



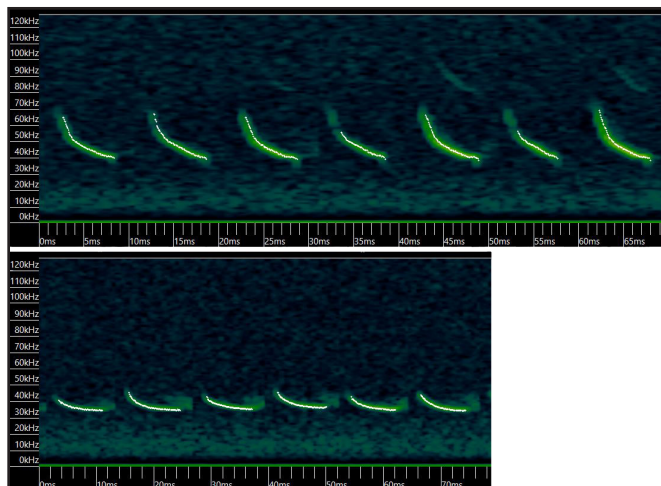
Bat Monitoring in the Apostle Islands, 2015–2019

Bats nationwide are struggling to survive against threats posed by climate change, habitat loss, wind turbines, and a devastating fungal disease called *white-nose syndrome* (WNS).

Among the bats found in the Apostle Islands, the eastern red, hoary, and silver-haired bats are only here in the summer, then migrate to the southwestern U.S., Mexico, and even Central America for the winter. While here, they roost in trees, clinging to branches and bark. The big brown, little brown, northern long-eared, and tricolored bats do not migrate. They hibernate here over the winter, roosting in caves and buildings. Except for big brown bats, which show greater resistance to the disease, the **hibernating bats are highly susceptible to WNS**. In addition, the northern long-eared bat is a federally endangered species under the Endangered Species Act.

Breaking the Ultrasonic Barrier

We established a bat monitoring program in 2015, placing ultrasonic audio recorders in the islands to identify what bat species are present. Bats give different calls while in flight to help them navigate and to locate things like food. Like bird songs, we can identify bat species by their calls, but the calls are ultrasonic—beyond the range of human hearing—so special microphones and software are used to record and identify them. However, also like birds, some bat species have similar calls, and there can be variation in the calls of any one species. As a result, the software we use to analyze and identify the recordings is not 100% accurate. In these cases, a proportion of call files are reviewed “manually” using a spectrogram to verify the results produced by the software.



Spectrogram used to “manually” review bat calls and identify a species when automated identification cannot be made or is questionable. Differences shown include the pitch or frequency of the call (measured in kilohertz on the left axis) and the duration of the call (measured in milliseconds on the bottom axis).

All Accounted For, Plus One!

The six bat species previously documented at the park were reconfirmed, and a seventh species—the tricolored bat—was newly documented (Table 1). The little brown bat and the eastern red bat were the most commonly recorded species, while the big brown bat and northern long-eared bat were the least commonly recorded. Six of the seven species were widely distributed, present at 75% to 95% or more of survey sites each year. The tricolored bat was less so, present at only 52%–86% of survey sites each year and showing a decreasing trend after 2015. Decreasing trends were also noted for the northern long-eared bat after 2015 and, ironically, for the little brown bat beginning in 2016.

Table 1. Bat species documented at Apostle Islands NL before the start of this monitoring program in 2015 and after five years of acoustic monitoring (2019). Asterisk (*) indicates winter hibernating species.

Common Name	Scientific Name	Pre-2015	2019
Big Brown Bat *	<i>Eptesicus fuscus</i>	Yes	Yes
Eastern Red Bat	<i>Lasiurus borealis</i>	Yes	Yes
Hoary Bat	<i>Lasiurus cinereus</i>	Yes	Yes
Little Brown Bat *	<i>Myotis lucifugus</i>	Yes	Yes
Northern Long-eared Bat *	<i>Myotis septentrionalis</i>	Yes	Yes
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	Yes	Yes
Tricolored Bat *	<i>Perimyotis subflavus</i>	No (close to edge of range)	Yes



Red bats and little brown bats were the most commonly recorded species in the islands. Red bats (*left*) are a migratory species, while little brown bats (*right*) spend the winter hibernating here in the north, roosting in buildings and caves. NPS PHOTOS

Interesting observations were made of big brown and hoary bats. Big brown bats were heard on 71% of recording nights in 2015, then on 50% or fewer nights in subsequent years. But in 2015, a very high number of the big brown call files were recorded over the septic field behind the ranger residence at both Rocky and Stockton Islands. It is possible that big brown bats were roosting in the buildings adjacent to each of these sample sites.

Hoary bats were recorded on 50% to 68% of nights each year. One site on Outer Island had extremely high hoary bat activity in 2016, with over 600 call files per recording night. This site also had the highest hoary bat activity of any of the island sites in 2018 and 2019. This sample site is in an open wetland area along a stream

corridor, which provides excellent foraging habitat for this species.

Activity levels for four of the seven species (big brown, eastern red, hoary, and silver-haired bats) appear to be stable or increasing slightly. The remaining three species (little brown, northern long-eared, and tricolored bats) appear to have decreasing trends in activity levels. These three species are all highly susceptible to WNS, and we suspect the disease is most likely causing the observed declines.

The Future of Bat Monitoring

When this project began, the Great Lakes region was at the leading edge of the WNS spread. This monitoring program helped parks to document baseline data on their bat populations and to assess changes over time.

We are working with the NABat Midwest Bat Hub (<https://midwestbathub.nres.illinois.edu/>) to create statistical models of bat occupancy, particularly those most affected by WNS. *Occupancy* measures the probability that a species is using an area, while taking into account the fact that we cannot always perfectly detect the species.

The Great Lakes Network handed over the equipment and responsibility for coordinating bat monitoring to Apostle Islands staff in 2023.



Bats of the Apostle Islands (top): Big brown bat, northern long-eared bat (WISCONSIN DNR/D. REDELL), silver-haired bat (WISCONSIN DNR PHOTO), hoary bat (USGS/P. CRYAN); (bottom) eastern red bat, tricolored bat, and little brown bat (NPS PHOTOS UNLESS CREDITED OTHERWISE).