

2023



# ROOST MONITORING REPORT

By Heather Kaarakka

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

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*To our Wisconsin Bat Program volunteers,  
What can we say about 2023 except that it was yet another successful year for summer bat roost monitoring! Volunteers and monitors continue to be an exceptionally dedicated group of scientists—this year you conducted over **670** emergence surveys and counted nearly **23,000** bats! We 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. The United States Fish and Wildlife Service continues to look to our program for important information on summer colonies of bats and impacts of WNS. We hope you are proud of the science you do and the fact that your data help inform important decisions for protecting bats. Enjoy learning about everyone's hard work surveying bats in 2023!*

*With thanks,  
The Wisconsin Bat Program team*

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Volunteers await the 2,000+ little brown bats emerging from bat houses in Grant County.  
Photo: H. Kaarakka, WDNR



Little brown bats using 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

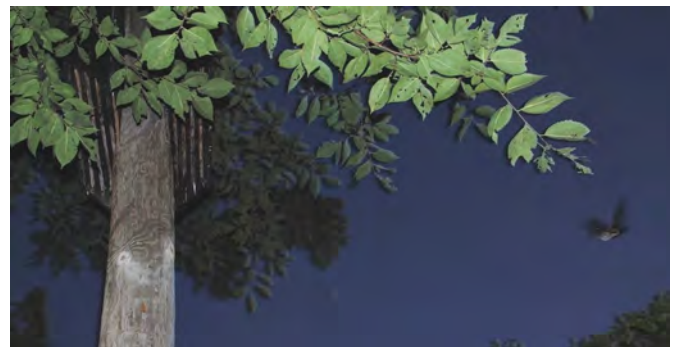
A roost is where bats congregate to rest during the day. Bats need these safe places to sleep and raise their young. Summer roosts can be trees, bat houses, attics, barns and other buildings, bridges, and other secret places.

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](#).

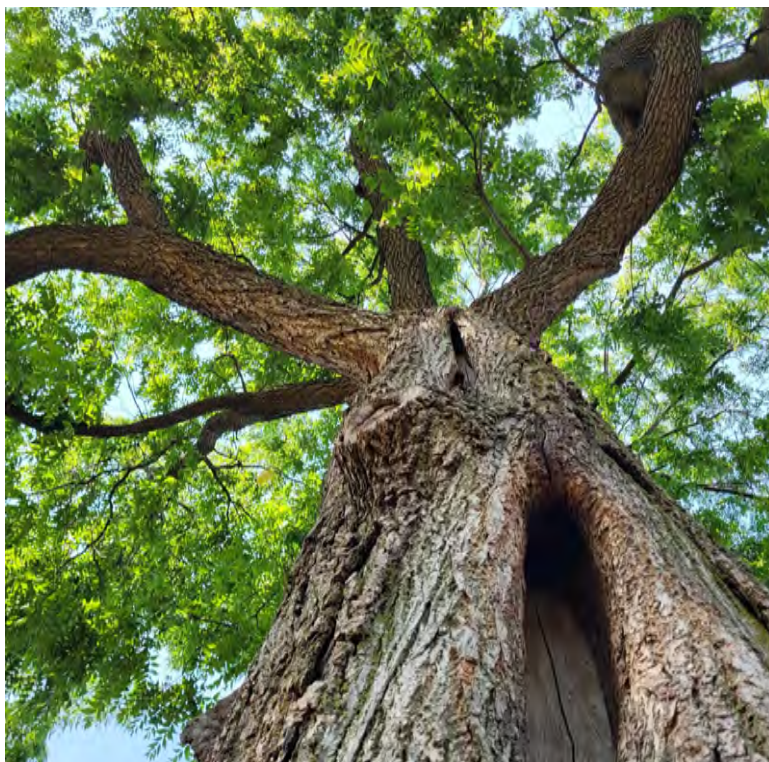


A little brown bat emerges from a bat house in Green County, WI. Photo: H. Kaarakka, WDNR.

# Roost Monitoring In 2023

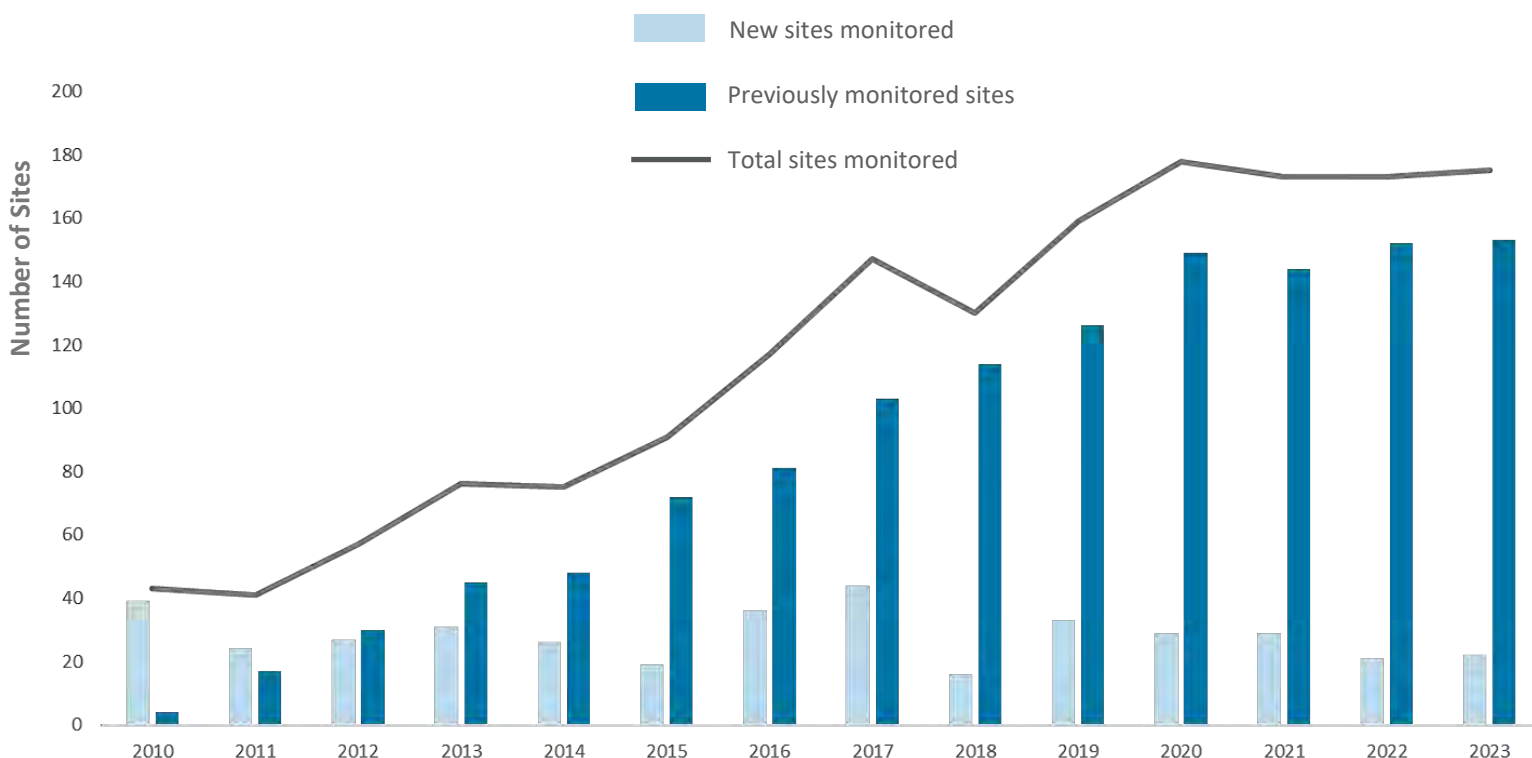
In 2023, 263 volunteers conducted 673 emergence surveys in 61 counties from March to October. Volunteers monitored 175 roosts in summer 2023 including 22 newly reported roost sites!

In 2023, a whopping 17,377 little brown bats were counted, which is again still down from the 2016 high count (23,000) but slowly creeping up after low counts in 2017-2020. A total of 5,221 big brown bats were counted, up a bit from the last two years. Total numbers counted are estimated from the highest counts at each site. Six tricolored bats were counted at one site in summer 2023. Little brown bats were counted at 44% of monitored sites in 2023, big brown bats were counted in 50% 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.

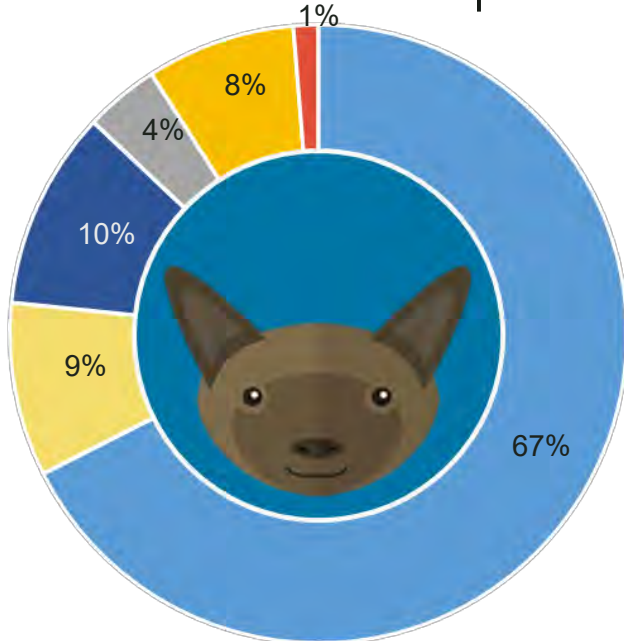


One of the first tree roosts for big brown bats in Wisconsin was reported this summer! Bats emerged from the top crevice. Photo: H. Kaarakka, WDNR.

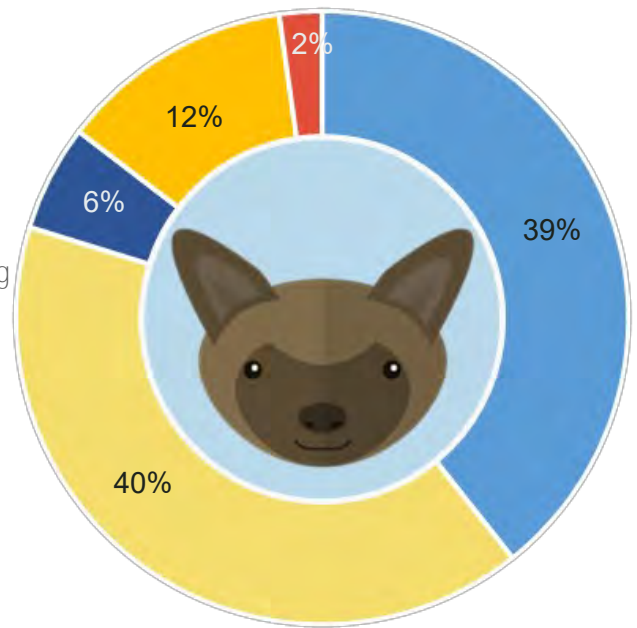
## 2023 Monitored Bat Roost Sites



# Bat Species By Roost Type



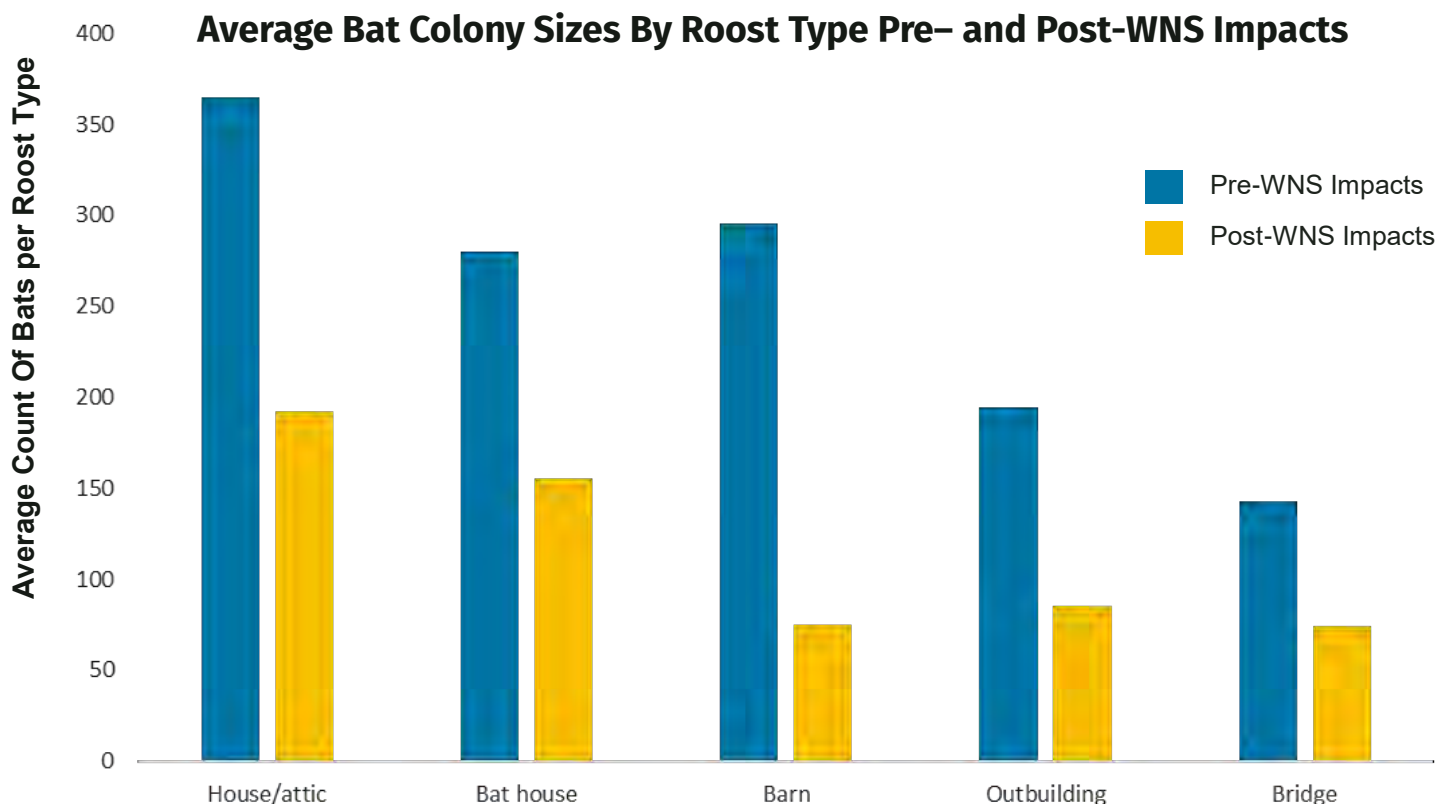
Little Brown  
78 roosts



Big Brown  
89 roosts

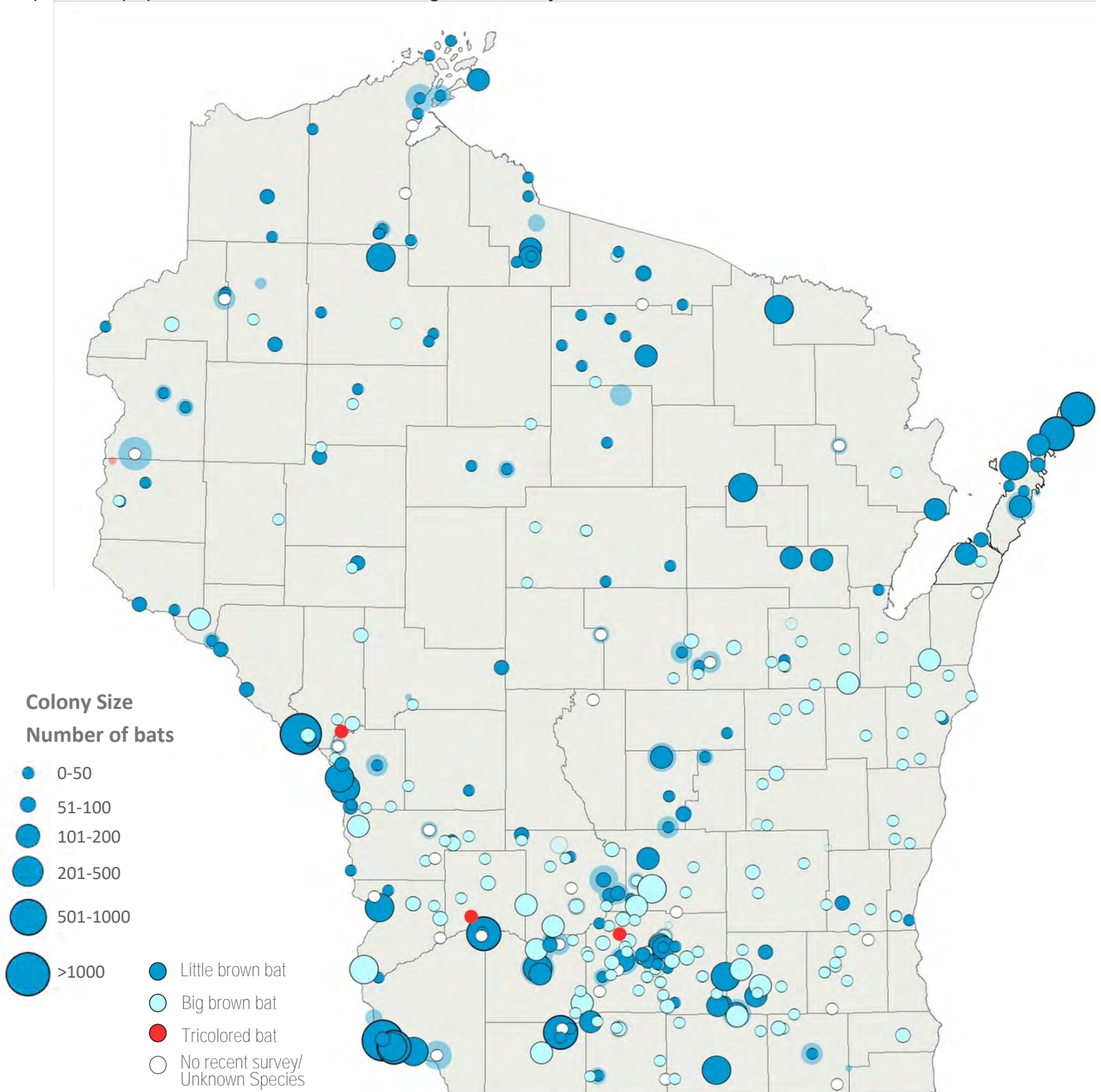
Little brown bats were found most often in bat houses, and big brown bats preferred barns.

Below displays the average little brown bat colony sizes by roost type before WNS impacts (2010-2016) and after WNS began impacting little brown bats (2017-2023). Overall, average little brown bat colonies declined by about 55% after WNS arrived in the region. You can see below that how much colonies declined varied by type of roost with colonies in barns experiencing the highest declines and those in bat houses and bridges experiencing the lowest declines. When one compares average colony size from 2023 to pre-WNS colonies, the picture is a little less bleak— average colony size in bat houses in 2023 was 89% of pre-WNS colonies suggesting bats in monitored roosts are starting to rebound!



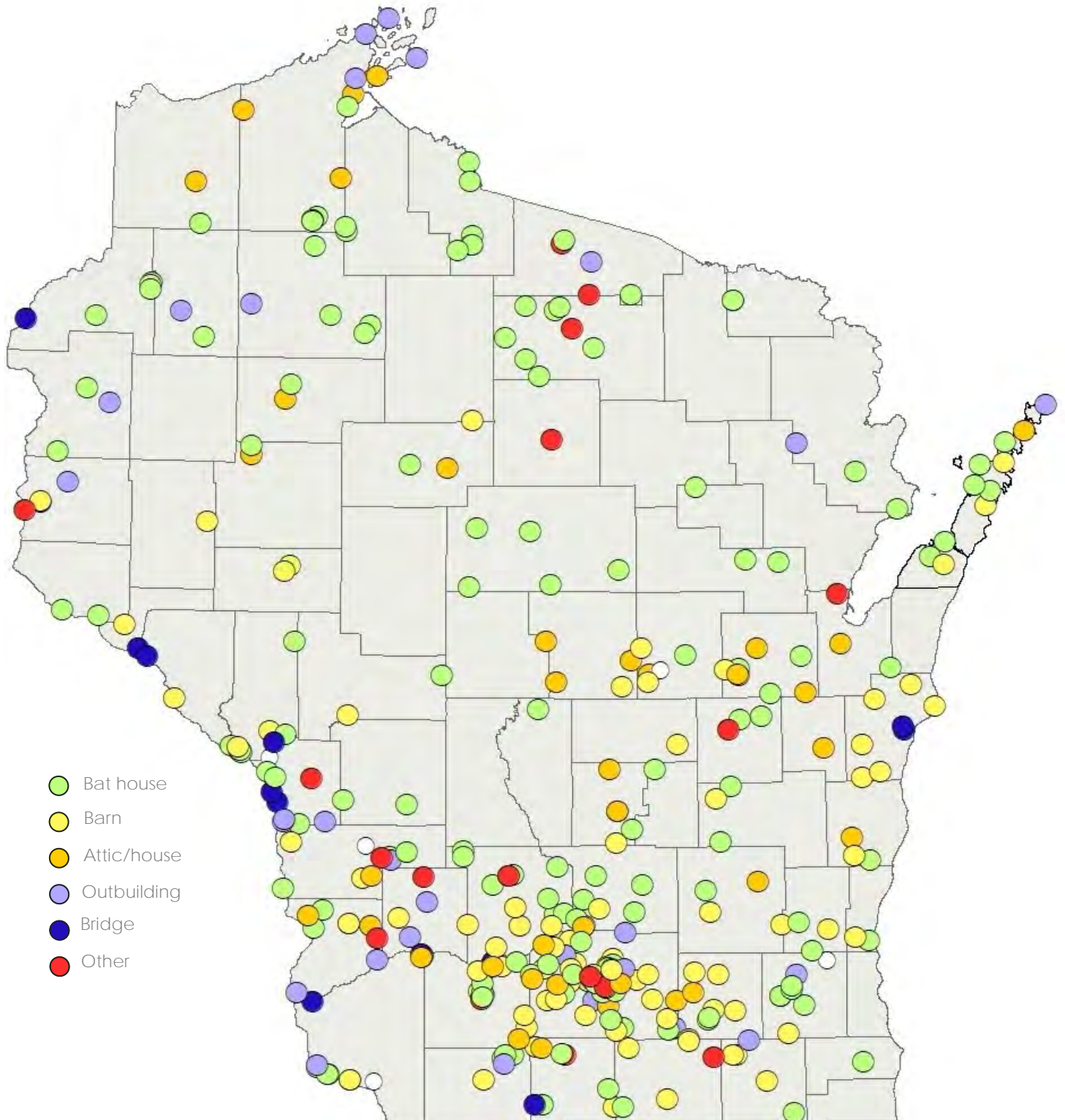
# Bat Roosts By Size

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

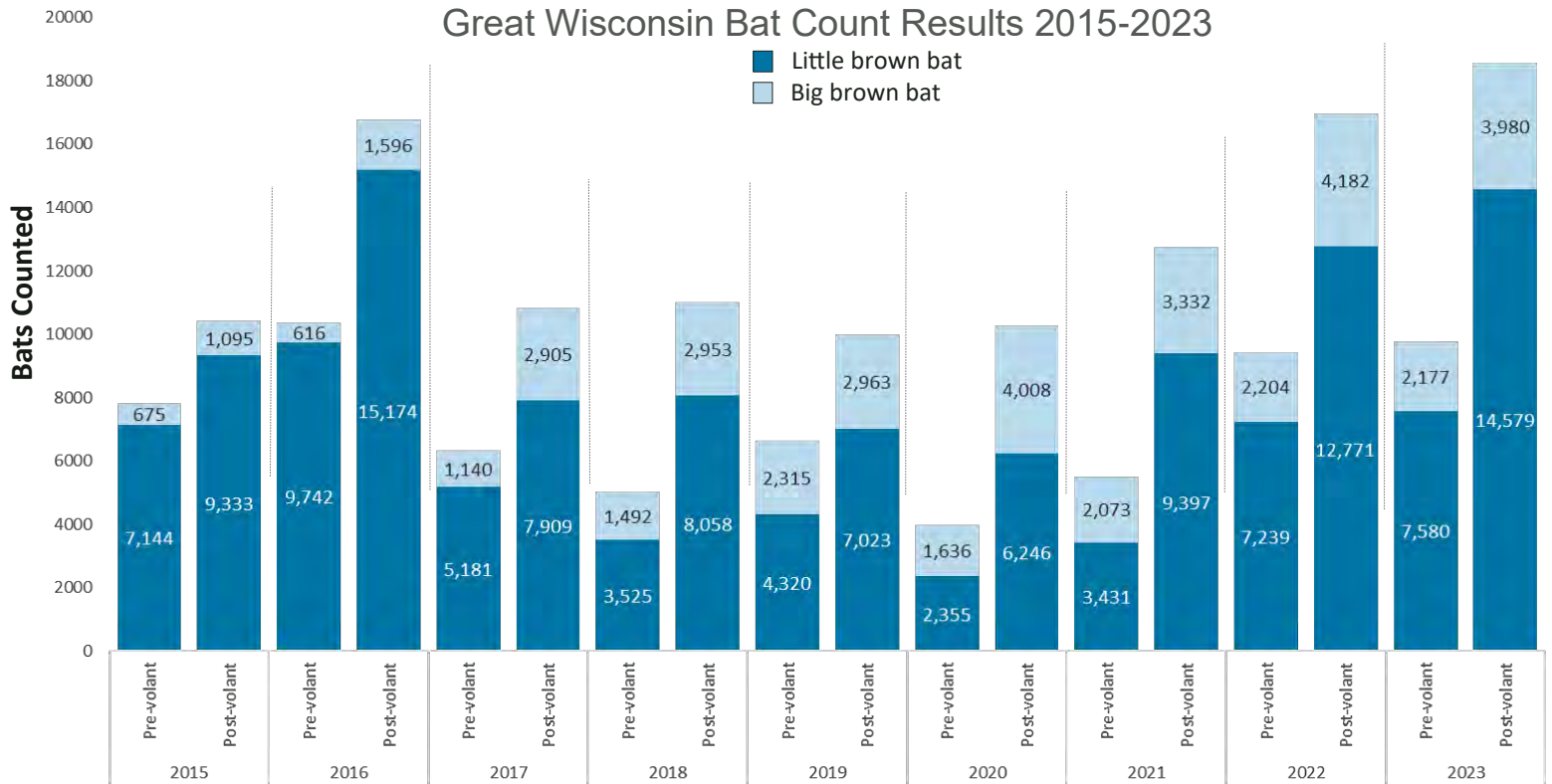
This map depicts the distribution of monitored bat colonies by type of roost. The color of the dot indicates the type of roost.



# Ninth 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 to create a long-term dataset helpful in identifying status and trends of monitored species. 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 monitored colonies. All these counts have been great successes. This year surveyors counted **9,757** bats in June and **17,074** bats in July, the highest total bat count ever during the GWBC! Both 2022 and 2023 little brown bat numbers are nearly to the highest count from 2016!



Volunteers in 2015 wait for bats to emerge at Yellowstone Lake State Park during the post-volancy Great Wisconsin Bat Count. Photo: H. Kaarakka, WDNR



# A Flight of Silver-haired Bats

Much like eastern red bats, silver-haired bats (*Lasionycteris noctivagans*), are a cryptic migratory species that is generally hard to spot in the wild. In summer these bats usually use trees as roost sites and hang under peeling bark or in crevices on tree trunks. Their winter habits are largely unknown in Wisconsin, but biologists suspect most bats migrate to warmer climates. During spring and fall, however, when bats move between seasonal habitats, silver-haired bats are often spotted hanging on buildings.

In September and October 2023, Wisconsin seemed to experience a boom in silver-haired bats spotted on buildings. Most were found along the Lake Michigan shoreline, but we also received silver-haired bat reports from Madison and the Fox River Valley.

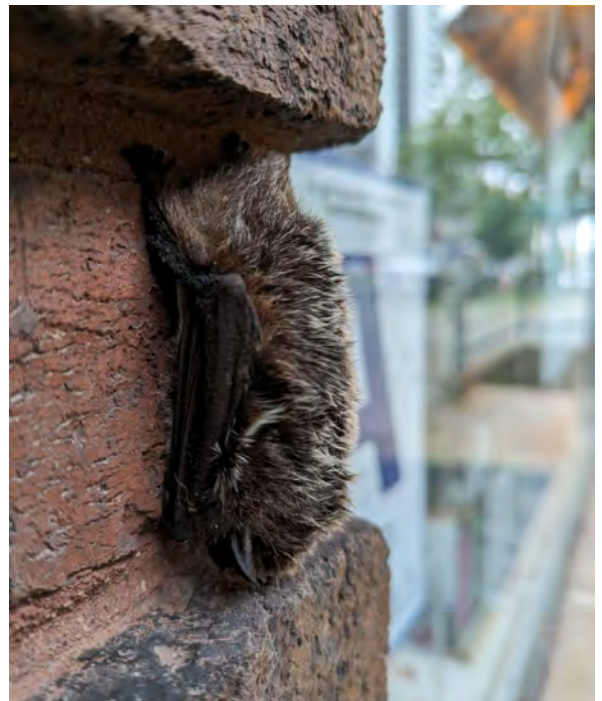
For several years, silver-haired bats have showed up on the same buildings in downtown Milwaukee during fall migration. This October, mammal ecologist Paul White visited the area and observed 21 bats on six buildings! Bats were always solitary even if they were hanging within a few feet of another bat, and most were hanging on brick or stone. Many bats were on the east or southeast sides, likely gaining some heat from the buildings.

The number of bats and annual observations in the same spots suggest that the Lake Michigan shoreline is a migratory corridor for tree bats. In addition to the silver-haired bats, several eastern red bats (another migratory species) were reported in Kenosha and Sheboygan, though earlier in the season. Given how significant and obvious the shoreline is, it isn't surprising bats and birds use it to orient during migration, though one wonders what features they use when they reach the southern point of the Lake?

A silver-haired bat hanging on classic Cream City brick in Milwaukee in October 2023. Photo P. White, WDNR.



A silver-haired bat taking advantage of the presumably warmer brick in a sheltered corner on a building in Milwaukee. Photo: P. White, WDNR.



One of the more brown-colored silver-haired bats observed, demonstrating the variation in color but all with the classic silver tips on the fur. Photo: P. White, WDNR.

# 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. Cameras were placed at two roosts for all of summer 2023 and at several other roosts for two weeklong periods at a time.

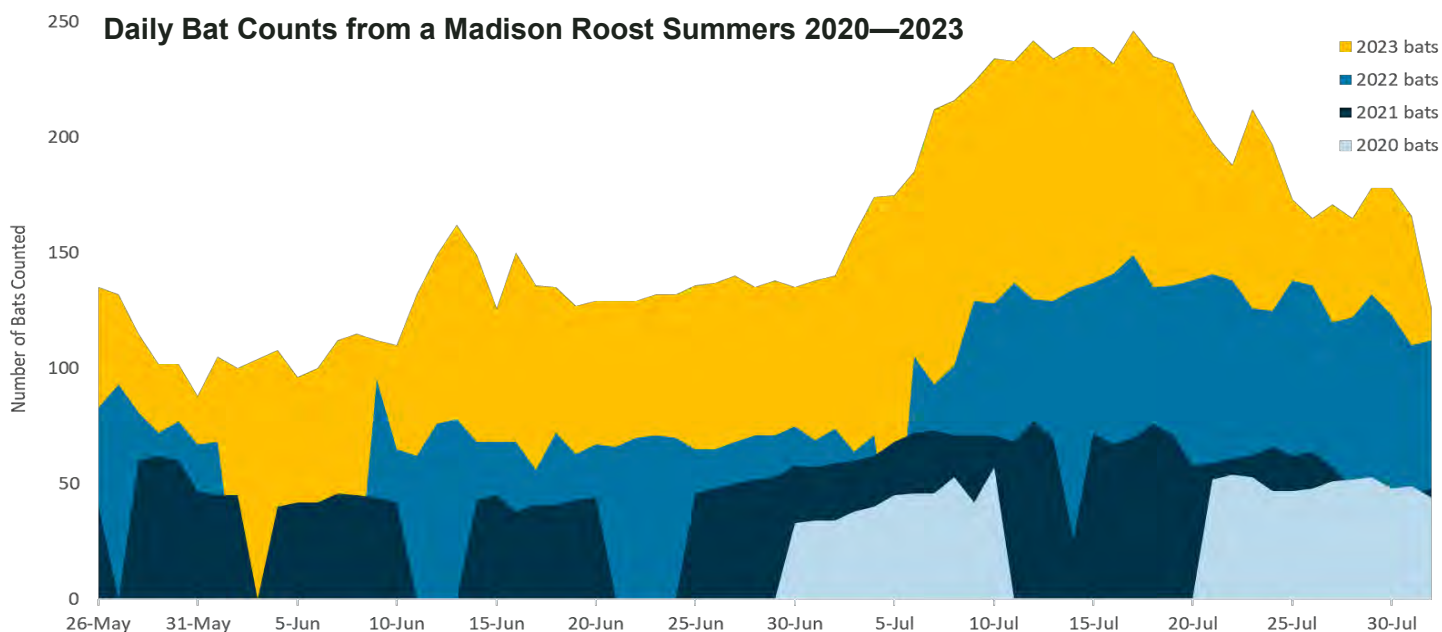
At a site in Madison where we recorded emergence summers of 2020-2023, the daily counts steady increased from 2020 to 2021 (see below) and doubled in 2022 and 2023! As with the big brown bat colony daily counts (page 10), the data start to get confusing after three years of counts. However, several things are becoming clear from these daily surveys:

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

pending 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. The volatility date range we've gleaned from these surveys suggests we're almost spot-on for counting the most flying juvenile little brown bats during the GWBC in mid-July!

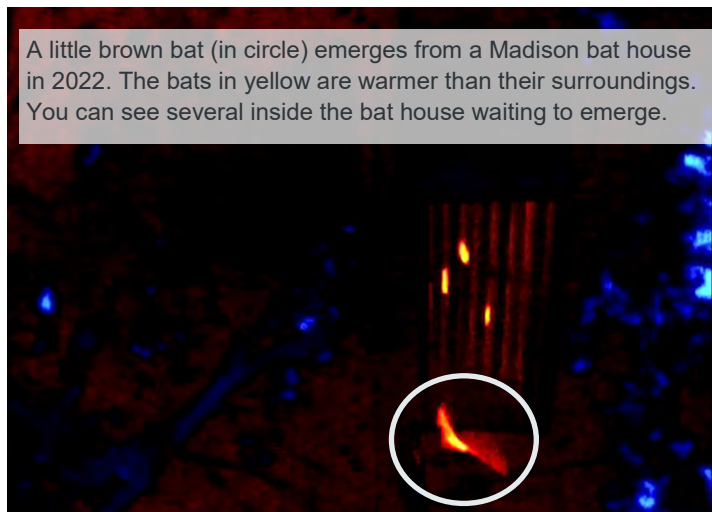
3. There are more bats each year these sites are surveyed. Whether these increases in population are driven by reproduction, survival or immigration remains a mystery. The large jump in 2022 may be due to clearing brush and trees around the box to increase solar exposure making the bat house more suitable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



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. Especially in 2022 and 2023 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 fluid. This doesn't mean that two counts or even one count doesn't provide good 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

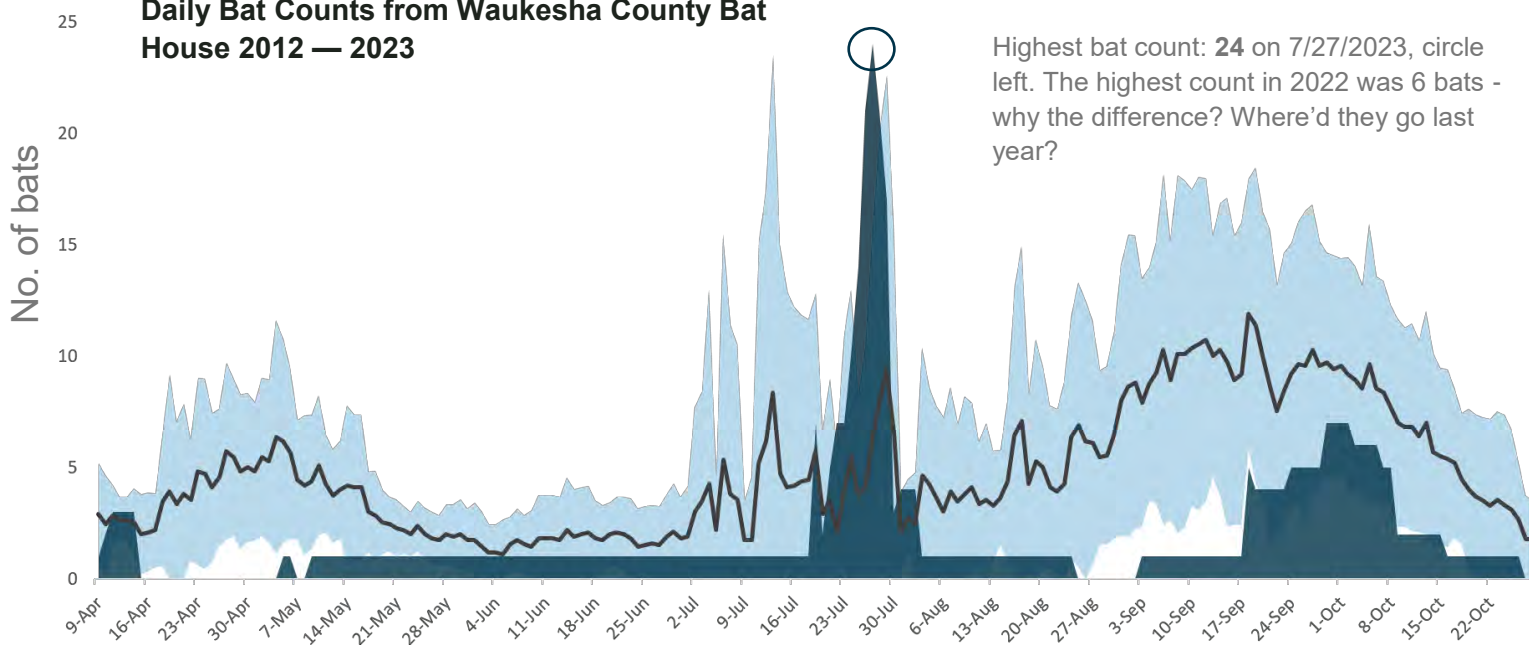
Daily count surveys also continued at the big brown bat house in Waukesha County. In 2023, the most bats counted was 24 in late July. The highest number of bats counted each surveyed year has been between 6 in 2022 and 49 in 2013. When in the summer the most bats were counted has also varied over the years. The most bats ever counted at this roost (49) was observed in mid-July, likely due to volant (flying) juveniles exploring. The brief jump in numbers in 2023 again lines up with this volancy period. Peaks in numbers in spring and fall suggest this may be bats moving between winter and summer habitat. The first bat in 2023 arrived nearly a month later than the first bats in 2022, suggesting weather conditions may play an important role in when big brown bats become active.

Overall, 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 monitored 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 12 years is very impressive!

**Daily Bat Counts from Waukesha County Bat House 2012 — 2023**



This site has been surveyed daily every year since 2012! In this graph, the dark blue indicates counts from 2023, the black line indicates the average daily number of bats at the roost over the past ten years, and light blue indicates how much variation in bat numbers there was on that day over the past ten 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](mailto: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 continue 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 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 to 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.



Happy little brown bats persisting in an attic in Door County. We don't have counts for this roost site before WNS arrived, however the building continues to be home to more than 1,000 little brown bats suggesting pre-WNS colony size was likely 2,000 or more. Continued monitoring is critical to understand recovery of bats from WNS impacts. Photo: H. Kaarakka, 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, 2022 and 2023 too! These recaptures suggest that some bats are indeed surviving white-nose syndrome and stabilizing colonies is not simply bats redistributing among roosts.

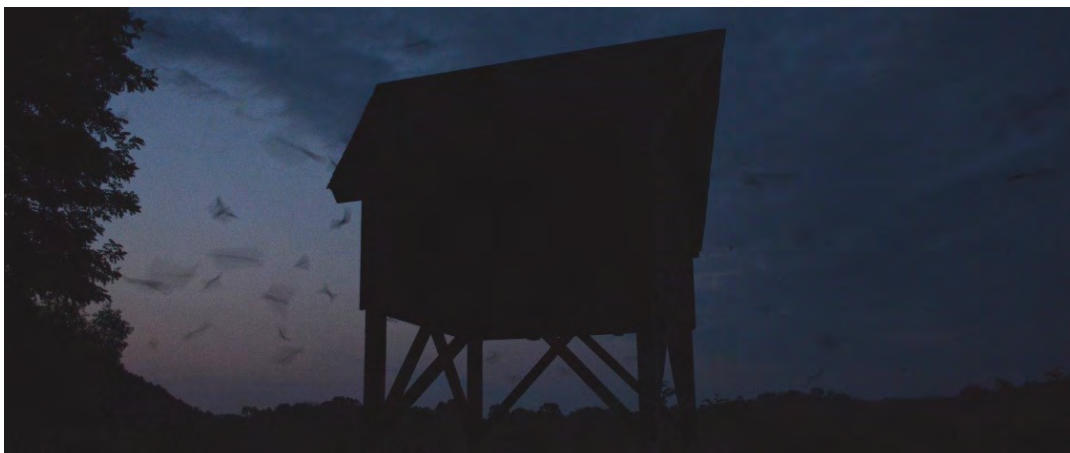
Banding efforts like this one in 2015 are the way biologists have been able to recapture marked individuals years later and assess survival. Photo: H. Kaarakka, WDNR.

# 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 2023.

## Projects Conducted at Reported Roosts

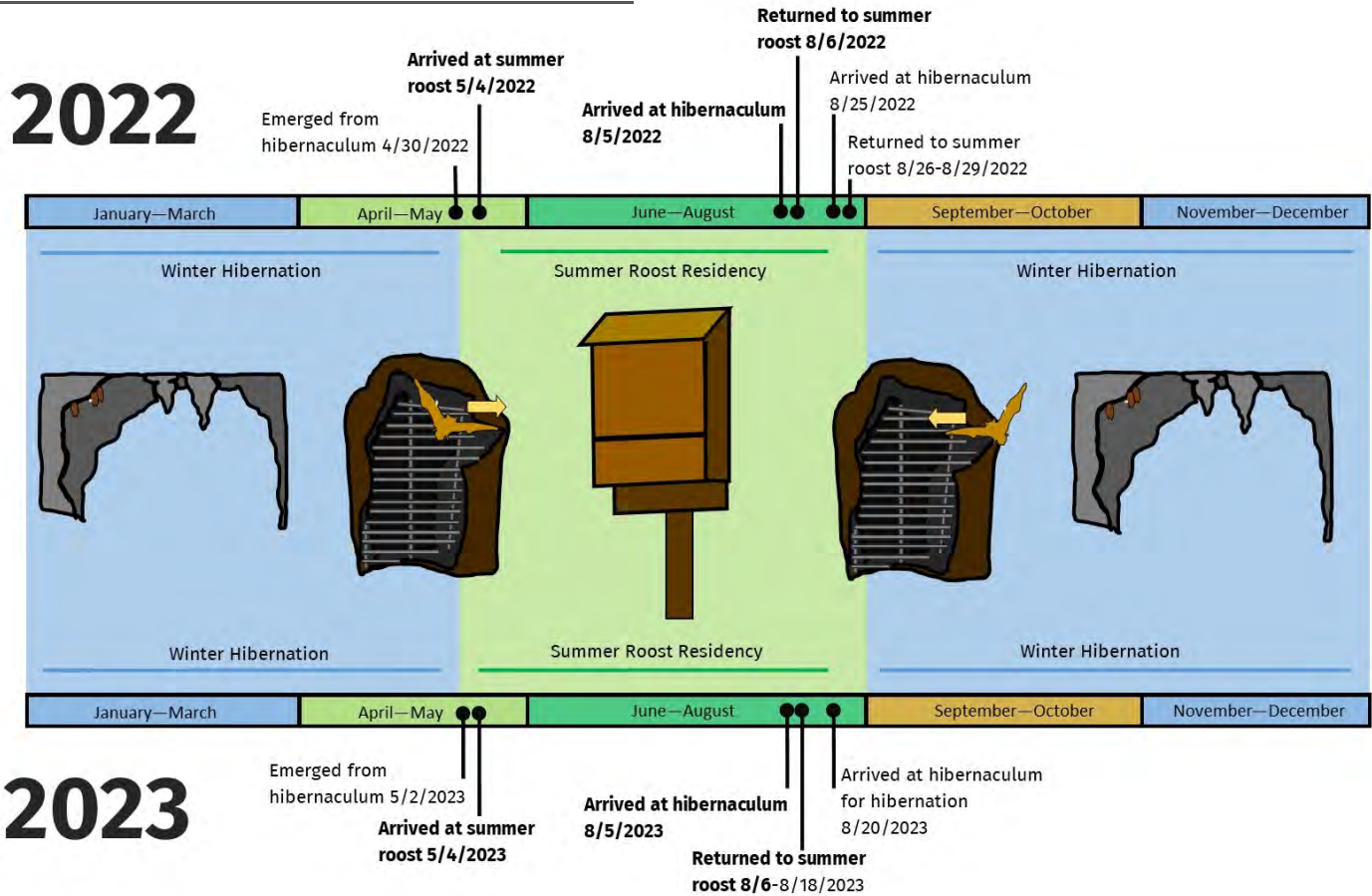
- **Differences in declines at summer roosts.**  
Some declines observed at summer roosts due to WNS-impacts in the state have been significantly more severe than at others. What would cause some roost sites to hold on while others see few or no bats? There are likely many factors impacting survival 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. This year USFWS relisted the northern long-eared bat as endangered, proposed listing tricolored 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.



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

## Bat 53 Seasonal Movements



### 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. Tagging 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. 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 summer roosts flew 30 and 50 miles to a winter site in Pierce County! One of these bats (affectionately called Bat 53) tagged in July

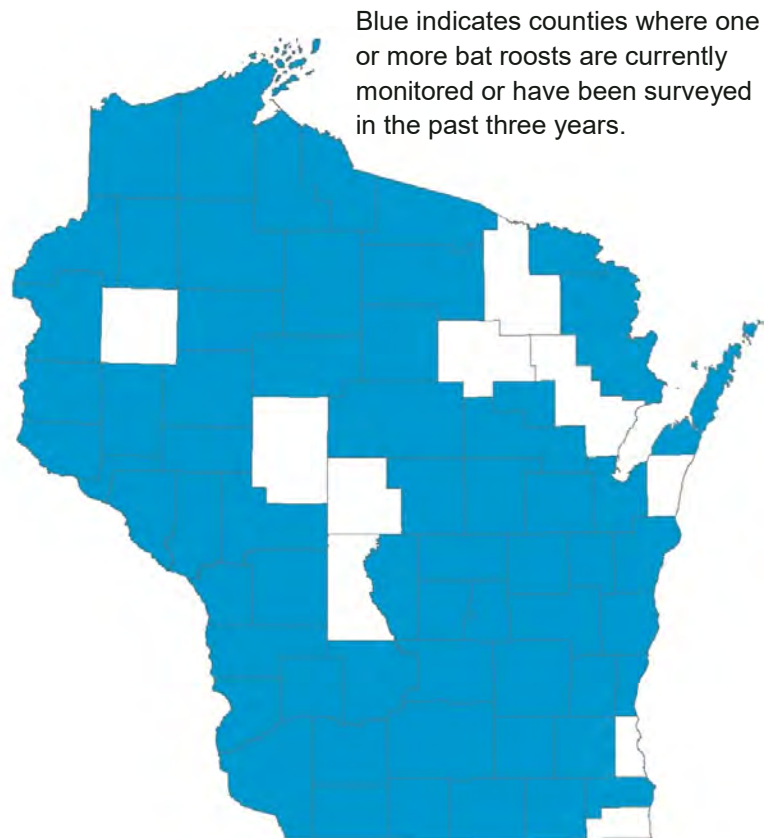
2021, returned to the summer roost site in 2022 and actually made several trips back and forth between summer and winter sites in August 2022. Bat 53 returned in 2023 to roost at her natal roost site and again moved back and forth between summer and winter habitats in August. Her 2022 and 2023 timelines of movements and habitation are depicted above. Rather intriguingly, Bat 53 arrived at her summer roost on the exact same day in May both years (5/4) and made a one-day trip to the hibernaculum the same day in both years (8/5). To our knowledge, this is the first full life history of movements and residency for a little brown bat. Her movements between summer and winter habitat both years in August, as well as similar movements recorded in other little brown bats suggest this may be a common behavior, at least for females.

- We have been able to PIT tag and install stationary readers at five summer roosts revealing a wealth of information on survival, timing of arrival and departure, daily occupancy and timing of daily emergence and returns. We're looking forward to other secrets of bat lives that this marking technique may show us!

# Continuing The Bat Roost Monitoring Project

Over the past 14 years, volunteers and citizen-scientists have helped create an important and invaluable 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 especially 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 Program scientists de-

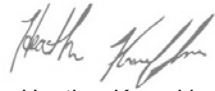


termine what potentially recovering populations look like, the roost data collected by volunteers shows that not all colonies are affected equally. Some habitats may be more suitable than others now that fewer bats are on the landscape. The data also help with understanding reproduction and whether bats in the region might fully recover or if what is observed in recent years is the “new normal” for little brown bats. Given what we’ve seen at many little brown bat roost sites the past couple years even a “new normal” is encouraging!

The summer bat roost monitoring 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, conducting an acoustic survey or giving a bat talk. 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 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](mailto:heather.kaarakka@wisconsin.gov)

One of my favorite bat counts this summer was at Peninsula State Park when 50+ people showed up to watch the bats and sunset. Over 400 little brown bats put on an emergence show from the condo at Welcker's Point despite high winds and cool temps. We're nowhere near the nightly bat show of the million free-tailed bats flying out of Congress Avenue Bridge in Austin, TX, but we're getting there!

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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 Wisconsin Bat Program funding comes from grants and donations and much of our data are collected by volunteers. Thank you for your support.





2023

Wisconsin Bat Program | Wisconsin Department of Natural Resources

673 surveys  
were completed in 2023, counting  
22,952 bats



# Roost Monitoring Report

## Bat houses, houses draw bat crowds

In 2023, bat houses and attics 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 silver-haired 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.



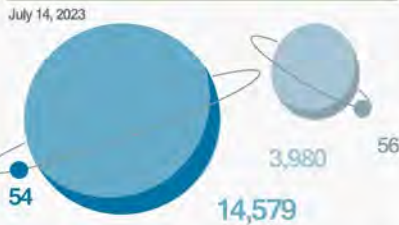
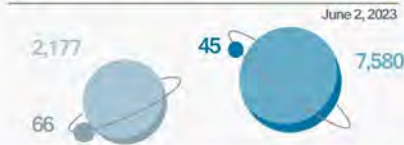
**Silver-haired bat**  
*Lasiurus noctivagans*

This fancy bat lives to eat leafhoppers and midges, and roosts under peeling bark and occasionally on buildings. In winter, silver-haired bats fly south, but sometimes go into torpor in rock cracks and crevices in Wisconsin.

## Great Wisconsin Bat Count

The goal was to count as many roosts as possible in a single weekend, now in its 9th year.

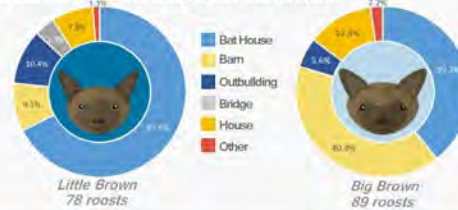
- Little brown bats counted
- Little brown bat surveys
- Big brown bats counted
- Big brown bat surveys



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

## Where do bats live?

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



- 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.

## Help survey bats!

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

Contact Heather at [heather.kaarakka@wisconsin.gov](mailto:heather.kaarakka@wisconsin.gov) or visit [wiatri.net/inventory/bats](http://wiatri.net/inventory/bats)

Number of roosts counted in 2023

Little Brown Bat



78 89



Big Brown Bat