are fitted with what is referred to as a one-way door, or excluder. An excluder allows bats to exit the home but not re-enter. Bats actually end up evicting themselves from the building. Depending on the weather, it may take a few nights for all the bats to exit the home. Once we feel they've had enough time to leave, we remove the excluders and seal up the entry points permanently.

2. How long does an exclusion usually take?

How long the actual work takes depends on the size of the home, how easily it is to work around the home, and how much needs to be sealed. Most homes can be sealed up and

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the excluders installed in a day or two. How long it takes for all the bats to exit the home depends on the weather and time of year. If we have warm stable weather most bats will usually vacate the home in just a couple of nights. Severe weather at night may limit bat activity and they may need some additional time to leave. Late fall bat exclusions, into October, may require that excluders be left on until it warms up again in the spring to make sure bats have had enough warm weather to remain active and vacate the home.

3. Knowing that each job can present different challenges, can you talk in general terms about how much an exclusion usually costs?

This is always a popular question when discussing a bat exclusion with a property owner. It is difficult to provide an exact number without seeing the property first. However, an experienced wildlife control operator that has done enough bat work should be able to at least provide a range. Knowing the type of home, age, condition, type of attic ventilation, pitch of the roof, number of rooflines and dormers, type of siding, chimneys, etc. can usually provide enough information to give a ballpark figure. Bat exclusions on ranch style homes typically start at around \$500. On larger multi-story homes the price climbs due to roof pitch, height of work, difficulty getting around on ladders, etc. It is not uncommon for a bat exclusion on a 2-story home to begin in the \$2,000 range and go up from there. If the home requires vent-guards over the attic vents, the ridge vent needs to be secured or the chimney requires a chimney cap, and these all add to the final cost.

Other factors that drive the cost of a bat exclusion include whether any special materials are required for the home, any additional equipment such as a lift is needed, and if there is landscaping or other buildings that need to be worked around. These all contribute to the amount of time

required to properly seal up a home.

4. What would you look for in a bat exclusion company?

Most importantly, you need to confirm that whomever you hire has adequate liability insurance. You do not want someone working on your home without knowing that you, and your contractor, are protected against any damage or injury. Secondly, you want to make sure the company you hire knows what they are doing. Excluding bats is meticulous work. If you leave bats an opportunity to find another way in, they will take advantage of it. I always tell homeowners there are two ways to do a bat exclusion: you either do it right or you can do it again. So try to find a company that has bat training and certification. It is also important to hire a local company. You want to be assured that if something doesn't go exactly to plan—and it can happen—that the company you hire will be there to honor their warranty. Finally, be sure you are comfortable with whomever you chose to work on your home. If you are skeptical of what you're being told, or have an uneasy feeling talking with someone, get a second opinion.

5. What is the busiest season for bat excluders?

Being in a northern climate, bat work is usually not done during the winter in Wisconsin. So those calls of bat activity during the winter can be scheduled for inspections once the weather warms. Bat exclusions ramp up in April and May. The Wisconsin Department of Natural Resources prohibits wildlife control operators from doing bat exclusions from June 1 through August 15. This period is regarded as the maternity season for little brown and big brown bats. To avoid excluding female bats from a roost and having all the pups die off, wildlife control operators wait until all the pups are able to fly and find their way out through the excluders. From August 16 until colder weather sets in is the busiest time for most

wildlife control operators who exclude bats in Wisconsin. We have a short period to get as much bat work done as possible. Bat inspections and preliminary work can be done all summer long. But once the maternity season has concluded, that's when the bulk of the work is completed.

6. In your experience, what is the most common entry point for bats?

If a home has dormers or multiple roofs, the area where a soffit from an upper roofline meets the shingles on the roof below is a popular place for bats to gain access into an attic. In this situation, the soffit seldom meets the shingles below flush. So if there is even a small gap, bats will land on the roof and crawl between the soffit and shingles. Also, wherever you have two different types of building materials that meet, it is common to find gaps that bats will take advantage of. It could be where a brick chimney meets vinyl siding or where a plastic ridge vent isn't fastened tightly to the shingles underneath.

7. Where is the best place to find a bat exclusion company?

There are many places wildlife control operators advertise and market their services. In years past, printed phone directories were a popular place to search for companies in your area. However, in recent years the trend continues to favor online advertising. Being able to use a search engine and find information is so much more convenient than using a printed phone book. As we get older, fewer and fewer young adults even have a phone book. A good place to start a search for a local wildlife control operator is the web site for the Wisconsin Wildlife Control Operators Association. Go to www.wwcoa.net to find a list of companies and area of the state they serve. We only list companies that have passed our certification test and have shown to have liability insurance, so hiring a company on our list will provide you with a local operator that has been certified and should be

Species Profile: Evening Bat

(Nycticeius humeralis)

Wisconsin's First New Bat Species Discovered in More Than 60 Years

By J. Paul White
DNR Mammal Ecologist,
Wisconsin Bat Program Lead

Meet Wisconsin's newest mammal – the evening bat. While several historical references mentioned this species as likely to occur in southern Wisconsin, actual evidence did not surface until a single juvenile male evening bat was captured in Rock County by Wisconsin Bat Program staff in July 2015.

This observation represented the first time a new bat species had been recorded in the state in over 60 years and hinted that this young male was not merely a single wayward bat but part of a breeding population. Follow-up surveys by WBP staff in summer 2016 yielded the capture of three additional female evening bats, two of which presented signs of active nursing. The biologists fitted these bats with tiny transmitters, and then radio-tracked them to three roost trees in the floodplain forest near the Sugar River at Avon Bottoms Wildlife Area. A dead branch of a mature silver maple revealed over 100 individuals in one tree – a good sign of a breeding population!

Similar Appearance but Earlier Emergence Than Two Other Bats
Evening bats gain their name because they emerge earlier in the evening than many other North American bats. They also are known as the black-shouldered bat. Evening bats' physical features are similar to a big



Photo credit: Heather Kaarakka
Wisconsin's newest bat species, the evening bat.

brown bat's, only smaller. Adult bats' bodies run 3-3.8 inches long (i.e. length of a credit card) and weigh 0.25-0.5 ounces, about as much as five pennies. Unfortunately, their size and weight means evening bats are easily misidentified as two other Wisconsin bat species, the little brown bat and the northern long-eared bat. Evening bats' short ears and blunt curved tragus, or earlobe, separate them from the other species, however. Their face, wings and tail membrane are all blackish and their hair is short and dull, darker brown on top and lighter below. Evening bats also have a unique, acrid odor that some have described as the smell of burnt oranges.

A Migratory Bat Not Vulnerable to White-Nose Syndrome

Different from its cave-dwelling doppelgangers, the evening bat is referred to as a tree or migratory bat. It moves from north to south during the winter season to find warmer weather and a ready supply of insects. Because evening bats do not hibernate in caves and mines,

it can be assumed that white-nose white-nose syndrome does not affect this species as it does cave-hibernating bats. Evening bats forage along waterways, forest edges and in canopy openings, feeding primarily on beetles, moths and leafhoppers. One study indicated that evening bats are a major predator of the spotted cucumber beetle, a significant pest of corn crops.

The Wisconsin Bat Program welcomes the evening bat to Wisconsin. Good news can be hard to come by when discussing bats, particularly as it relates to WNS or wind-energy mortality. Neither of these threats to other bat species seems to affect the evening bat in any measurable way. And its recent discovery conjures a list of exciting and challenging questions:

- Are there other populations in Wisconsin?
- Where are they located?
- How can they be protected?
- Is this assumed range expansion northward due to habitat conversion/degradation, climate change or something else?

Tasked with identifying, protecting and managing rare and endangered animal species, Wisconsin Bat Program staff look forward to answering these and other questions as we continue to investigate the evening bat's presence in Wisconsin.

Want to Learn More About Evening Bats?

Check out our recent research paper appearing in *The American Midland Naturalist*, Volume 180, on the discovery. [“Notes on Capture and Roost Characteristics of Three Female Evening Bats \(*Nycticeius humeralis*\) in Southern Wisconsin: An Expanding Species?”](#)

Why do Wisconsin Bats and Bald Eagles go Together?



DNR bat biologists and their DNR colleagues responsible for Wisconsin's endangered species are funded through a variety of sources including the sale of Endangered Resources license plates. People who buy these specialty license plates pay a \$25 annual donation to keep the plate.

State law limits DNR to two designs. The bald eagle design honors one of Wisconsin's soaring successes: the comeback of bald eagles, made possible in part by plate sales and other donations funding nest monitoring and protection. So buy an Endangered Resources license

plate today and you'll help foster bats' comeback and conserve a whole array of rare Wisconsin species and State Natural Areas.

Learn more and get your application for a plate today: dnr.wi.gov, "eagle plate."

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