2015 ROOST MONITORING REPORT

Wisconsin Bat Program

By Heather Kaarakka

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Bat "condo" sketch by Heather Kaarakka.

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Big brown bats in a bat house in Appleton in early spring

A little brown bat emerges from a bat house in Grant County

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.

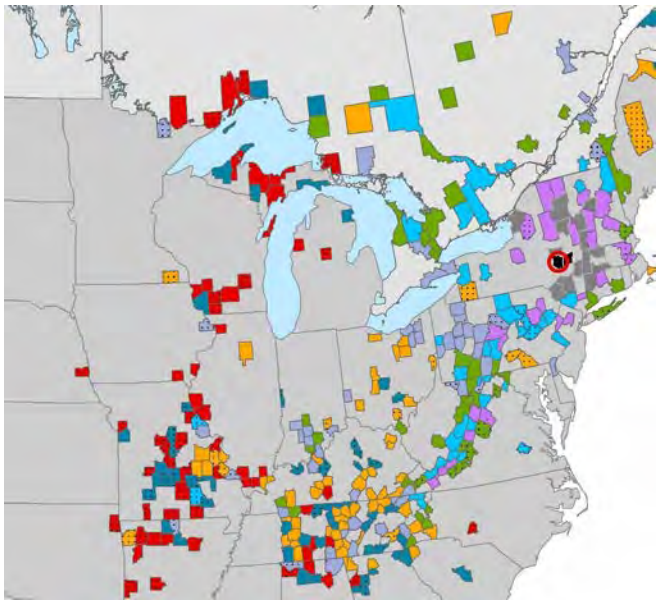
Bats are cryptic and commonly misunderstood animals, but they are critical to almost every ecosystem on the planet. Bats provide many ecosystem services including pollination, seed dispersal and **pest-insect control .** In fact, it has been estimated that bats save farmers in North America upwards of $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 suppressing the spread of crop-damaging fungus by reducing the amount of fungus-carrying pests (Maine & Boyles 2015).

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

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 26 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. Thirteen sites in eight counties are infected in the state as of fall 2015.

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 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.

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!



Currently, Wisconsin has eight 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** . 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 this year **eastern pipistrelles** were reported roosting on a porch in St. Croix County.

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

The big brown bat prefers to eat beetles.

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.

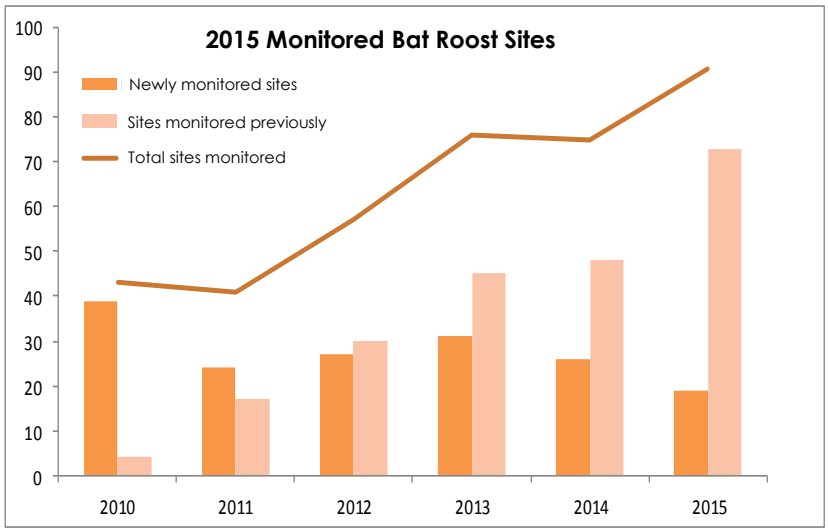
Eastern pipistrelles roost on a porch near Somerset, Wisconsin. Photo: S. Richardson

Roost monitoring in 2015

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, 109 volunteer conducted over 400 emergence surveys in 56 counties from March to October. Volunteers monitored 93 roosts in summer of 2015, including 19 newly reported roost sites; up from 75 monitored roosts in 2014.

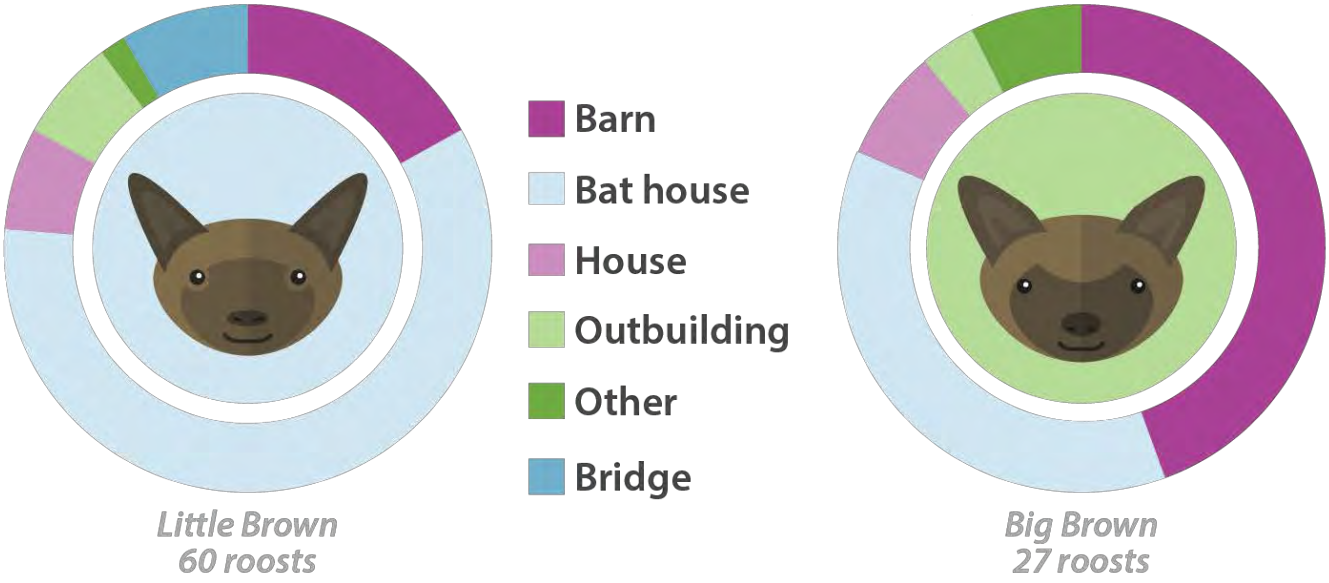
In 2015, a total of 28,037 little brown bats, 1,714 big brown bats and 3 eastern pipistrelles were counted. Little brown bat roosts comprised 65% of monitored sites in 2015. Big brown bats were counted in 30% of the sites and the remaining sites house eastern pipistrelles or are unknown which species is housed.



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

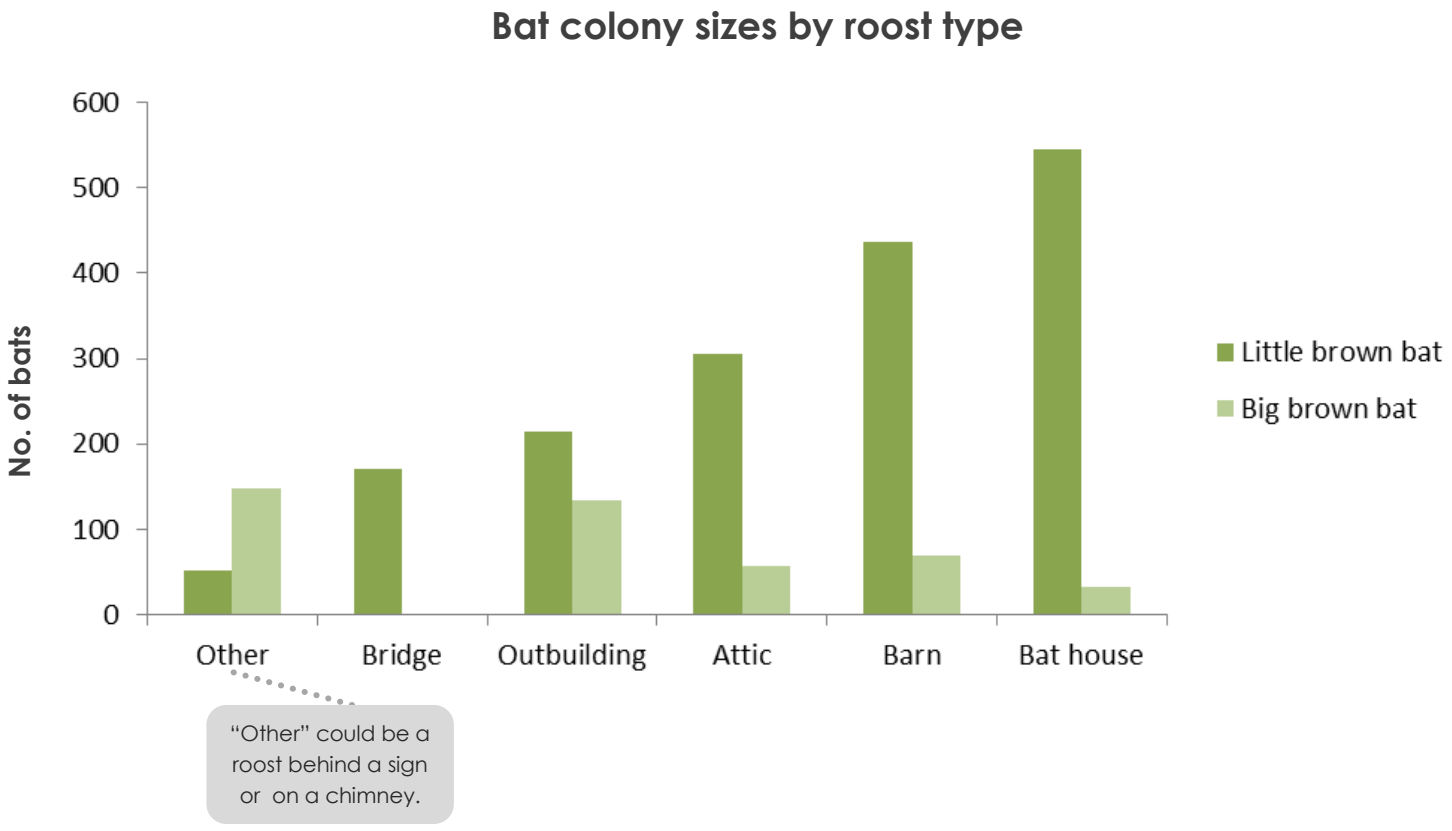
Below: a bat house in Cassville, Wisconsin housing hundreds of little brown bats every year.

Bat species by roost type



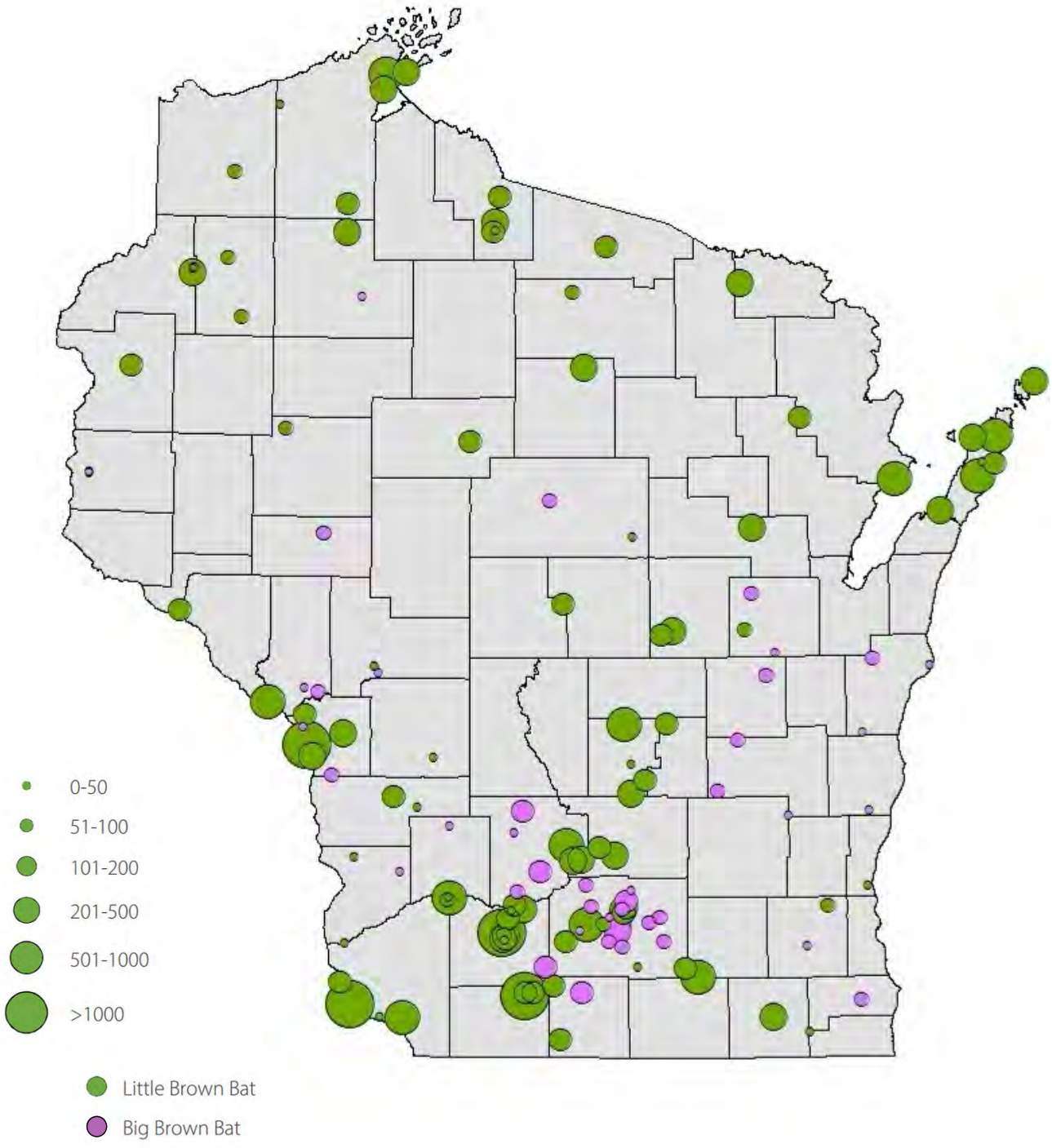
***Above**: sites of each species are split by type of roost. Little brown bats are found most often in bat houses while big brown bats seem to prefer barns.*

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



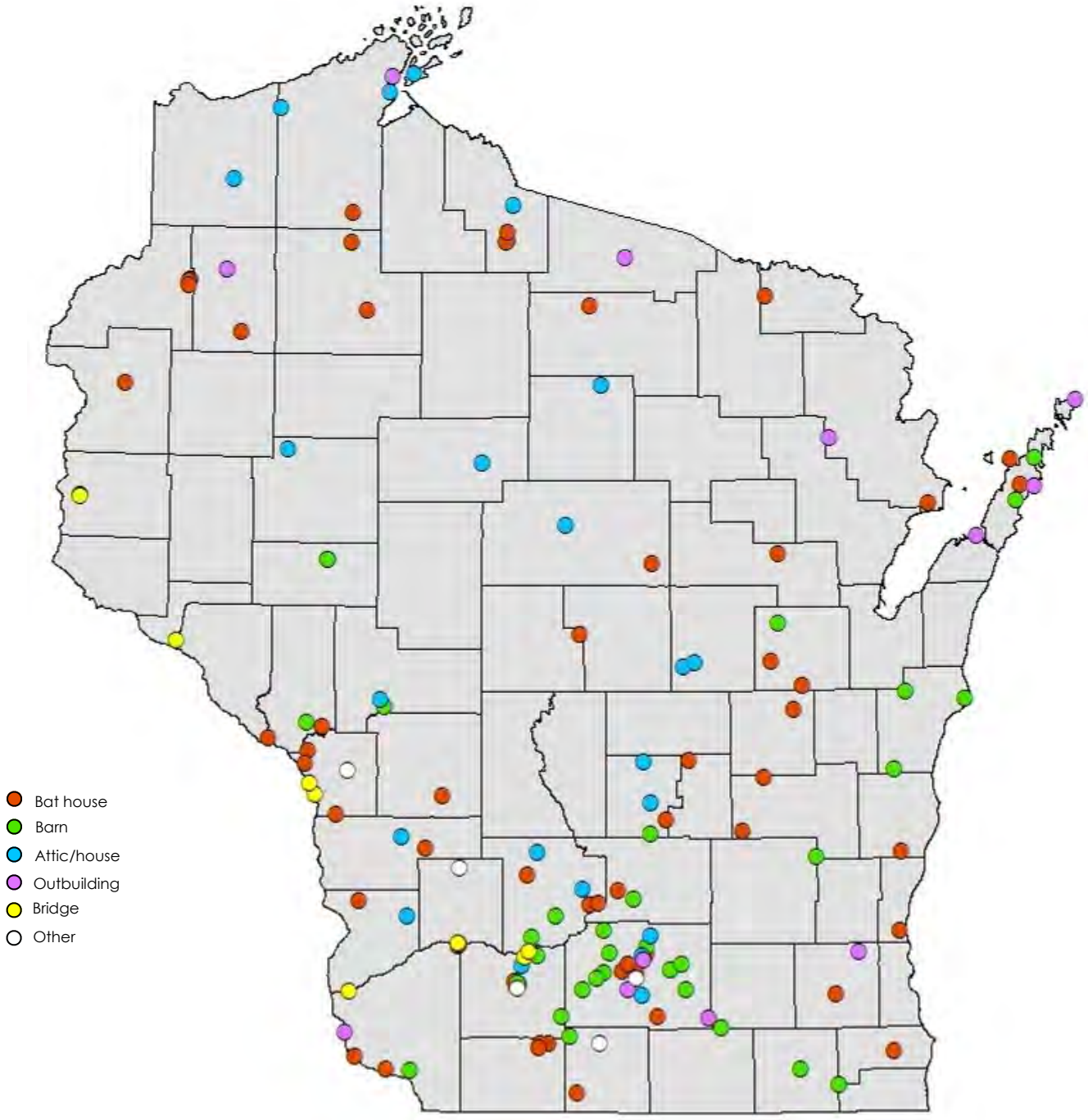
Bat roosts by size

The below map depicts the distribution of monitored bat colonies and their sizes in Wisconsin, where purple indicates big brown bat colonies and green, little brown bat 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.



First annual Great Wisconsin Bat Count

This year, WBP decided to try a statewide bat count, similar to the Christmas Bird Count.

It was dubbed the Great Wisconsin Bat Count, and has the goal of counting as many roost sites as possible on a single weekend. Two statewide counts were completed this year, one on June 14th during the pre-volant period and one the first weekend in August during the post-volancy period to help investigate reproductive success of the monitored colonies. Both statewide counts were great successes. Volunteers counted at 32 roosts on June 14, counting a total of 7,819 bats. On the first weekend of August, volunteers surveyed at 42 roosts and counted 10,428 total bats!

Pre-volant	# sites	# bats
Little brown bats	19	7144
Big brown bats	13	675
Northern long-eared bats	1	60

Post-volant	# sites	# bats
Little brown bats	28	9333
Big brown bats	14	1095

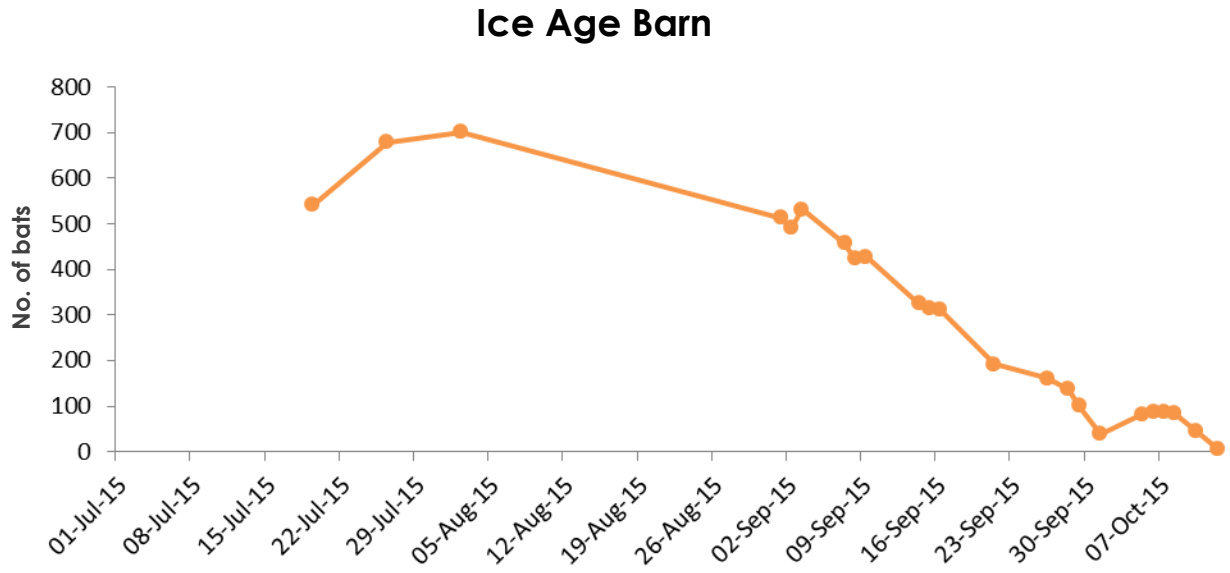
Volunteers wait to start an emergence count at Yellowstone Lake State Park during the post-valancy Great Wisconsin Bat Count

The importance of yearly monitoring

Much remains to be learned about bat roost preference and roosting behavior. Thanks to volunteers and landowners who monitor their bat roosts yearly and several times each summer, WBP begins to understand impacts of weather, roost conditions and disease on bat colonies around the state.

This year, impacts on behavior and population sizes were noted. Another chilly spring delayed emergence, though not as much as previous years. Several big brown bat colony monitors observed much lower populations than previously seen, and one little brown bat site recorded a significant decline in population.

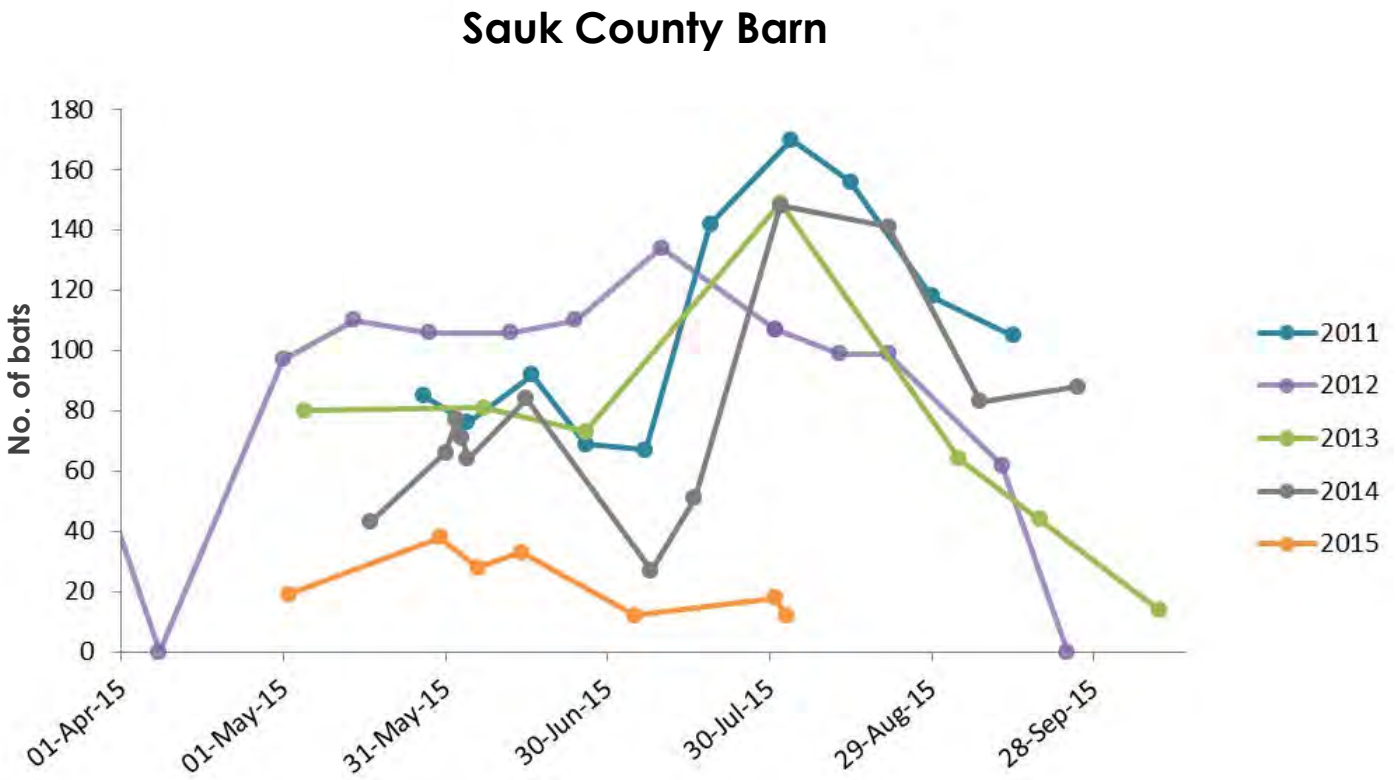
Big brown bats stayed at summer sites much longer into the fall than what we consider normal behavior. These stragglers were probably present at summer sites well into fall because the state continued to see warm, dry weather into November.



The above example displays counts conducted at a newly reported little brown bat roost west of Madison. Though the roost was not reported and monitored until July, counts completed at this site highlight how a colony population may change even day-to-day over the summer. Several counts are needed to help accurately establish a population size for each colony.

***Right**: this barn, owned by the National Park Service, houses over 700 bats in the height of the summer maternity season.*

The importance of yearly monitoring



The above graph depicts counts conducted several times over the summer every year since 2011 at a barn housing big brown bats. Displayed in 2011, 2013 and 2014 are what we predict happens to the colony population over the summer- a steady increase in numbers until late June, then a jump in population as pups begin **flying** . 2012 was a particularly warm year and not only did the bats return to the summer site earlier in the spring, the population didn't show a jump in numbers when pups normally begin flying. This could be an indication of births and flight of pups spread out throughout the season, or low reproduction and high pup mortality because of high temperatures.

Flight in young bats is referred to as volancy. Conducting counts pre-volant and post-volant helps assess reproductive success of the colony.

This year, this site was one of several big brown bat colonies that have declined significantly from previous years. Big brown bats are unlikely to make large migrations from summer to winter habitat and they are not as susceptible to WNS as other species, so declines are unlikely due to the disease. Like little brown bats, much remains to be learned about big brown bat roosting behavior and site fidelity. Conditions of these roost sites may have changed, or other roost habitat may have been created causing bats to switch roosts. Weather conditions may play a role in selection of sites- bats may choose one site in warm years and another in cooler years. Though the decline in population is unfortunate to observe, WBP would not know this behavior was occurring but for the monitoring efforts of volunteers.

First impacts of white-nose syndrome?

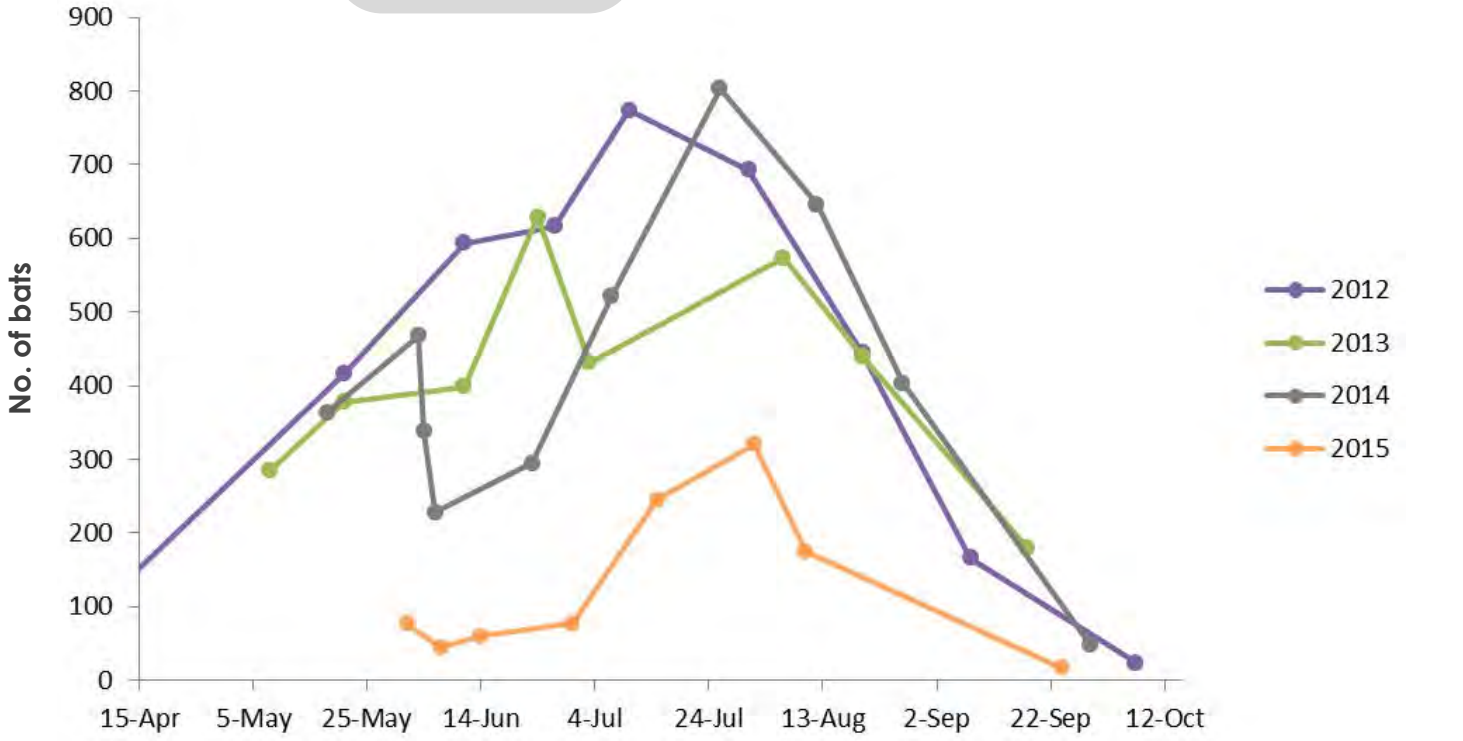
This graph below depicts counts conducted several times over the summer every year since 2012. This barn in Door County houses a significant population of little brown bats. Thanks to the efforts of volunteers, we were able to establish a baseline population for the site over several years. For three years the population has been steady between 600 and 800 bats. In 2015, however, a significant decline was documented as volunteers surveyed the site. 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 the winter of 2013-2014, WNS was confirmed in four counties in Upper Peninsula Michigan, well within **migration distances** of little brown bats using summer habitat in Door County (Barbour & David 1965). 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, 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.

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

Interestingly, there are several other monitored colonies in Door County with significant populations, but none show declines that this site does. When consulted about this apparent decline from WNS, a **bat biologist** in Pennsylvania described following 16 little brown bats from a hibernaculum to 11 different summer maternity sites

Greg Turned has worked with bats in Pennsylvania since 2004. In 2008, Pennsylvania was one of the first states to confirm WNS as it spread across the continent.



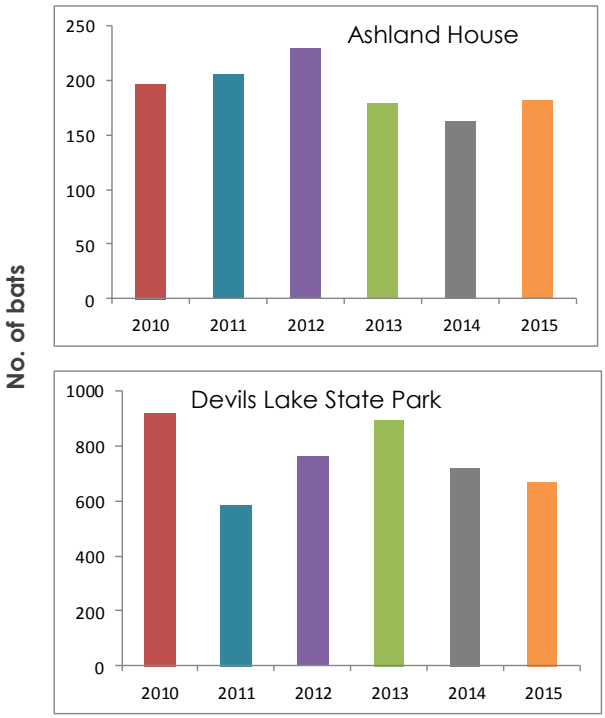
First impacts of white-nose syndrome?

and tracked both the hibernaculum and the roost sites as WNS invaded the area. In the second year of infection, summer roost populations declined about 60% and about 90% in the third year of infection. He suggested that because Door County has few major bat hibernacula, bats are traveling further between summer and winter habitat, and the bats at this Door County barn may come from sites in Upper Peninsula Michigan. Summer colonies holding steady in the area right now are possibly coming from local hibernacula or from sites in UP in the first year of infection.

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.



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.

A plastic bag collecting guano beneath a bat house in Lafayette County.

- **University of Wisconsin-Madison project investigating bat diet and the importance of bats as pest control in the state.** Dr. Claudio Gratton and Dr. Zach Peery from UW Madison have been developing a project collecting guano and insect samples at roost sites throughout the summer. 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. This year was the first of five seasons samples will be collected.
- **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 marked on the summer landscape is 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 at these sites and we look forward to finding them this winter.

A banded bat captured and recovered in Iowa County

How Wisconsin Bat Program uses information from volunteers

- **Student independent research projects.** Though bats are at their roost sites most prominently in June and July outside of the school season, monitoring bat roosts still provide students with opportunities to form and complete independent research. One high school student in Verona monitored the newly reported barn on the west side of Madison. In addition to counting the bats as they emerge, he is also recording the bats using an **ultrasound detector**. During analysis he will compare the number of bats counted with the number of bats recorded on the ultrasound detector to help investigate whether an ultrasound detector could be used to determine colony population sizes.

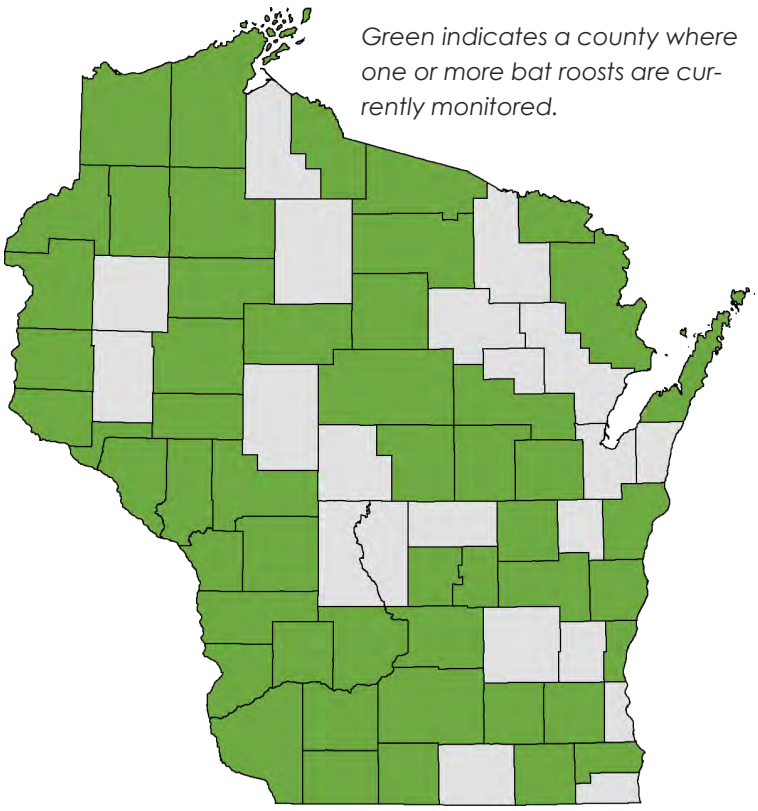
All bats in Wisconsin echolocate in the ultrasound range as they navigate and forage for insects. This detector records the bats in sonograms which can be analyzed in the office.

- **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 bats can be scanned through the wood wall of the barn and three students from University of Wisconsin Platteville completed six 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.

A little brown bat emerges from the roost in Grant County with PIT tagged bats.

Continuing the Bat Roost Monitoring Project

Over the past six years, volunteers and citizen-scientists have helped create an important database of bats 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 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!



Green indicates a county where one or more bat roosts are currently monitored.

Feedback from the Great Wisconsin Bat Counts was very positive and WBP will continue this new tradition in the coming years. Even if volunteers 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.

A little brown bat roosts under a bridge over the Wisconsin River.

The bat roost monitored project is able to thrive because of the incredible efforts 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 start to seem redundant, but thank you. We cannot continue the program without your help and support.

Heather Kaarakka
Bat Roost Project Coordinator

References

Boyles, J. G., P. M. Cryan, G. F. McCracken and T. H. Kunz. 2011 Economic importance of bats in agriculture. Science 332: 41-42.

Humphrey, S. R. and J. B. Cope. 1976 Population ecology of the little brown bat, *Myotis lucifugus*, in Indiana and North-Central Kentucky. American Society of Mammalogists: Special publication 4.

Maine, J. J. and J. G. Boyles. 2015 Bats initiate vital agroecological interactions in corn. PNAS 112: 12438-12444.

Heather Kaarakka using radio-telemetry to track northern long-eared bats in northern Wisconsin. Photo: Amanda McDonald

Have questions about bats or roost monitoring? Feel free to contact Heather:
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608.266.2576

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.

2015 Roost Monitoring Infographic