



2016 
ROOST
MONITORING
REPORT

By Heather Kaarakka

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Wisconsin Bat Program
Bureau of Natural Heritage Conservation
Wisconsin Department of Natural Resources
Bat “condo” sketch by Heather Kaarakka

**WISCONSIN
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Little brown bats swarm bat houses in Grant County in the early morning before sunrise.



Little brown bats happily using the new bat houses at the I-90 bridge site.

A background on bats

Bats are found on every continent except Antarctica, and have diverse diets including bats that eat fruit, insects, pollen, scorpions, fish and even blood.

Bats are cryptic and commonly misunderstood animals, but they are important to almost every ecosystem on the planet. Bats provide many ecosystem services including pollination, seed dispersal and **pest-insect control**. In fact, it has been estimated that bats save farmers in North America upwards of \$22 billion in pest control services every year, and bats' services are worth \$1 billion each year to the corn industry alone (Boyles et al 2011, Maine & Boyles 2015). Bats not only eat insects that damage crops, they also have other beneficial effects like sup-

A single little brown bat can consume up to 1,000 mosquito-sized insects in one hour!

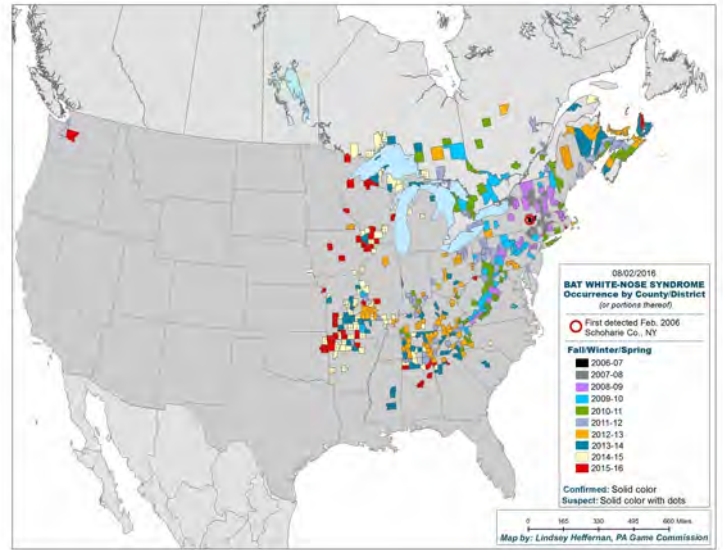
pressing the spread of crop-damaging fungus by reducing the amount of fungus-carrying pests (Maine & Boyles 2015).

Bats are important to Wisconsin's agricultural industry, but they are under threat of extinction from a deadly fungal disease called white-nose syndrome (WNS). In 2006, a fungus, later named *Pseudogymnoascus destructans*, was documented growing on the muzzles and wings of hibernating bats in a New York cave. The disease causes mass mortality in hibernating bats, and population die-offs of 90-100% are not uncommon. WNS has spread to 29 states and five Canadian provinces, and over 6 million bats have died from WNS since 2007. Unfortunately, WNS was confirmed in Wisconsin in March of 2014. Over twenty sites in thirteen counties are infected in the state as of fall 2016.

With the threat of WNS looming, the Wisconsin Bat Program (WBP) began efforts in 2010 to locate and monitor both summer and winter colonies of bats. Landowners and volunteers have helped WBP locate and monitor over 150 summer bat **roosts** in the state since 2010. These monitoring

A roost refers to the area where bats congregate to rest during the day. Bats need these safe places to sleep and raise their young. Summer roosts can be trees, bat houses, attics, barns and other buildings, bridges and even signs!

efforts by citizen-scientists help WBP establish baseline information about where bats are, what type of roosts bats use, and how many bats inhabit each roost over the summer before declines from WNS are seen in the state.



Currently, Wisconsin has thirteen counties where sites are infected with WNS or have the fungus causing the disease. Lindsey Heffernan PA Game Commission

Wisconsin's bats

Wisconsin has seven species of bat, but only two are likely to use bat houses or man-made structures- the **little brown bat** and the **big brown bat**.

The little brown bat is Wisconsin's most common species.

The big brown bat prefers to eat beetles.

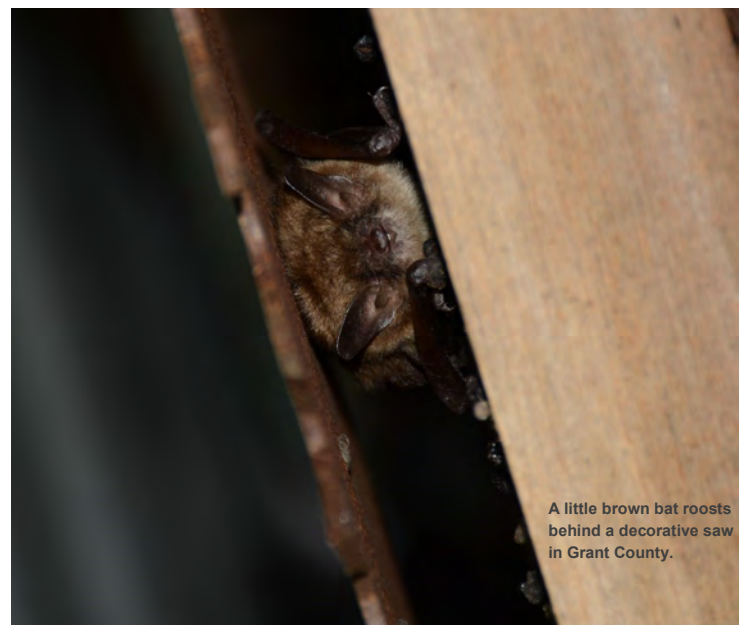
Little brown bats tend to use hot places in south-facing bat houses and barns, while big brown bats prefer cooler conditions. The warm temperatures help females bats gestate quickly and

the new born bats (called pups) mature quickly. These two species will also form large colonies in summer and bats often return to the same roost yearly. The other five species in the state are solitary or form much smaller colonies, use mostly trees in summer, and do not often return to the same roost sites making them much harder to find and monitor. As a result, WBP volunteers monitor primarily little brown bat and big brown bat roosts in summer,

but last year **eastern pipistrelles** were reported roosting on a porch in St. Croix County.

Eastern pipistrelles are the state's smallest bat and are also called the tri-colored bat.

Bats in Wisconsin return to summer roosts from winter habitat in April and May. By late May and June, most of the colony is present at the site. Bat pups are born in early June and are flightless for four to six weeks. In late July, bat roost monitors often count an increase in bats because the juveniles begin flying. In August, the adults begin to leave their summer roost to go to winter habitat where they will forage and mate at the entrances of caves and mines. Females delay fertilization until they emerge in the spring.



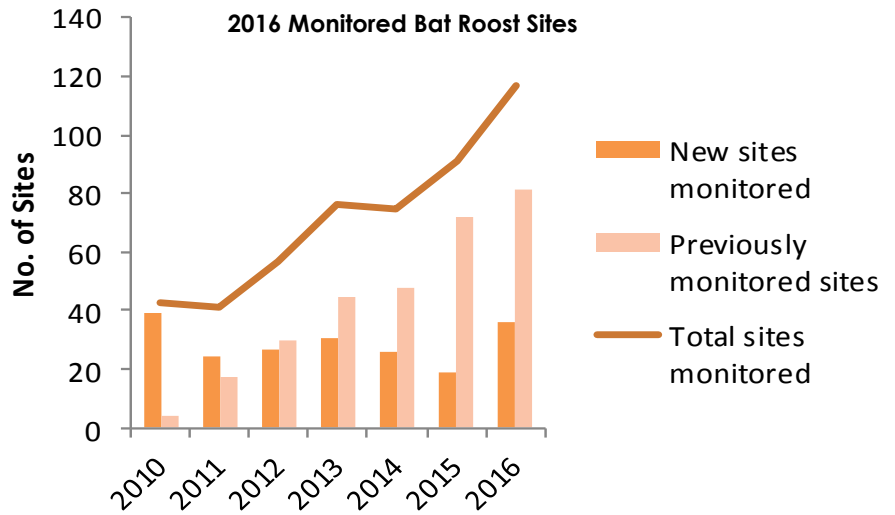
A little brown bat roosts behind a decorative saw in Grant County.

Roost monitoring in 2016

Since the effort was established in 2010, over 500 people have reported summer bat roosts on their property, or roosts of which they know.

This year, 127 volunteers conducted over 400 emergence surveys in 51 counties from March to October. Volunteers monitored 117 roosts in summer of 2016, including 36 newly reported roost sites; up from 91 monitored roosts in 2015.

In 2016, a total of 23,607 little brown bats, 2,275 big brown bats, 28 eastern pipistrelles, and 1 northern long-eared bat were counted. Little brown bat roosts comprised 64% of monitored sites in 2016. Big brown bats were counted in 25% of the sites and the remaining sites house eastern pipistrelles, northern long-eared bats, both little brown and big brown, or it is unknown which species is housed.

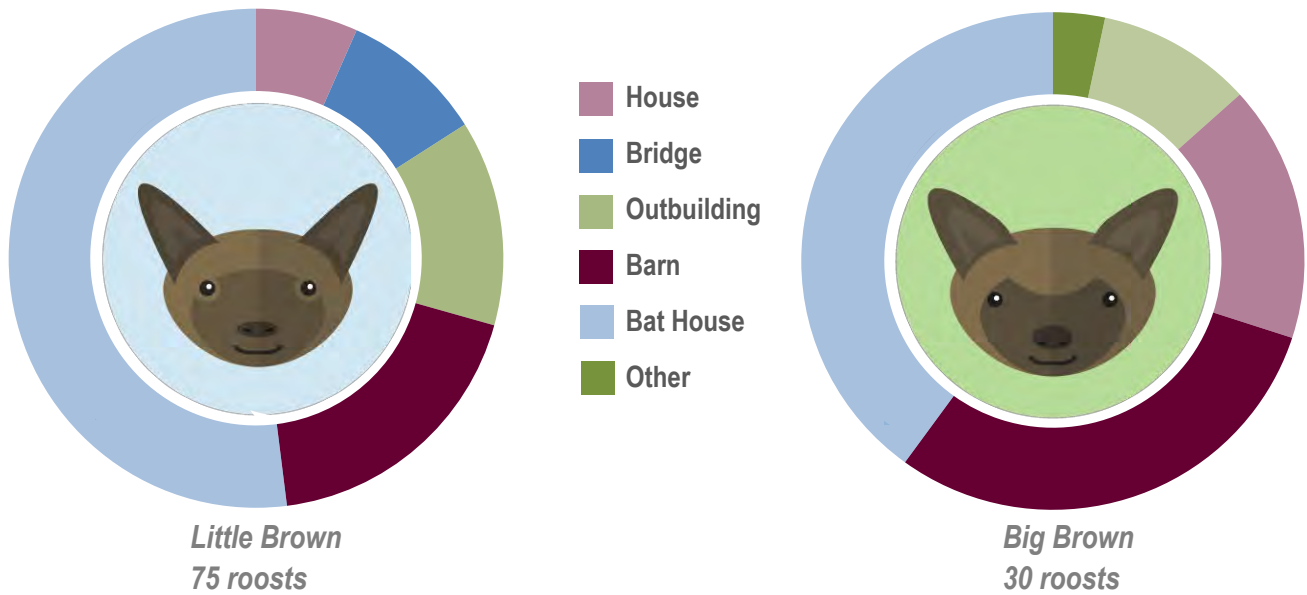


Above: a graph depicting the number of sites monitored every year through the roost monitoring project.

Below: a lone big brown bat sharing a bridge roost with little browns.

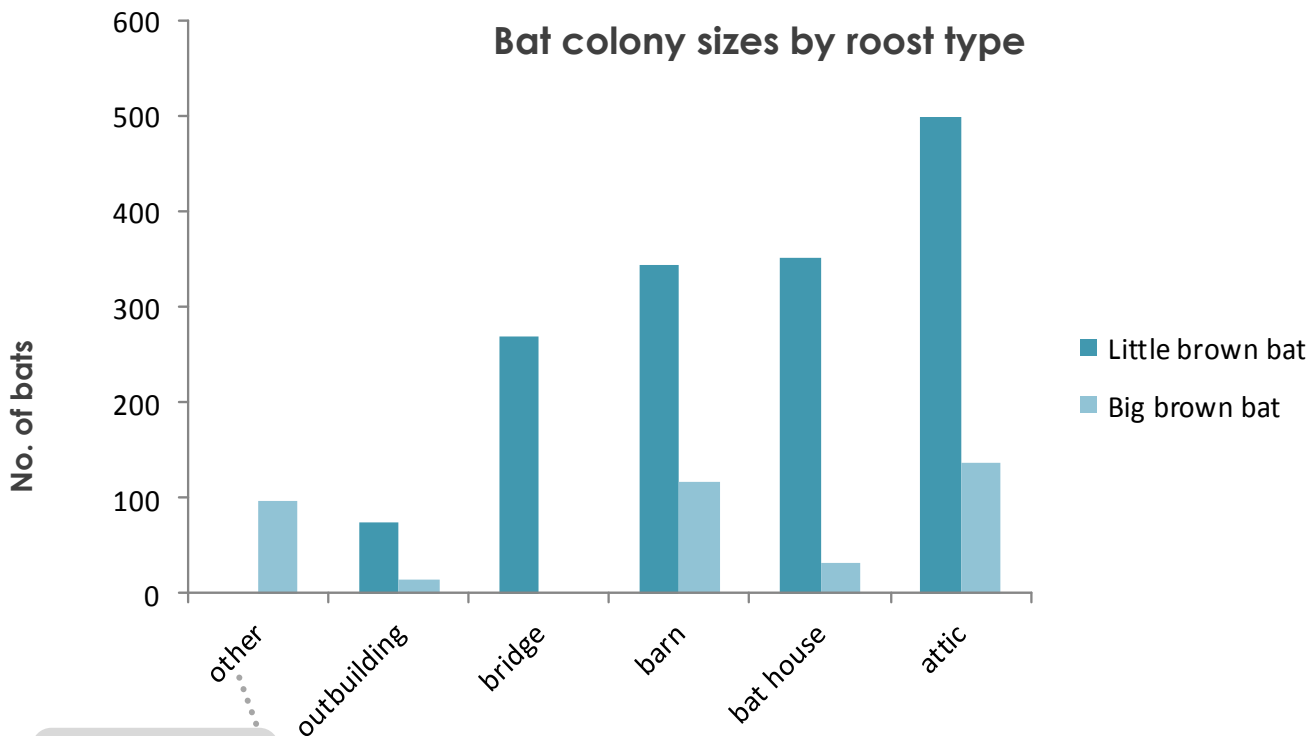


Bat species by roost type



Above: sites of each species are split by type of roost. Both little brown bats and big brown bats are found most often in bat houses.

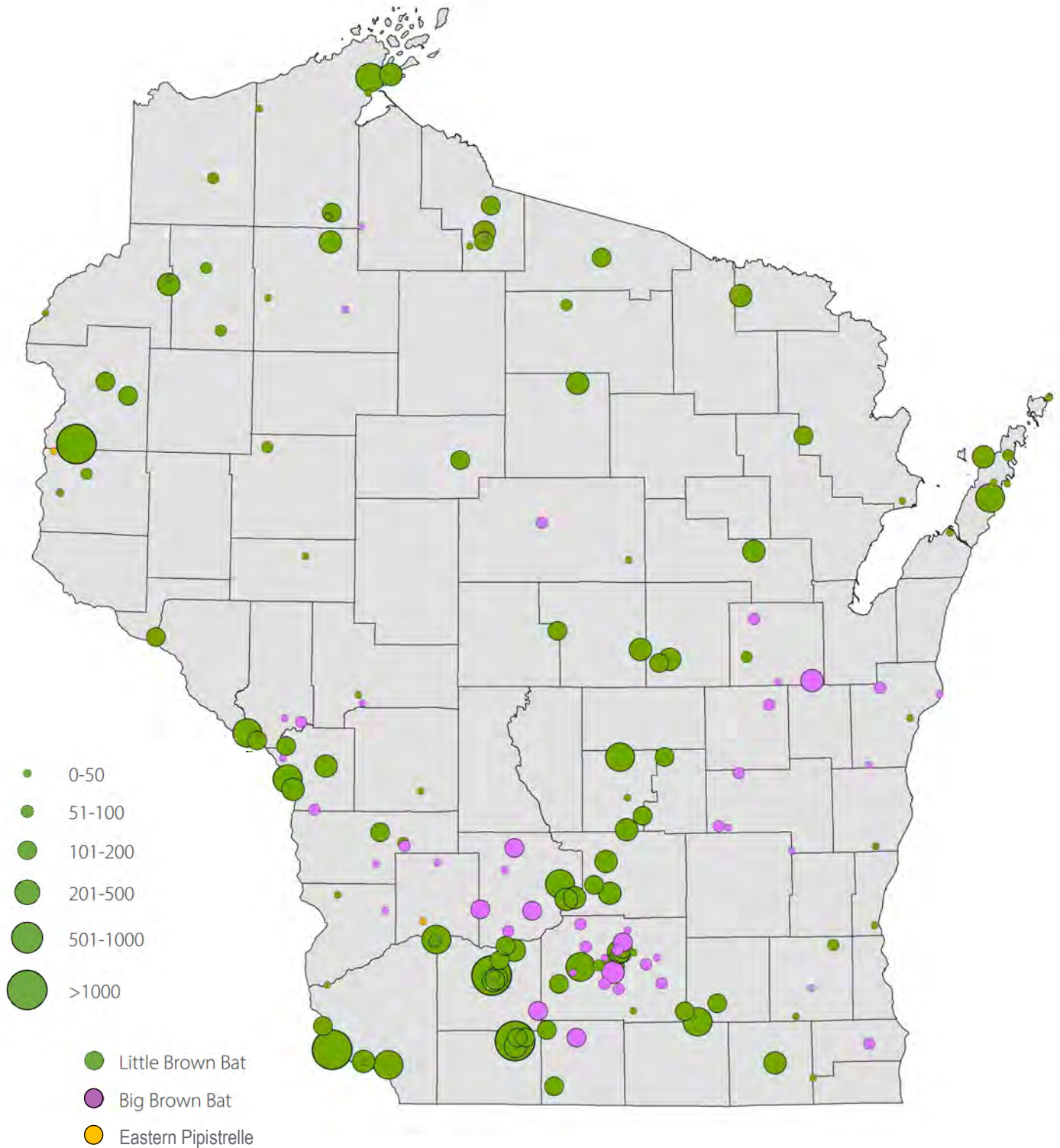
Below: Colony sizes for each species are sorted by the average population size found in each roost type.



"Other" could be a roost behind a sign or on a chimney.

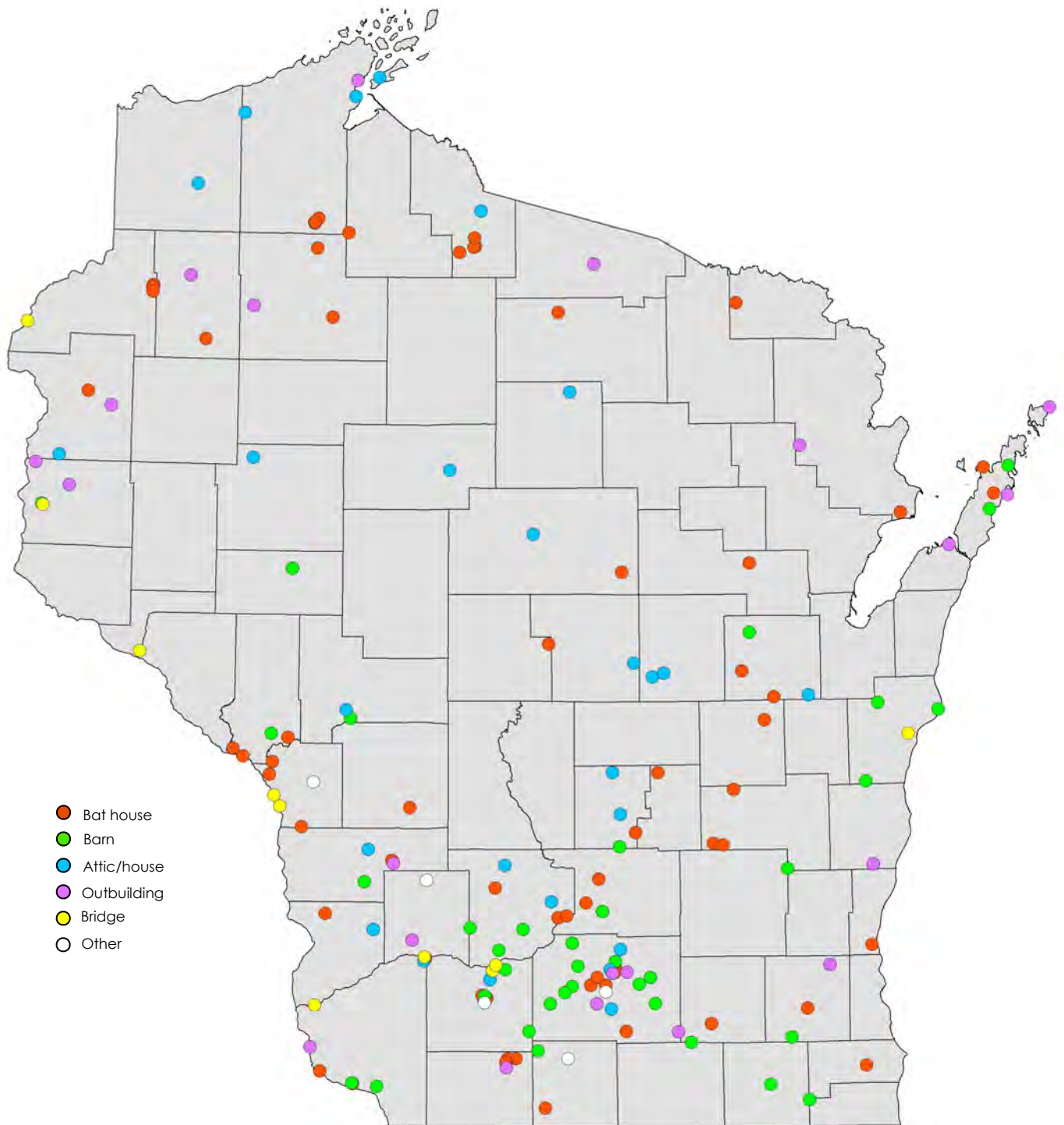
Bat roosts by size

The below map depicts the distribution of monitored bat colonies and their sizes in Wisconsin, where purple indicates big brown bat colonies green, little brown bat colonies, and orange, eastern pipistrelle colonies. Size of the dot indicates average size of the population at the roost.



Bat roosts by type

This map depicts the distribution of monitored bat colonies by type of roost. Color of the dot indicates whether the bats roost in a bat house, attic, outbuilding, barn, bridge or other.



Second annual Great Wisconsin Bat Count

WBP created a statewide bat count, similar to the Christmas Bird Count.

Last year we began the Great Wisconsin Bat Count, with the goal of counting as many roost sites as possible on a single weekend. Two statewide counts were completed last year and this year- the first weekend in June during the pre-**volancy** period and the last week-

Volancy refers to flight. A pre-volant count is conducted before pups can fly and a post-Volant count after pups can fly.

end in July during the post-volancy period to help investigate reproductive success of the monitored colonies. Both statewide counts were great successes. Volunteers counted at 52 roosts in June, counting a total of 10,359 bats. On

the last weekend in July, volunteers surveyed 59 roosts and counted 16,796 total bats! Counting at large sites such as Yellowstone Lake State Park (2,214 bats) during the post-volancy count helped boost numbers for this survey.

Pre-Volant 2016	# Sites	# Bats
Little Brown	35	9742
Big Brown	16	616
Eastern pipistrelle	1	1
Post-Volant 2016	# sites	# bats
Little Brown	41	15174
Big Brown	16	1596
Eastern Pipistrelle	1	25
Northern Long-eared Bat	1	1
Pre-Volant 2015	# sites	# bats
Little Brown	19	7144
Big Brown	13	675
Northern Long-eared bat	1	60
Post-Volant 2015	# sites	# bats
Little Brown	28	9333
Big Brown	14	1095



Volunteers wait for bats to emerge at Yellowstone Lake State Park during the pre-volancy Great Wisconsin Bat Count

Rise of the pipistrelle roosts

Until last year, when three eastern pipistrelles were reported roosting under a porch in May, nothing was known about summer roost habitat of this species in Wisconsin. Eastern pipistrelles do not form large colonies, and are not commonly observed roosting on or in buildings, so this cryptic species has gone largely undetected since the roost monitoring project began. This year however, we had a pleasant surprise when a photo of an eastern pipistrelle colony was sent to us in July. This particular colony roosts under the eaves of a cabin in Richland County. Over the summer, the bats moved around the cabin, sometimes roosting on the south side, and sometimes on the north side. When pups were too large to move, the small colony of 7-9 adults and 9-11 juveniles remained in one location offering the opportunity to place a trail camera and record their behavior. In late July, the pups began to fly on their own and the colony slowly dispersed.

Maternity colonies of eastern pipistrelles in buildings are not uncommon elsewhere in the country. In a

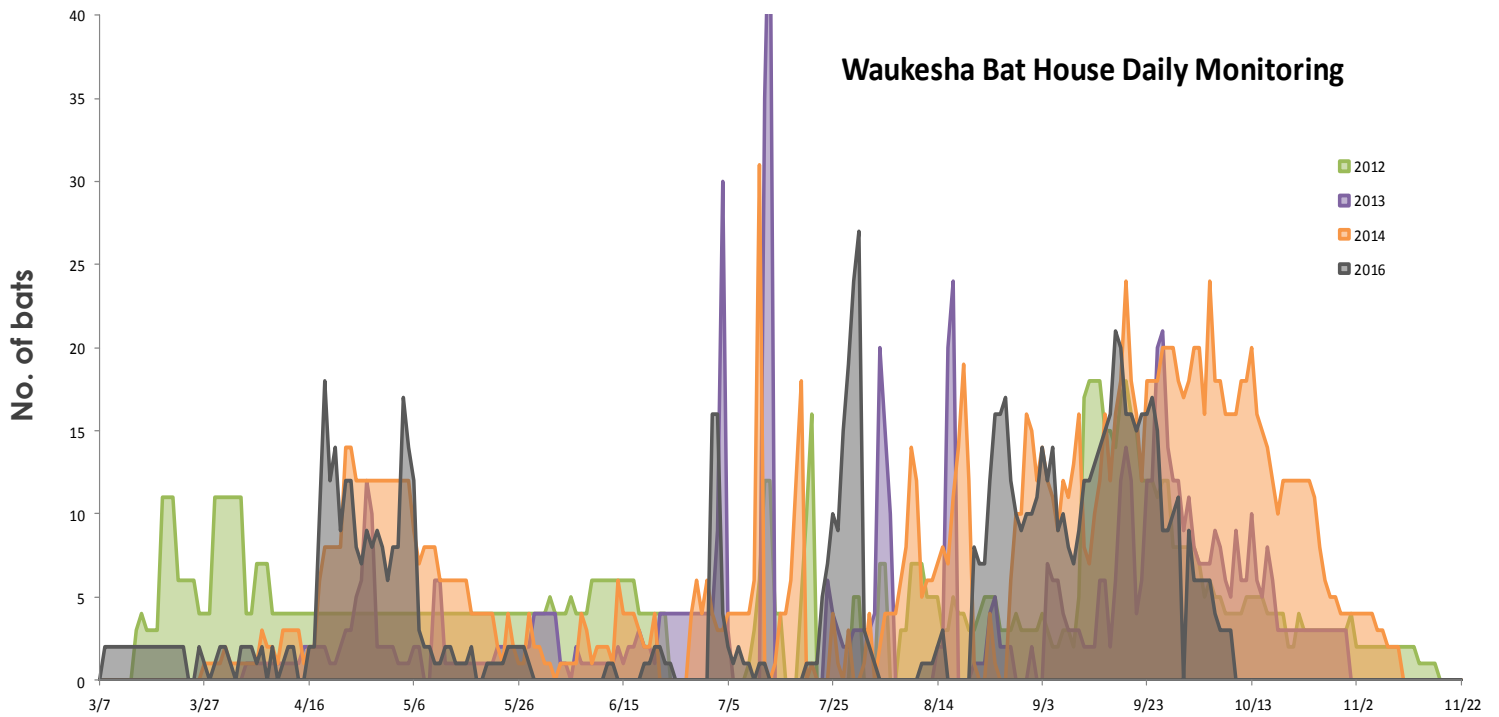
study in Indiana, six colonies of eastern pipistrelles roosting in buildings were monitored by landowners (Whitaker 1998). The monitors in this study provided valuable information about timing of arrival, birth, flight of juveniles, and departure, as well as movement of the colonies among different roosts. Because eastern pipistrelles appear to prefer to roost in open but sheltered areas, observations can be easily made about their behavior. Little brown bats and big brown bats tend to roost in tight places where observations of bats in the roost are more difficult.

The landowner of the pipistrelle roost in Wisconsin noted that earlier in the summer, more adults were present, and over the 4th of July weekend, there were nearly twice as many pups as later in July indicating that the colony may have split up in early July while pups were still small enough to carry. This behavior could indicate that this species may have a maximum capacity depending on the roost structure.



Above: the colony of eastern pipistrelles in Richland County roosting under the eaves of a cabin. The lighter tan individuals are pups and the orange individuals are adults. A pup can be seen nursing at the bottom of the photo.

The importance of yearly monitoring



The above graph depicts counts conducted daily over the summers 2012-2014 and 2016 at a bat house housing big brown bats in Waukesha County. While big brown bats are known to periodically switch roosts over the course of the summer due to various factors such as ambient temperature, and parasite load (Ellison et al. 2007), the daily monitoring of this roost in Waukesha County shows just how much big brown bats can move between roosts. When the number of bats displayed is zero, it means that no bats were counted in the roost, not that no count was completed, with the exception of one week in late June. Because of the difference in numbers of bats, even daily, inhabiting this roost, it is unlikely that this is a maternity roost since there are few bats present in June, and pups are difficult to move and carry after they reach a certain weight. There are

likely several roosts in the area that these bats move between over the course of the summer.

Monitoring this bat house daily has given insights into the phenology of big brown bats; for example the bats arrived almost a week earlier this year than previous years, but also left earlier than all other years. Though the timing of jumps in numbers doesn't exactly match every year, there are clear patterns of larger numbers of bats arriving in the second half of April and leaving in early May. Likewise, all years show a jump in population starting in late August and most bats leaving in late September, indicating this roost may be used as a migratory stopover for bats moving from winter to summer habitat and vice-versa. Curiously, there seems to be at least one brief, very large jump in bat numbers in mid- to late-July. It is unknown what would cause a sudden increase in numbers and just as sudden vacancy in the roost.

First impacts of white-nose syndrome

This graph below depicts counts conducted at a barn roost several times over the summer every year since 2012. This barn in Door County housed a significant population of little brown bats until the past two summers. Thanks to the efforts of volunteers, we were able to establish a baseline population for the site over several years. For three years the population has been steady between 600 and 800 bats. In 2015, however, a significant decline was documented as volunteers surveyed the site. In 2015, less than 20% of the normal population was counted until late July when the colony jumped in size to less than half of previous years' numbers. In 2016, the colony struggled to reach 13% of the average colony size in late July. This trend of ~50% decline one year and nearly 90% decline during the next year aligns with observations from biologists in the east (Turner 2015).

In the winter of 2013-2014, white-nose syndrome (WNS) was confirmed in four counties in Upper

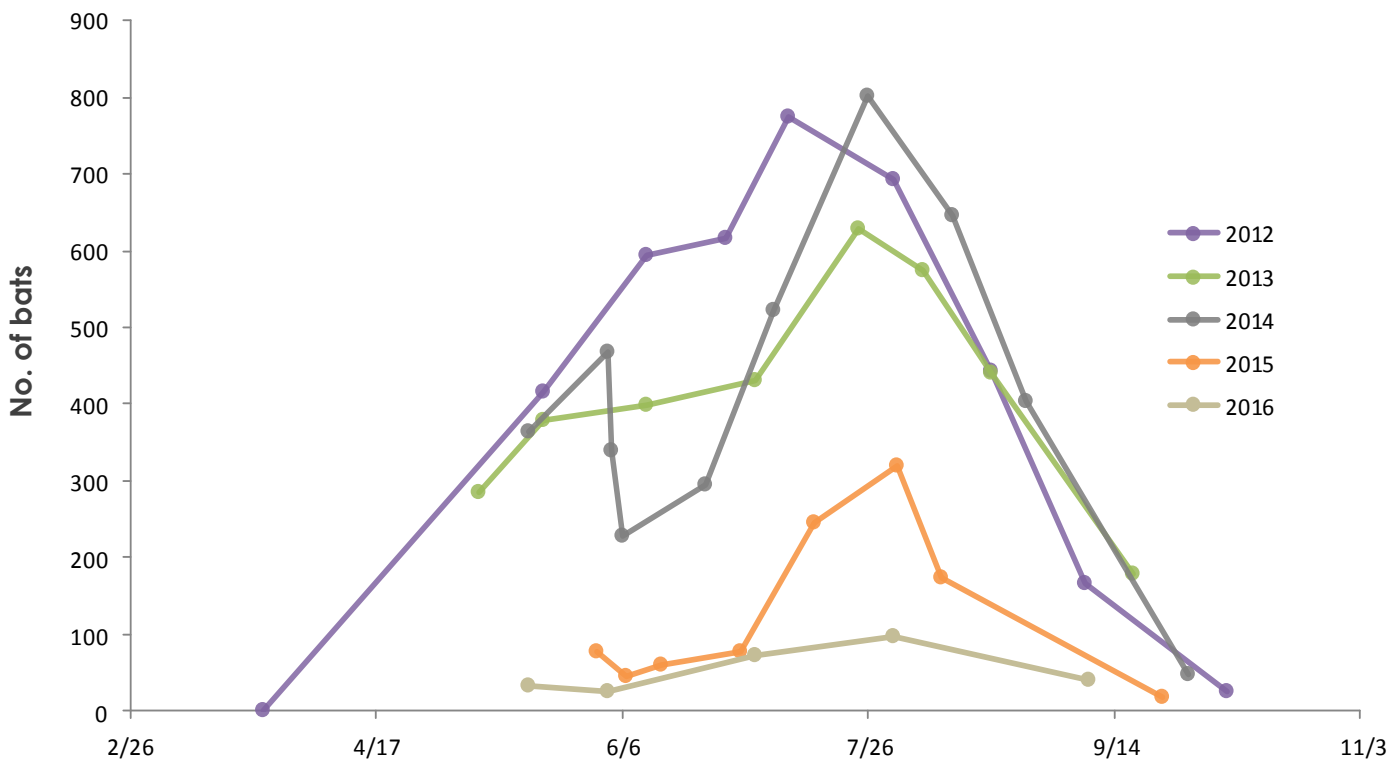
Peninsula Michigan (UP), well within migration distances of little brown bats using summer habitat in

Door County. Typically, when WNS is first observed in a hibernaculum, few dead bats are found and population declines are not observed during the first winter of infection. Significant mortality and population declines are usually observed in the second and third years of infection. Because of this Door County

barn's proximity to infected hibernacula in the UP, and the dramatic decline in population this year after WNS has been present for two years, we surmise that this may be the first evidence of WNS impacts on summer populations in Wisconsin.

Other summer colonies of little brown bats in Door County that showed little decline in 2015 began to show drops in numbers when monitored this summer. A site near Potawatomi State Park, and the roost in Peninsula State Park both declined roughly 60% from previous years.

Little brown bats can migrate up to 280 miles between summer and winter habitat (Humphrey and Cope 1976). Though shorter migrations are probably more the norm.



First impacts of white-nose syndrome

This year, Door County was not the only area in Wisconsin to observe declines in summer populations presumably from white-nose syndrome. Several landowners in northern Wisconsin called to report they had no bats return to their summer colonies this year, and one colony near Ashland that has consistently had several hundred little brown bats dropped to 40 individuals this summer.

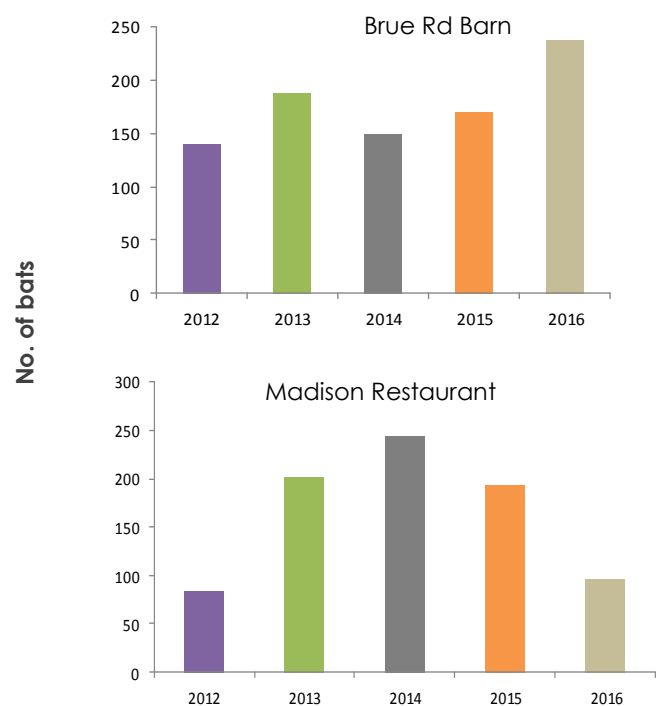
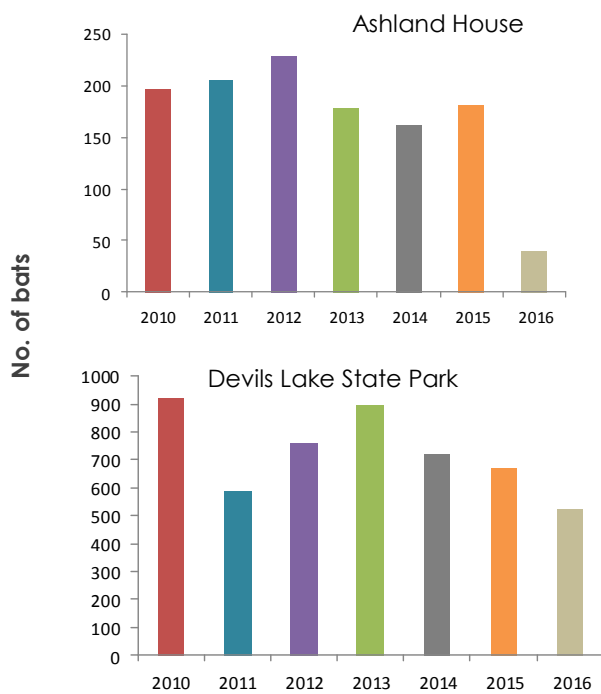
With the exception of several roosts in southern Wisconsin, all reported declines have been at little brown bat roosts. Big brown bats do not appear to experience the same declines from white-nose syndrome as little brown bats. There are still many questions to be answered about big brown bat roosting ecology before we can describe why drops in summer populations may be observed in big brown colonies.



A northern long-eared bat infected with white-nose syndrome in Crawford County.

Highest counts from multiple years

The below graphs depict the highest counts from a selection of sites where emergence surveys have been completed yearly. Some sites are counted only once a year, and even at different times of year so numbers may not always accurately represent the colony. These counts do, however, start to give us a look at long-term trends for colonies. Note the y-axis scale is different for each site. Graphs on the left are from little brown bat sites and graphs on the right are from big brown bat sites



How Wisconsin Bat Program uses information from volunteers

Reported and monitored bat roosts are important for furthering research and understanding of bats in Wisconsin. Thanks to the efforts of volunteers and landowners, Wisconsin is unique and fortunate to have an established database of summer roost sites throughout the state which acts as a springboard for other important projects investigating bats and WNS in the state. This summer we were able to help coordinate and complete four projects at reported summer roost sites.

- **University of Wisconsin-Madison project investigating bat diet and the importance of bats as pest control in the state.** Amy Wray, PhD student of Dr. Claudio Gratton and Dr. Zach Peery, is coordinating a project collecting guano and insect samples at summer roosts around the state. The guano will be analyzed genetically and the project will get a detailed look at diet of bats roosting in agricultural landscapes. The project selected all sites from reported roosts in WBP database and is scheduled for five years, tracking colonies as WNS invades the state. Some of the participating landowners collect guano for Amy, while other sites get full surveys of bat activity, guano and insect collections.
- **Banding bats at summer roost sites to recover marked individuals in hibernacula.** Little to nothing is known about the movements of bats between summer and winter habitat in Wisconsin. Because bats congregate in a small number of sites in winter, chances of recovery



of bats that were marked on the summer landscape is thought to be high. In order to begin investigating bat movements, WBP selected 14 significant little brown bat colonies in the southwest portion of the state at which to trap and band. WBP banded over 850 little brown bats in 2015, and 498 additional bats were tagged in 2016 at these sites. While trapping at the same sites this year, we recaptured 24 individuals (2.8% recovery rate), and we noted how well bats seemed to remember what occurred last year. To funnel bats into the trap, we set up tarps



How Wisconsin Bat Program uses information from volunteers



WI bat crew and USGS work with private landowners to investigate vaccine transmission. Photo: Katie Luukkonen

around the roost entrance so they must fly into the trap; however, bats at almost every site had ingenious ways of escaping beneath the tarps or avoiding the trap. This year we had our first long-distance recapture of a banded bat: a female little brown bat banded in southeastern Dane County was found along the Wisconsin River in Grant County, making this movement roughly 90 miles in a straight line.

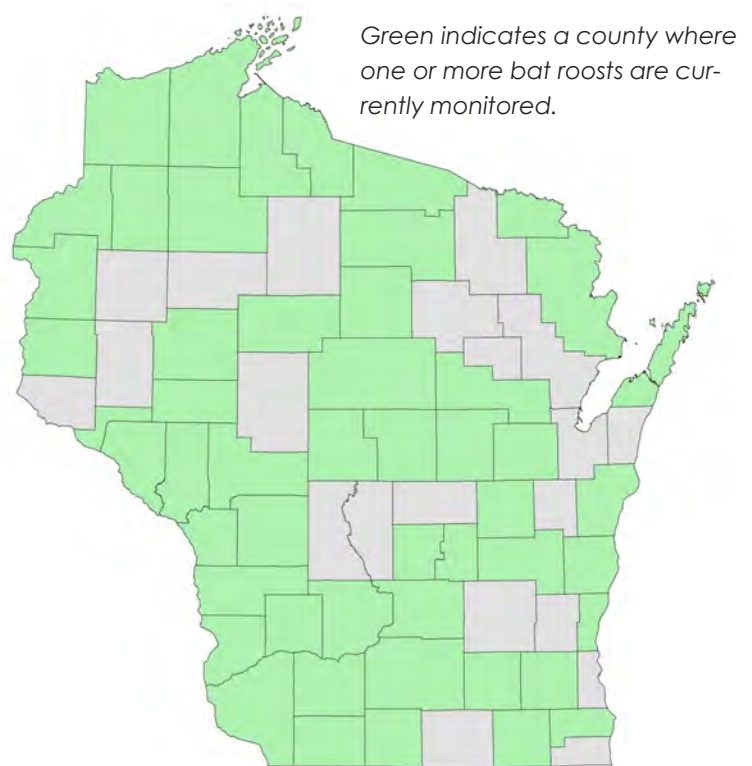
- **Using PIT tags to investigate roost site fidelity.** At a roost site in Grant County, WBP attached passive integrated transponder (PIT) tags to bats in the colony in 2011 and 2013. PIT tags are similar to RFID chips and result in an identifying number when they are scanned with a special reader. The tagged bats can be scanned through the wood wall of the barn and several students, along with Dr. Jeff Huebschman from University of Wisconsin Platteville completed several surveys this year scanning for bats and conducting emergence counts. 33% of the tagged bats have been recovered so far. Continuing these surveys will allow us to track individuals who return every year, showing fidelity to the roost site.

- **Investigating transmission of vaccine at roosts.** Researchers at USGS and UW-Madison are investigating possible vaccinations for bats to prevent WNS infections. Part of vaccination includes determining best methods for administering vaccines to individuals. From previous research, the group found that topical treatments can be transferred among members of summer bat colonies during grooming and interaction in the colony, even if a only a few individuals are treated. To test whether a WNS vaccine could be administered in this fashion, we worked with landowners at two little brown bat roosts in Dane County. A portion of each colony was captured and treated with a topical biomarker. When the biomarker is ingested, it is visible in the hair follicles. We returned to the sites a week later to take hair samples from all individuals that we caught. All individuals treated had hair positive for the biomarker, but only one untreated individual was positive for the biomarker indicating that this species may not participate in mutual grooming. Other factors such as time of year and age of pups could also play a role in how bats interact in a colony.

Continuing the Bat Roost Monitoring Project

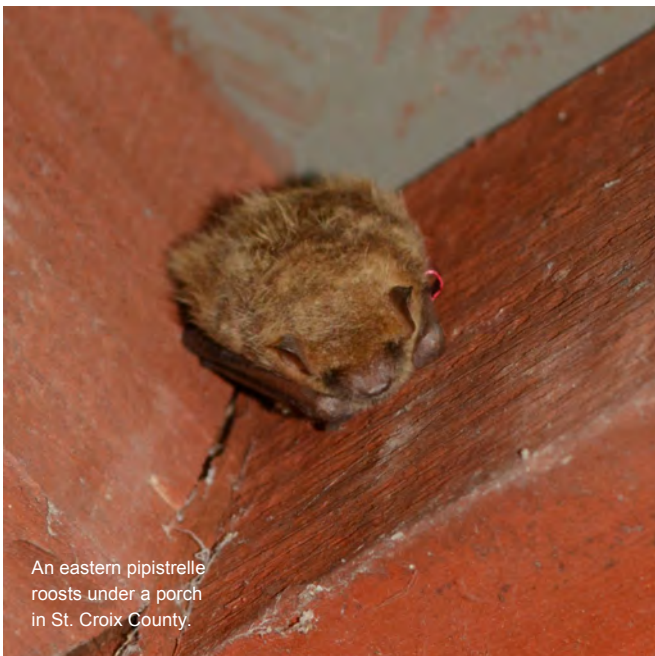
Over the past seven years, volunteers and citizen-scientists have helped create an important database of bat roosts around the state. Each roost reported and emergence count completed helps create a better picture of summer bat roosting ecology in the state. The amazing efforts by landowners and volunteers are extremely valuable and we will continue monitoring current roosts in the coming summers. WBP also continues aims to grow the summer bat roost database. Every year the number of monitored roosts grows and gives the WBP important information. The map at right shows each county where bat roosts are monitored in Wisconsin. If you know of a bat roost in a county lacking a monitored roost, or even in a county where bats are currently monitored, please feel free to report it!

Feedback from the second Great Wisconsin Bat Counts was again positive, and WBP will continue this new tradition in the coming years. Even if vol-



unteers are not able to participate in the Great Wisconsin Bat Counts, you are still encouraged to conduct emergence surveys each year. Each survey conducted adds to the growing database of baseline information about bat roost population trends across the state. This critical information gathered by volunteers helps WBP investigate the full impacts of white-nose syndrome on bats in Wisconsin.

The bat roost monitored project is able to thrive because of the incredible work of volunteers and landowners. **We cannot thank everyone involved enough for their dedication and effort.**



I am constantly amazed by and thankful for the effort put forth by everyone who volunteers for the bat program, whether it be counting a roost or conducting an acoustic survey. It is truly magical to witness the excitement people have about bats and science, and I count myself very lucky to be a part of it. There is a long, hard road ahead with WNS finally in the state, but thanks to your efforts, we have made great strides in preparing for the disease. It may seem redundant, but thank you. We cannot continue the program without your help and support.

Heather Kaarakka
Bat Roost Project Coordinator



Heather Kaarakka removes a bat from a mist-net in northern Wisconsin.
Photo: Michael Kienitz

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Have questions about bats or roost monitoring?
Feel free to contact Heather:
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The Wisconsin Bat Program is part of the Bureau of Natural Heritage Conservation in Wisconsin Department of Natural Resources. The majority of Bat Program funding comes from grants and donations and much of our data is collected by volunteers. Thank you for your support.