



2022 ROOST MONITORING REPORT

By Heather Kaarakka

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Wisconsin Bat Program
Bureau of Natural Heritage Conservation
Wisconsin Department of Natural Resources
Image courtesy of Heather Kaarakka

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To our Wisconsin Bat Program volunteers, 2022 brought the return of normal roost monitoring and the return of some very large little brown bat roosts. Volunteers and monitors continue to be an exceptionally dedicated group of scientists—this year you conducted over 600 emergence surveys and counted over 19,000 bats! We continue to receive more data than we can incorporate into the yearly report for which we are extremely grateful, but we've included some highlights and information here that we hope you'll find interesting. Enjoy learning about everyone's hard work surveying bats in 2022!

With thanks,

The Wisconsin Bat Program team

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Big brown bats happily hanging in a bat house. Photo: M. Peczynski.



Little brown bats using the bat houses in La Crosse County. Photo: H. Kaarakka, WDNR

A Background On Bat Roost Monitoring in Wisconsin

As the threat of the deadly bat disease, [white-nose syndrome](#) (WNS), loomed on the horizon in 2010, the Wisconsin Bat Program (WBP) set out to find out where bats are roosting in the summer in the state, what types of roost sites they use and how many bats are inhabiting the roosts. Since 2010, landowners and volunteers have helped

A roost is 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 other secret places.

WBP locate and monitor over 200 summer **roosts** of [little brown bats](#), [big brown bats](#) and [tricolored bats](#). These monitoring efforts by citizen-scientists helped WBP establish baseline information about summer

bat colonies prior to the arrival of WNS to Wisconsin, watched declines in colonies when WNS hit in 2014, and are now starting to observe stabilization and even recovery at some roosts.

Conducting emergence counts is simple and entails sitting at the roost at dusk and counting the bats as they fly out. We know that the number of bats in roosts changes daily, and bats move among roost sites frequently, but even just one emergence count can provide the WBP with important information—the roost is inhabited and there are roughly so many bats!

You can read more background on bats and roost monitoring in previous [roost monitoring reports](#) and in the [roost monitoring packet](#).



A little brown bat emerges from a bat house in Green County, WI. Photo: H. Kaarakka, WDNR.

Roost Monitoring In 2022

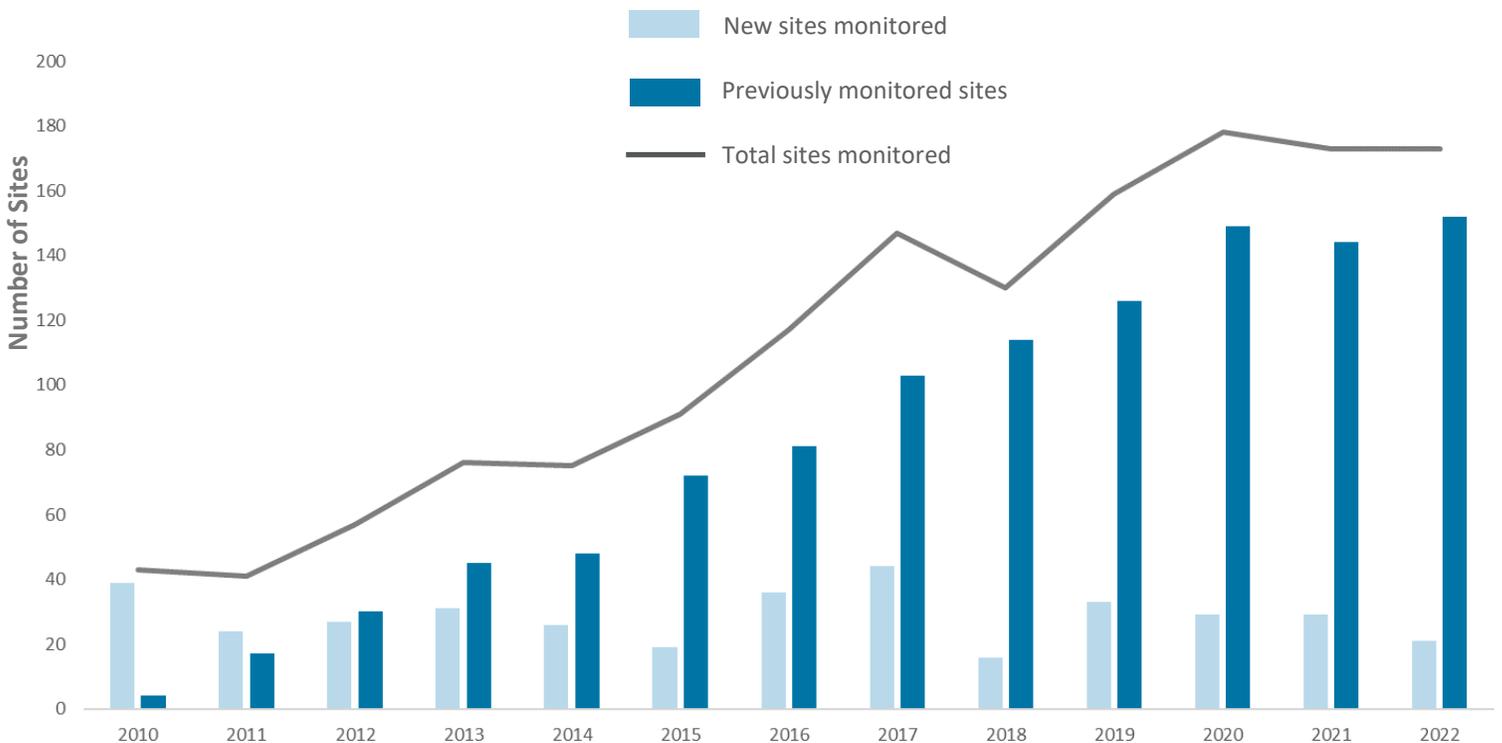
In 2022, 235 volunteers conducted 621 emergence surveys in 62 counties from March to October. Volunteers monitored 173 roosts in summer 2022 including 21 newly reported roost sites!

In 2022, a whopping 15,374 little brown bats were counted, which is still down from the 2016 high count but slowly creeping up after low counts in 2017-2020. A total of 4,436 big brown bats were counted, about the same as the last two years. Total numbers counted are estimated from the highest counts at each site. Nine tricolored bats were counted at three sites in summer 2022; however, two individuals were observed only in spring at a bridge roost. Little brown bats were counted at 42% of monitored sites in 2022, big brown bats were counted in 49% of the sites, and the remaining sites housed tricolored bats, both little brown and big brown bats, or it is unknown which species is housed. See page 15 for more details in the roost monitoring infographic.

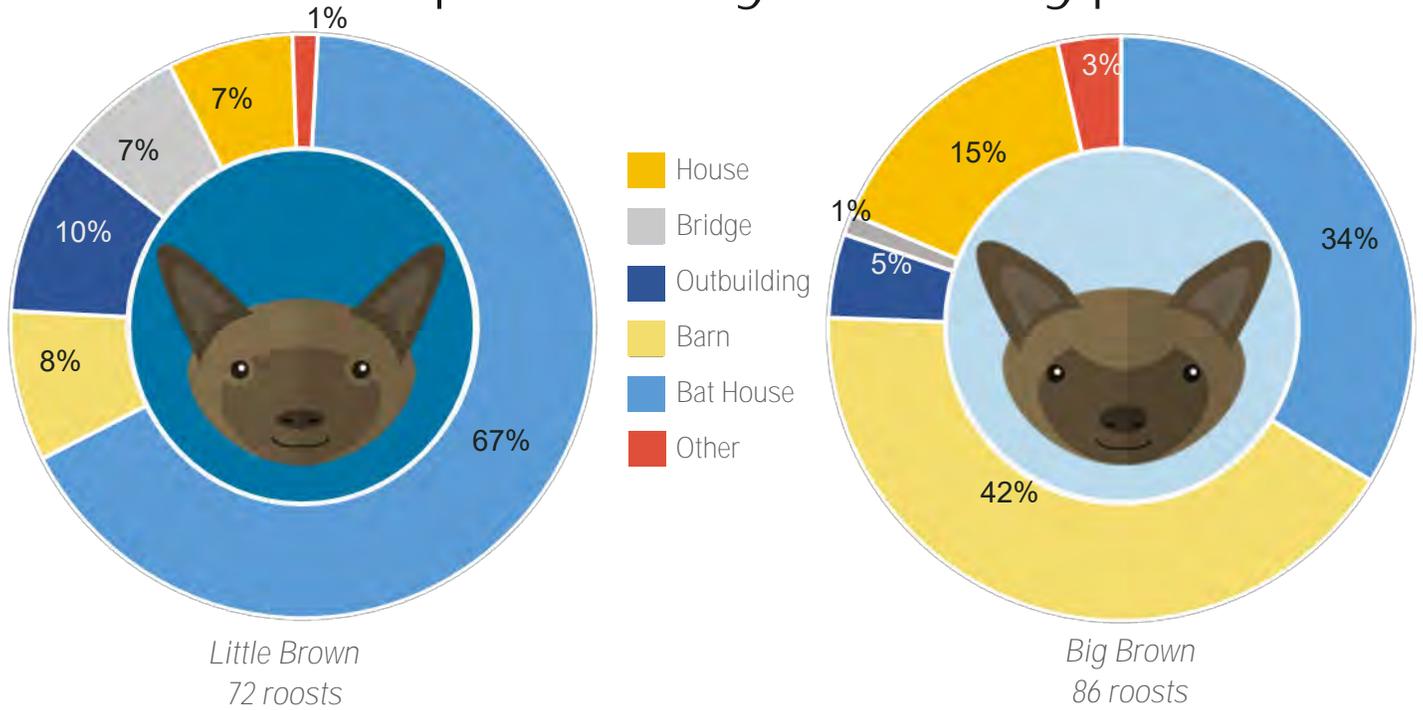


Above: Mother big brown bats nurse their young in a roost in Crawford County. Photo: H. Kaarakka, WDNR.

2022 Monitored Bat Roost Sites



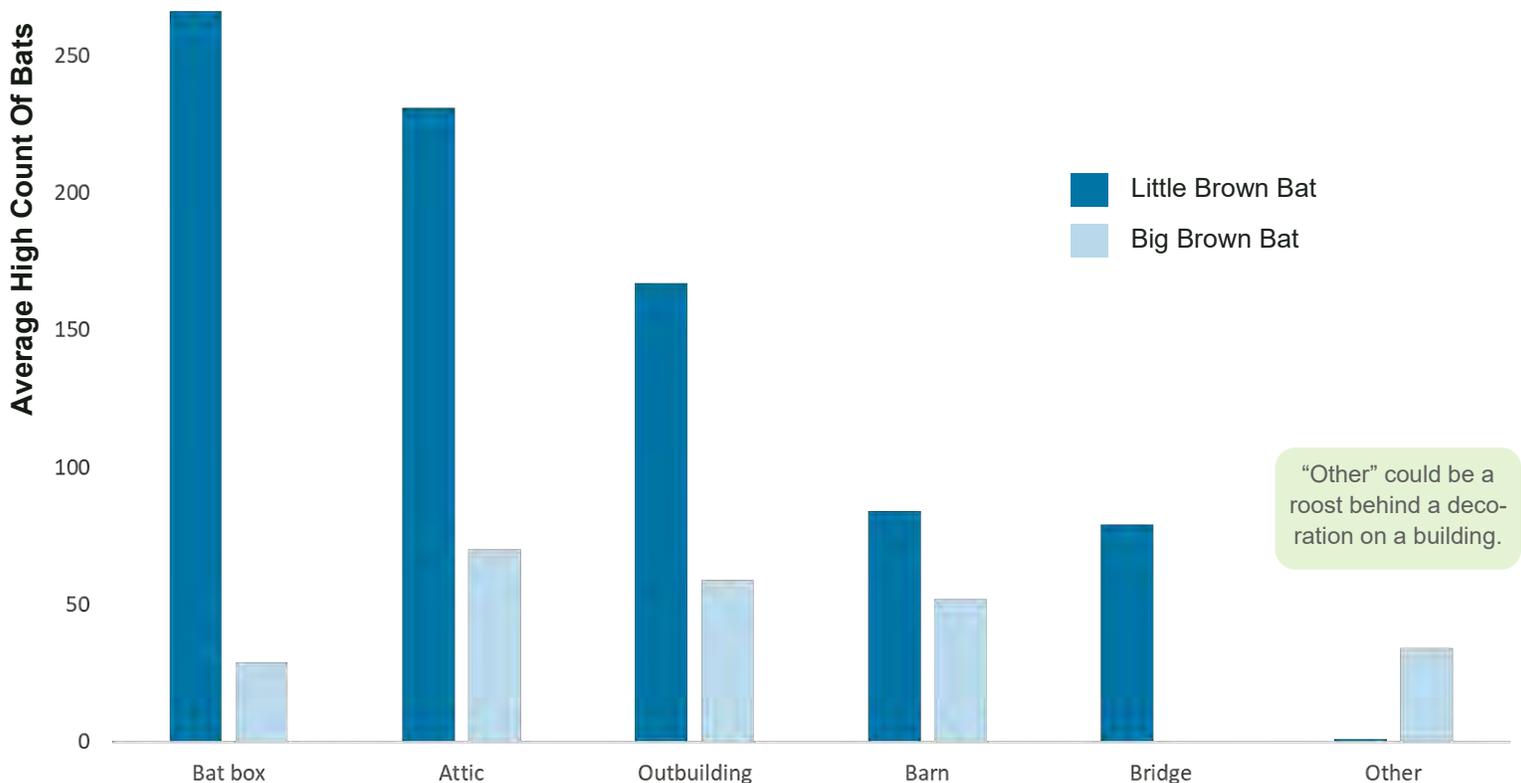
Bat Species By Roost Type



Little brown bats were found most often in bat houses, and big brown bats preferred barns.

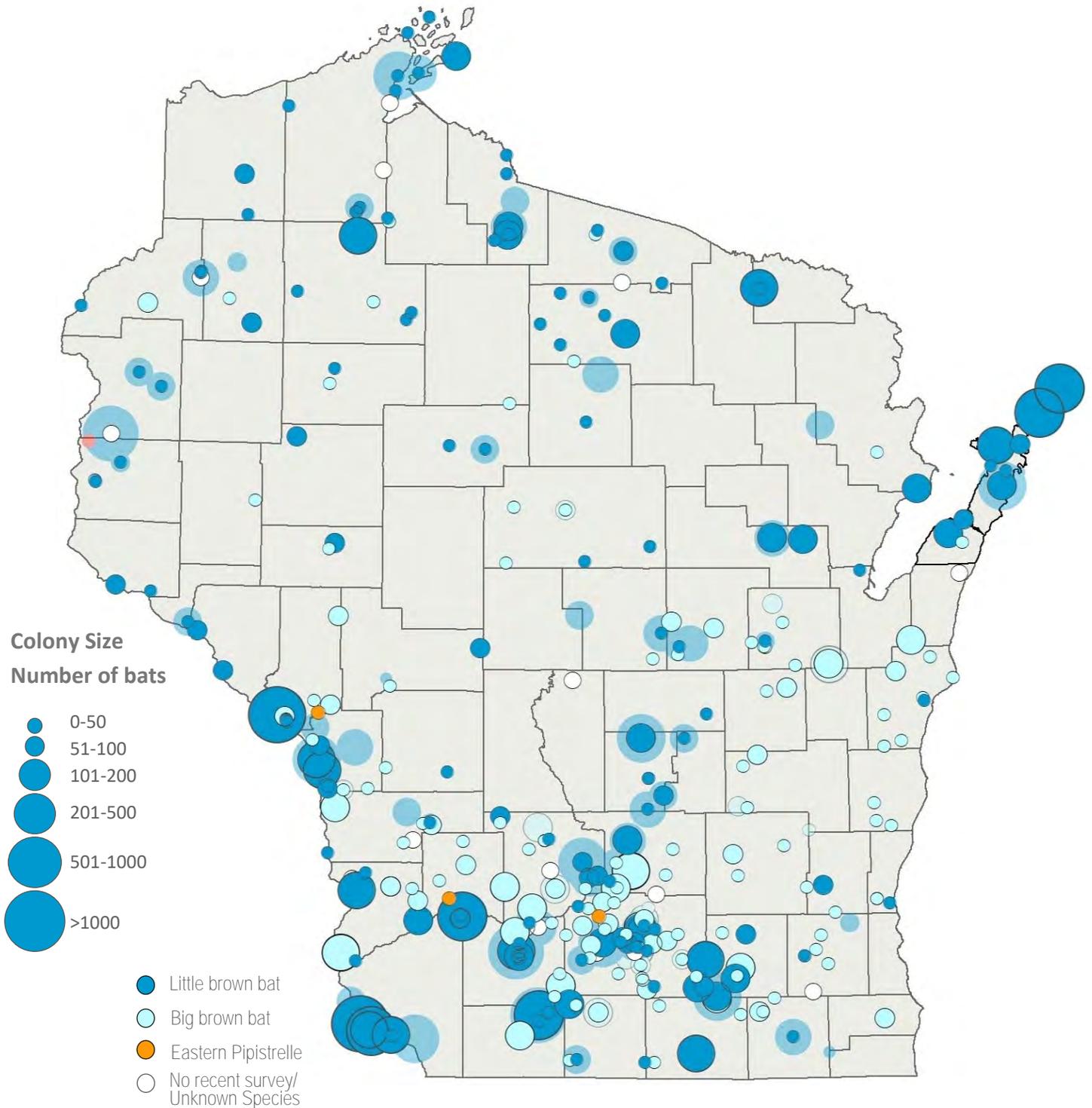
Results from 2016, before white-nose syndrome started to affect bat populations, showed several average little brown bat roost colony sizes by type between 300 and 600 bats. In 2022, the largest little brown bat average colony size was 266 bats, down from pre-WNS colony sizes but continuing to creep up from the past couple of years!

Bat Colony Sizes By Roost Type



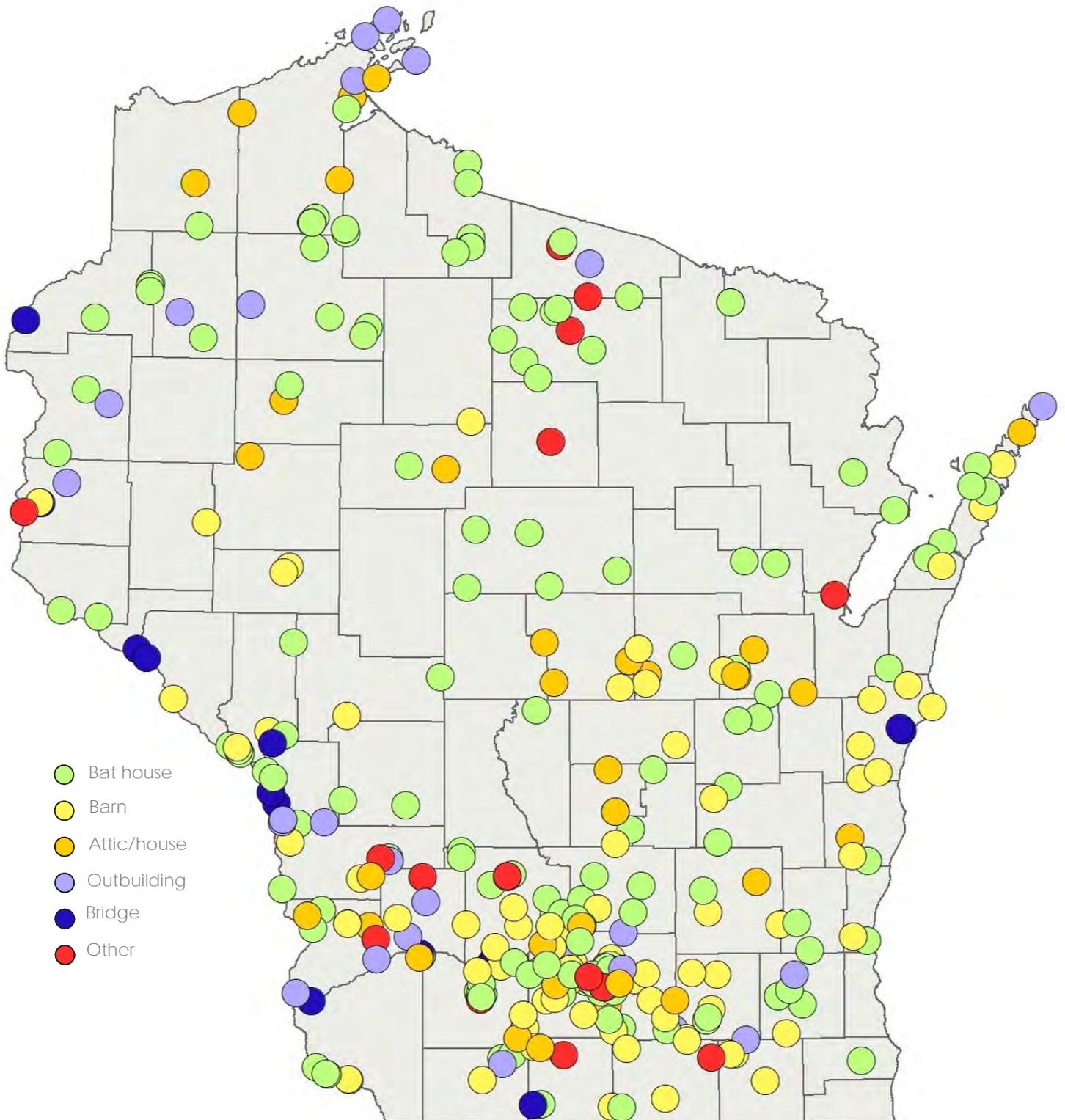
Bat Roosts By Size

This map depicts the distribution and size of monitored bat colonies in Wisconsin. Light blue indicates big brown bat colonies, dark blue indicates little brown bat colonies, orange indicates tricolored bat colonies and white indicates a roost with no recent survey or unknown species. The size of the dot indicates the average size of the population at the roost, and the shaded circles behind the roost locations are previous population estimates from emergence surveys.



Bat Roosts By Type

This map depicts the distribution of monitored bat colonies by type of roost. The color of the dot indicates the type of roost.

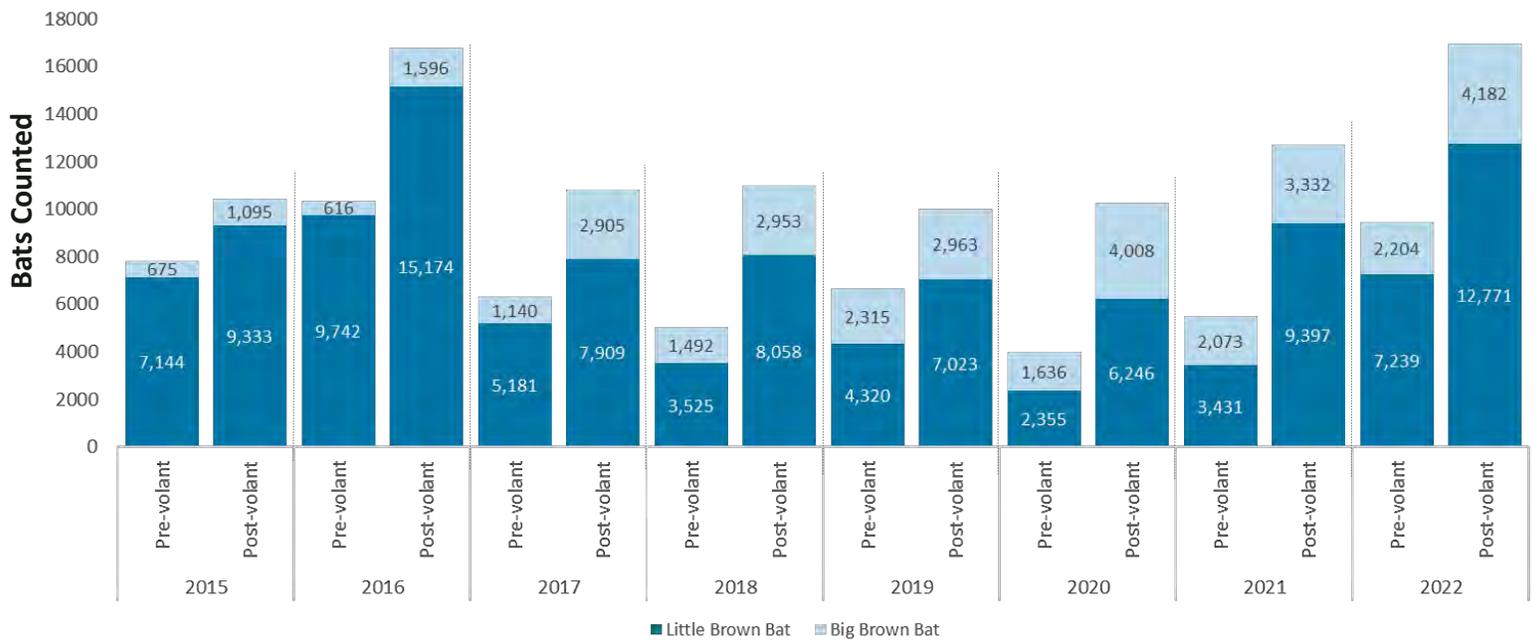


Eighth Annual Great Wisconsin Bat Count

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

The Great Wisconsin Bat Count (GWBC) started in 2015 with the goal of counting as many roost sites as possible in a single weekend. Two statewide counts are completed yearly, the first weekend in June during the pre-volancy period (before pups are able to fly) and a weekend in mid-July during the post-volancy period (after juveniles can fly) to help investigate reproductive success of the monitored colonies. All these counts have been great successes. This year surveyors counted **9,443** bats in June and **16,953** bats in July, the highest count ever during the GWBC!

Great Wisconsin Bat Count Results 2015-2022



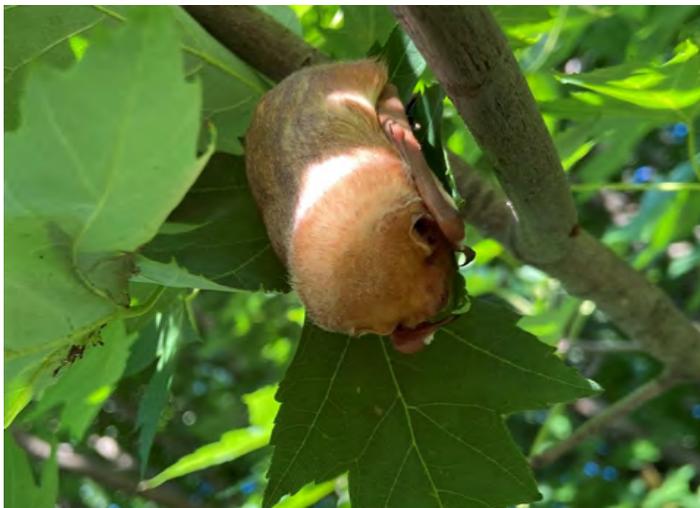
Where Do Eastern Red Bats Roost?

Almost all the summer roosts that we survey in the Wisconsin Bat Program are inhabited by little brown bats and big brown bats. We have some limited information on tricolored bat and northern long-eared bat roosts, but we know little of the roosting habits of the migratory bats in Wisconsin. Hoary bats (*Lasiurus cinereus*) are extremely secretive and reports of roosting bats are very rare. Eastern red bats (*Lasiurus borealis*) and silver-haired bats (*Lasionycterius nactivagans*), however, are occasionally spotted in spring and fall as they migrate.

Observant naturalists and roost monitors sometimes find eastern red bats, often while surveying for other critters or plants! Eastern red bats are frequently found hanging from foliage mostly in deciduous and coniferous trees, but sometimes are found low in bushes and even near the ground on plants! In fall and spring when they are most encountered, they tend to roost alone and often switch spots every day, but they sometimes stay in the same general area. For example, roost monitor E. Raasch found an eastern red bat hanging in different trees in the same area in Columbia County last September. The bat used both maple trees and a spruce trees moving among different spots in the foliage for a week.



Eastern red bat hanging in one of several trees in the area in September in Columbia County, WI. Photo: E. Raasch.



One of the other trees used by this eastern red bat in Columbia County, WI, over the course of a week. Photo: E. Raasch.

Eastern red bats' coloring lets them blend in well with their chosen roost spot. Eagle-eyed B. Davies found the below bat roosting in Portage County about 5 feet off the ground and hanging by one foot on a dead leaf. It is remarkable how well it matches the color of the oak leaves.



This eastern red bat was spotted near a lake in Portage County, WI in October while student, B. Davies was out for a field course. Eastern red bats are expert camouflage artists. Photo: B. Davies

In winter, eastern red bats are sometimes found on the ground roosting among leaf litter. They can curl their furred tail membrane over their body to conserve heat, giving them a built-in blanket!



With their furred tail membrane, eastern red bats can keep warm by curling it around themselves! Sometimes these balls of fur are found in the leaf litter on the ground in winter. Photo: L. Robbins.

Continued Daily Emergence Counts

Study of daily emergence continues with thermal cameras at several little brown bat roosts and one big brown bat roost this year.

At a site in Madison where we recorded emergence summers of 2020-2022, the daily counts steady increased from 2020 to 2021 (see below) and doubled in 2022! As with the big brown bat colony daily counts (page 10), the data start to get confusing after three years of counts. However, several things are becoming clear from these counts:

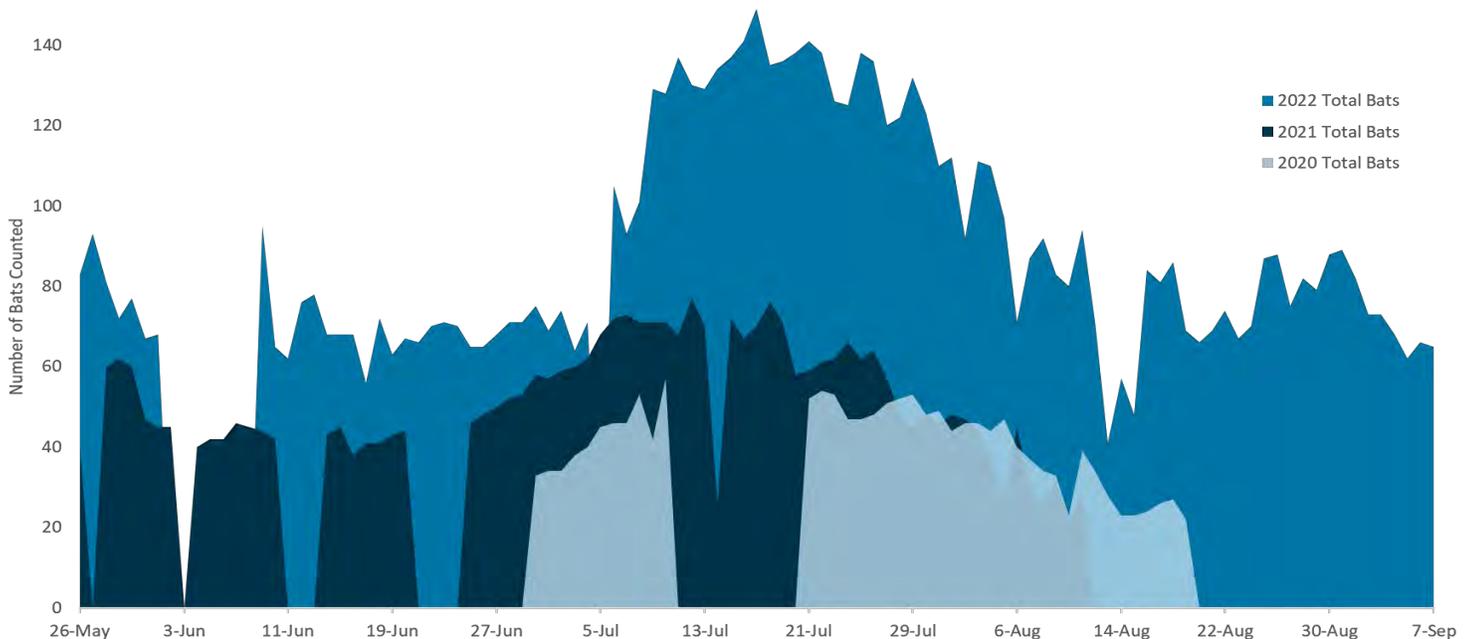
1. The number of bats emerging daily can be drastically different, likely due to changes in behavior

depending on the time of year (e.g., pups in roost) and weather (e.g., cold snaps in May and June).

2. Juvenile little brown bats in southern Wisconsin start to fly in the first couple of weeks of July and when exactly this happens may vary depending on spring weather.

3. There appears to be more bats each year these sites are surveyed. Whether these increases in population are driven by reproduction, survival or immigration remains a mystery. The large jump in 2022 may be due to clearing brush and trees around the box to increase solar exposure making the bat house more suitable (warmer and less cluttered).

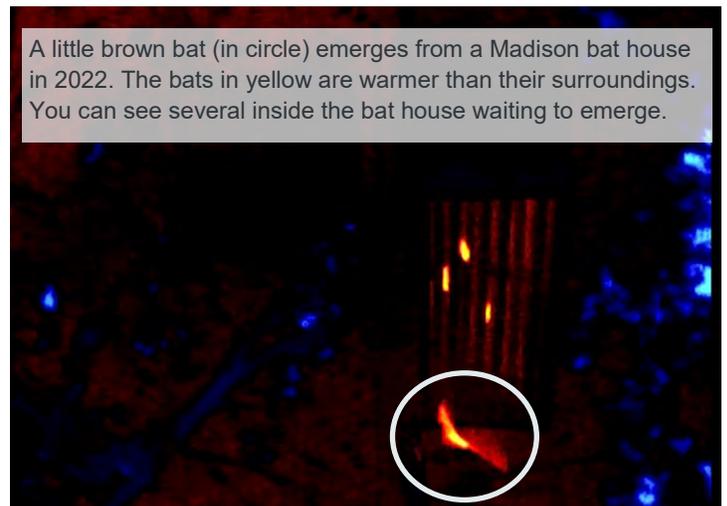
Daily Bat Counts from a Madison Roost Summers 2020—2022



Note: gaps in counts were because the battery ran out or the camera was pointed away from the bat house. In 2020, the camera was not installed until July. In all years we can see bat numbers increase when juveniles are volant in early July.

These daily counts show that we will never get an exact number of bats using a roost in summer since the number is so fluid. This doesn't mean that two counts or even one count doesn't provide us any information. The Wisconsin Bat Program is starting to think about roosts in terms of classes and even with one or two counts per year, long-term trends begin to appear, such as the effects of white-nose syndrome on little brown bat summer colonies.

The Wisconsin Bat Program continues to be cautiously optimistic about seeing increases in little brown bat numbers!



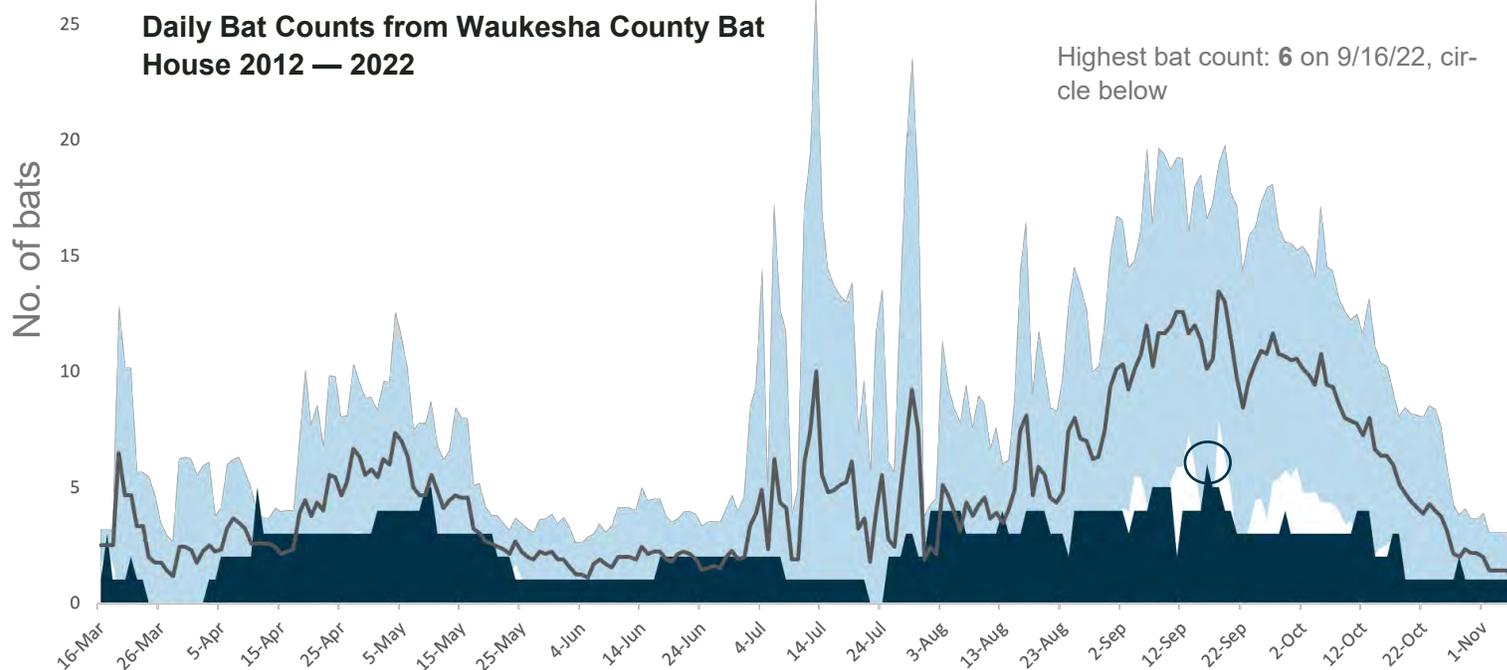
Big Brown Bat Roost Daily Counts

Daily count surveys also continued at the big brown bat house in Waukesha County. In 2022, the most bats counted this year was 6 in mid-September. The highest number of bats counted each surveyed year has been between 17 in 2018 and 49 in 2013. When in the summer the most bats were counted has also varied over the years. The most bats ever counted at this roost (49) was observed in mid-July, likely due to volant (flying) juveniles exploring, whereas the high count from 2022 was observed on September 16 possibly when bats were moving from summer to winter habitat.

Fewer bats were observed in the roost this summer than in previous years. The reason for the drop in numbers is unknown, however few big brown bat roosts have been moni-



tored consistently for so long. It's possible that bat colonies may ebb and flow naturally as bats find and move into new roosts or success of raising young may vary with conditions. Even with the drop in colony size, the fact that this bat house has been consistently inhabited and surveyed for 11 years is impressive!



This site has been surveyed daily every year since 2012! In this graph, the dark blue indicates counts from 2022, the black line indicates the average daily number of bats at the roost over the past nine years, and light blue indicates how much variation in bat numbers there was on that day over the past nine years.

Have you observed bats flying out of bat roosts on hot days?

Researchers in the western and southern North America have observed bats flying out of bat houses during the day seeking shade because bat houses reach temperatures that are too hot for them. If you have observed instances of this we would be very interested to learn about them since it can help complete the picture of critical temperatures for bats. DNRbats@wisconsin.gov

Impacts Of White-nose Syndrome

There is no doubt that white-nose syndrome has impacted summer bat colonies; however, impacts are varied and may not be as dire for some species as expected. Like biologists watching populations in the east, the Wisconsin Bat Program has started to observe stabilization of little brown bat colonies and even some roosts that still have significant numbers of little brown bats. What causes some summer colonies to collapse and others to persist is unclear, but potential causes could be hibernation locations and conditions. Some summer roost sites might be ideal habitat encompassing good roost locations and close proximity to foraging habitat to reduce commuting costs. The questions about surviving bats and their habitats are what make summer roost monitoring and projects like marking important. Big brown and little brown bat populations can con-

tinue to be tracked long-term with citizen-based monitoring at summer bat counts. Marking efforts can track individuals over time and potentially make connections between summer and winter habitats. This link between seasons is one of the remaining mysteries for bats surviving white-nose syndrome in Wisconsin and is one of the keys to understanding what the future of bats looks like in the region.



A northern long-eared bat infected with white-nose syndrome in Crawford County. Photo: H. Kaarakka, WDNR

Persisting, And Potentially Growing, Colonies

Thanks to the monitoring efforts of landowners and volunteers, the WBP has been able to identify several key roost sites around the state where little brown bat colonies appear to be persisting in large numbers despite impacts from WNS. Several roost sites along the Mississippi and Wisconsin rivers again had post-volancy counts of over 70% of historical numbers. These sites used to be home to more than 1,500 bats each, meaning these roosts continue to house significant colonies in the age of WNS. The Wisconsin Bat Program will continue examine whether there are differences between roost sites that are persisting and sites where the bats have declined sharply. Differences could include how old the roost site is, how many bat houses are present and proximity to large water bodies.



Little brown bats persisting in an attic in Marquette County. This roost has declined by about 82% in response to WNS. However, like other roosts monitored by volunteers, this one saw a slight increase in bat numbers in 2022 since steep drops in 2017 and 2018. Photo: P. White, WDNR



Through banding and now passive integrated transponder (PIT) tagging bats at many summer roost sites has made it clear that many colonies have bats that are surviving white-nose syndrome infection. Female bats banded in 2016 and 2017 were recaptured in 2022 during coordinated summer roost work with United States Geological Survey – National Wildlife Health Center. A bat PIT tagged in 2011 was recaptured in 2021 and 2022 too! These recaptures suggest that some bats are indeed surviving white-nose syndrome and stabilizing colonies is not simply bats redistributing among roosts.

Banding efforts like this one in 2015 are the way biologists have been able to recapture marked individuals years later and assess survival. Photo: H. Kaarakka, WDNR.

How Wisconsin Bat Program Uses Information From Volunteers

Reported and monitored bat roosts are important for furthering research and understanding of bats and white-nose syndrome 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 bat behavior and WNS in the state. The assistance of volunteers and roost owners allowed the Wisconsin Bat Project to coordinate and complete several projects at reported summer roost sites in summer 2022.

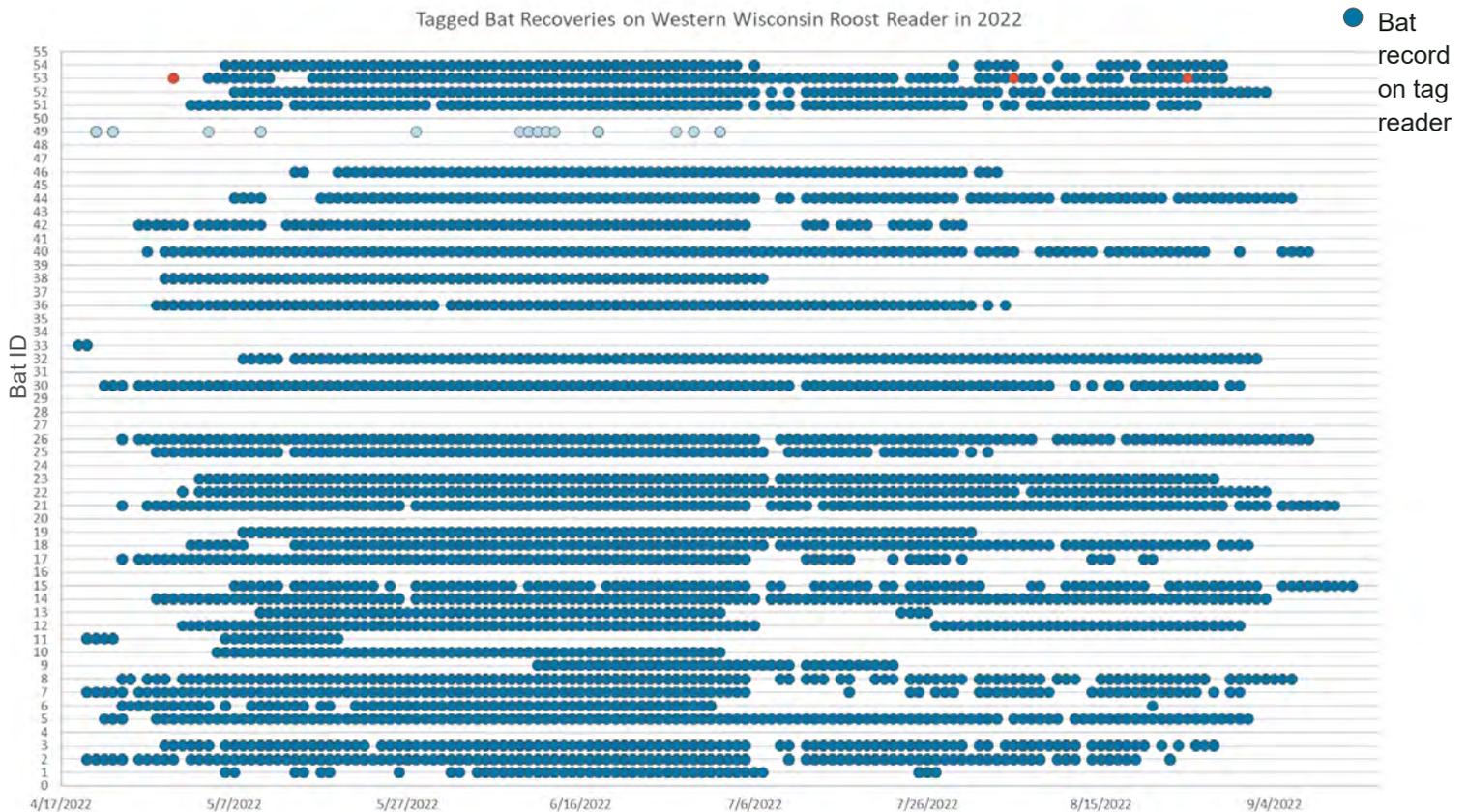
Projects Conducted at Reported Roosts

- **Differences in declines at summer roosts.**
Some declines observed at summer roosts due to WNS-impacts in the state have been significantly more severe than at others. What would cause some roost sites to hold on while others see few or no bats? There are likely many factors impacting survival of bats in both summer and winter. Using count data collected pre- and post-WNS arrival at little brown bat roosts across the state, the Wisconsin Bat Program is investigating what might play roles in the differences in observed declines. Does distance to water or how long the roost has existed impact how much a site declined? Learning these details can help determine management of summer roosts moving forward. Preliminary results from this study suggest that large colonies (>500 bats) had less severe declines from WNS-impacts than smaller colonies. This may suggest that there is a survival advantage to roosting with many other bats. Perhaps roosting with many other bats helps increase the temperature of the roost, particularly in spring when night temperatures can still be cold.
- **Supporting information for listing of bat species.**
Due to severe impacts from WNS, northern long-eared bats were listed by United States Fish and Wildlife Service (USFWS) as threatened on the Federal Endangered Species list. Recently USFWS proposed listing tricolored bat as endangered, relisting northern long-eared bat as endangered, and proposed listing the little brown bat. To help make the most informed decision about listing bat species, USFWS create species status assessments and consider population data from across the species' ranges including colony estimates from winter and summer sites. Thanks to monitoring efforts and counts from citizen-scientists in the summer bat roost project, Wisconsin was in a good position to provide detailed, long-term information on little brown bat summer roosts in the State. Less is known about northern long-eared bat and tricolored bat summer roosts in Wisconsin, but data from the few monitored roosts of these species were incorporated into the species status assessments and considered in listing and relisting of these bats. Specific details such as exact locations and landowners of roosts are kept confidential and such details are not provided to USFWS.



Little brown bats swarm in early morning at one study site used to investigate variation in declines from WNS. Photo: H. Kaarakka, WDNR

How Wisconsin Bat Program Uses Information From Volunteers



Each dark blue dot represents a date and time when a tagged little brown bat was recorded on the tag reader at this Western Wisconsin roost site. Bat 49 (light blue dots) was a male big brown bat who returned to the roost for early summer. Of note is bat 53 who was recorded at a winter hibernation site in April as she emerged in spring, and again twice in August during mating season meaning she flew 50 miles on multiple night-long trips. These winter site records are indicated in orange and are the first records of a little brown bat moving back and forth between summer and winter sites.

Projects Conducted at Reported Roosts

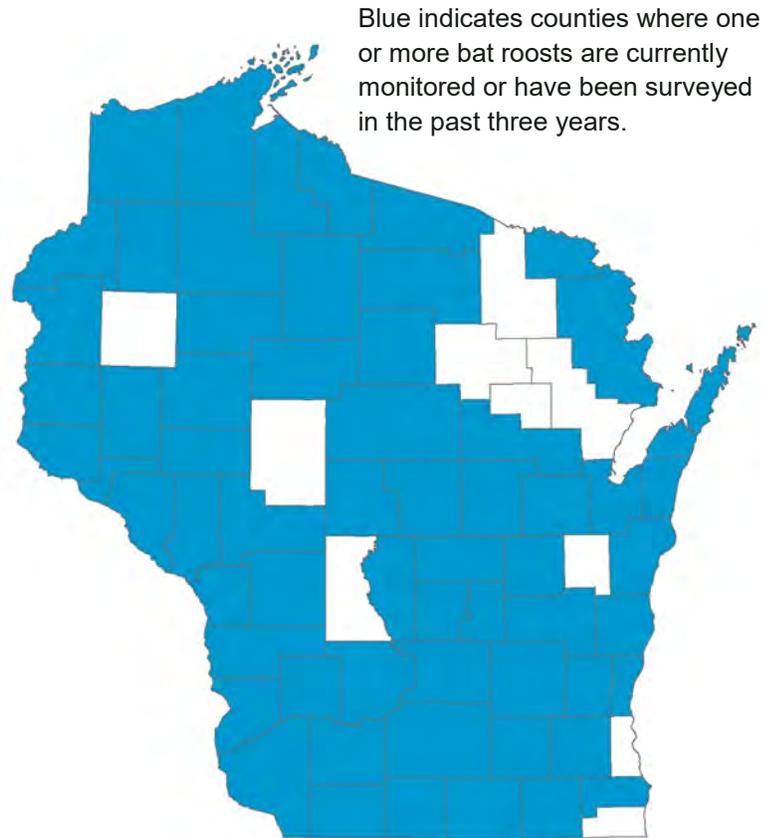
- Tagging bats with passive integrated transponders and installing readers.** Tagging bats with passive integrated transponder (PIT) tags offers the opportunity to collect much-needed information without recapturing and handling bats to read the band number. Tagged bats can be scanned using special readers to record the exact date and time of their activity of each tagged bat. Tagged also allows biologists to watch movements of bats between roosts and even between summer and winter habitat. While working with United States Geological Survey - National Wildlife Health Center to investigate efficacy of a WNS vaccine, as well as with other partners, the Wisconsin Bat Program installed several readers on multiple bat houses and discovered that bats moved readily between bat houses. At the roost site highlighted above, the

PIT tag reader revealed that bats returned in late April and stayed through early September when they made their way to winter sites. Working with partners at Virginia Tech University, the Wisconsin Bat Program tagged bats and installed stationary readers at the entrances to major hibernation sites. This allowed biologists to make some of the first seasonal connections between summer roosts and winter hibernacula when two juvenile females from different roosts flew 30 and 50 miles to a site in Pierce County! One of these bats tagged in 2021 returned to the roost site in 2022 and actually made several trips back and forth between summer and winter sites in August 2022. Another bat flew a whopping 160 miles from a summer roost in southern Wisconsin to a winter site in western Wisconsin! Having a network of tagged bats and readers at both winter and summer sites will help to make more connections and investigate aspects such as seasonal timing and survival.

Continuing The Bat Roost Monitoring Project

Over the past 13 years, volunteers and citizen-scientists have helped create an important and valuable 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 Wisconsin. The amazing efforts by landowners and volunteers are extremely valuable and current (and future!) roost monitoring will continue in the coming summers. WBP also continues the aim 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. The public is encouraged to report bat roosts in counties with and without monitored roosts.

Based on surveys conducted by Wisconsin Bat Program volunteers, bat colonies in Wisconsin appear to be stabilizing following impacts from



WNS. As Wisconsin Bat Project scientists determine what potentially recovering populations look like, the roost data collected by volunteers shows that not all colonies are affected equally. Some habitats may be more suitable than others now that fewer bats are on the landscape. The data also help with understanding reproduction and whether bats in the region might fully recover or if what is observed now is the “new normal” for little brown bats.

The bat roost monitored project is able to thrive because of the incredible work of volunteers and landowners. **The Wisconsin Bat Program 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 magical to witness the excitement people have about bats and science, and I count myself very lucky to be a part of it. It's been a hard road with WNS finally in the state, but thanks to your efforts, we have made great strides in assessing WNS impacts on Wisconsin's bats. It may seem excessive, 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 western Wisconsin. Photo: Michael Kienitz

Have questions about bats or roost monitoring? Feel free to contact Heather:
heather.kaarakka@wisconsin.gov

The Wisconsin Bat Program is part of the Bureau of Natural Heritage Conservation in Wisconsin Department of Natural Resources. The majority of Wisconsin Bat Program funding comes from grants and donations and much of our data are collected by volunteers. Thank you for your support.



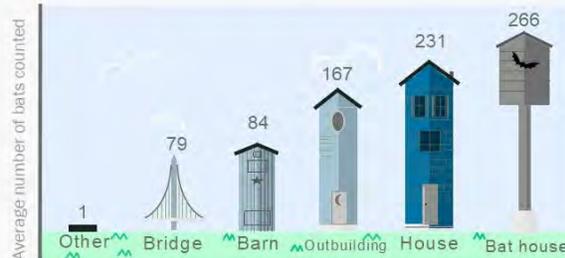
621 surveys
were completed in 2022, counting
19,821 bats



Roost Monitoring Report

Bat houses, houses draw bat crowds

In 2022, bat houses and houses housed the largest numbers of little brown bats.



Meet a couple of our bat species

Two bats that sometimes use artificial roosts in Wisconsin are the northern long-eared bat and tricolored bat



Northern long-eared bat
Myotis septentrionalis

This rare bat usually roosts in dead trees in summer but is sometimes found in buildings. In winter they hibernate in caves and mines and are heavily impacted by white-nose syndrome



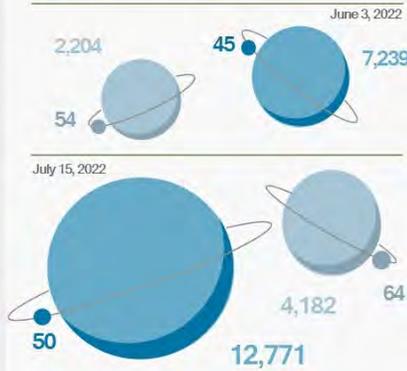
Tricolored bat
Perimyotis subflavus

This little bat likes to eat caddisflies and beetles, and roosts in leaf clusters on open areas of buildings. In winter, tricolored bats hibernate in caves and mines

Great Wisconsin Bat Count

The goal was to count as many roosts as possible in a single weekend, now in its 8th year.

- Little brown bats counted
- Little brown bat surveys
- Big brown bats counted
- Big brown bat surveys

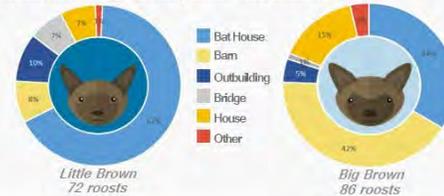


Where do bats live?

The bats we count live in a variety of man-made structures.



235 volunteers reached for their clicker-counters to help count bats this summer



05

May: the roost colony population steadily grows as bats return to their summer roost from overwintering habitat.

06

June: most of the colony is present at the roost, and female bats give birth to flightless young, called pups.

07

July: bat pups born in June begin to fly in late July and the number of bats emerging from the roost increases.

08

August: adults begin migration back to winter habitat where they will mate throughout the fall.

Number of roosts counted in 2022

Little Brown Bat



72 86



Big Brown Bat

Help survey bats!

Know a place where bats roost? Want to help count bats?

Contact Heather at heather.kaarakka@wisconsin.gov or visit wiatri.net/inventory/bats