



Bat Monitoring in Great Lakes Network Parks

Why Monitor Bats?

Bats are one of nature's pest controllers. In the United States, they feed almost exclusively on mosquitoes and other insects that can be agricultural pests. One study estimated that bats save the U.S. agricultural industry \$22.9 billion each year by reducing pesticide application costs.

Keeping insect populations in check is a role that conveys crucial benefits for humans and entire ecosystems. Yet, bats in the United States face several threats, including wind energy turbines, land use change, and white-nose syndrome.

White-nose syndrome (WNS) is the single biggest threat to many bat species right now. It is caused by a cold-hardy fungus that grows on the hairless parts of hibernating bats, causing them to awaken prematurely and thus starve to death as they use energy with no food source available to replace it. More than half of the 47 bat species living in the United States and Canada rely on hibernation for winter survival. Already, in the 10 years since it was first discovered in New York, WNS has killed more than 6 million bats in the United States and Canada, and spread to 29 states and 5 Canadian provinces in the east and Midwest (*see map*). Then, in 2015, the fungus was discovered in Washington State, more than 1,000 miles from the leading edge of the disease. How it got there is uncertain, but the ease with which the fungus can move is unsettling.

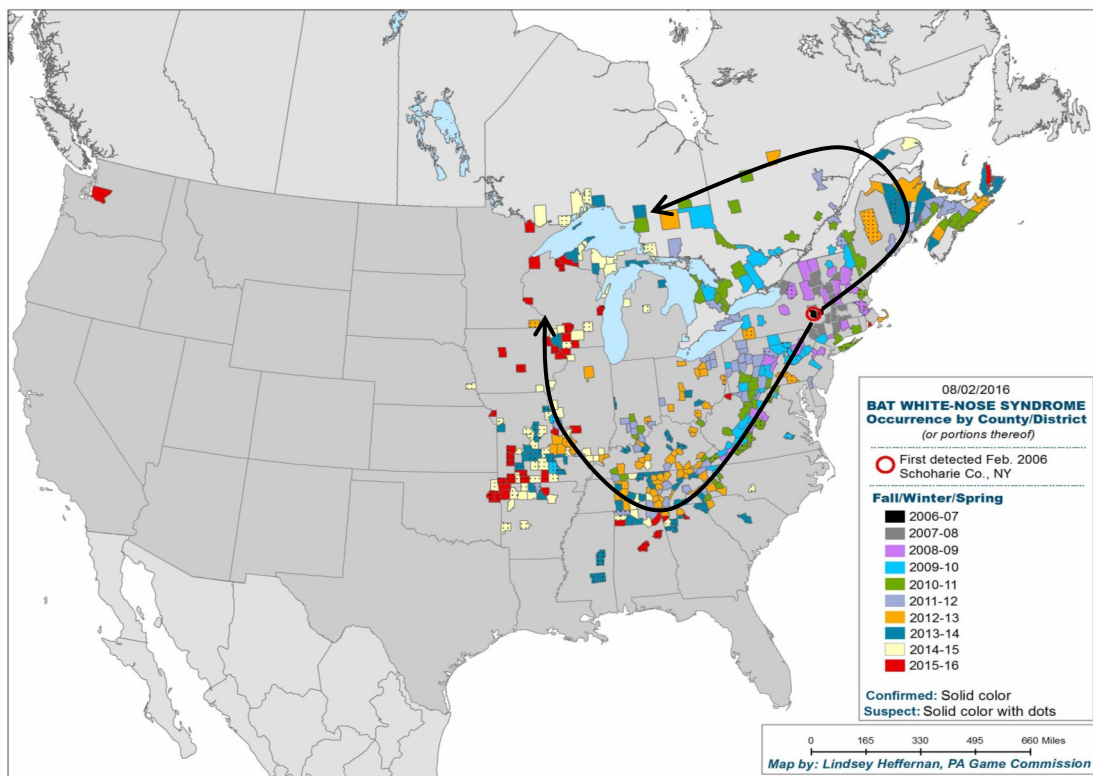
Ultrasonic Echoes

There are two common ways to monitor bat populations and activity. One is to catch them in nets, fit them with identification tags or radio telemetry (or both), and release them. We are using the less intrusive method of acoustic bat monitoring—collecting recordings of bat echolocation calls.

Bats find their food and navigate while flying by using **echolocation**. To do this, a bat sends out ultrasonic sound waves that hit a tree, a person, or a mosquito and bounce back to the bat's ears as an "echo." Bats use these echoes to figure out where the object is, how big it is, and its



A bat recording station on the St. Croix River. NPS photo.



Distribution of white-nose syndrome in North America as of August 2016. Arrows indicate general dispersal pattern from where WNS was first detected. Map produced by Pennsylvania Game Commission and available at www.whitenosesyndrome.org.

shape. If it's a tree or a person, the bat changes direction. If it's a mosquito or a moth, it sends out sound waves more rapidly to find exactly where it is and catch it.

Bat echolocation calls are ultrasonic, meaning they are greater than 20 kHz and above the range of human hearing. So we use recorders (song meters) equipped with an ultrasonic microphone that is placed two meters (six feet) or more above the ground. The recorder turns on when a bat's echolocation call is detected. Later, the digital recordings are run through a computer program that compares them to a set of known calls and makes an identification. Similar to identifying birds by their songs, bats can be identified by their echolocation calls. But the program is not fool-proof, so we visually inspect a subsample of *sonograms*, or graphs, that show the frequency and duration of the calls, to determine the accuracy of the computer identifications. This process allows us to use the recordings to create an inventory of what bat species are in each park and estimate the relative abundance of each identified species.

We began collecting recordings in four of the network parks in 2015. We are sampling a diversity of habitats, including the historic range of the federally endangered Indiana bat and the threatened northern long-eared bat. Three to six recorders are placed in each park from June through mid-August, and recordings are collected nightly between 6:00 p.m. and 8:00 a.m.

What's Out There?

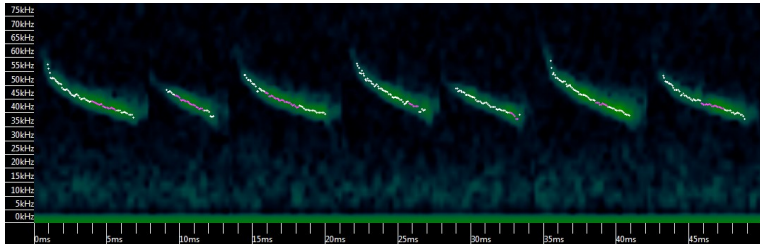
Preliminary analysis of 2015 data confirmed the presence of six species in the four parks (*see graph*). The **little brown bat was the most commonly recorded species** in all four parks, and the **northern long-eared bat was the least common**, rising above 1% of the total calls only on Isle Royale. Two other species—the Indiana bat and the tri-colored bat—may have been recorded, but because our parks are outside the current estimated ranges of both species, confidence in those computer-generated identifications is low.

In 2016, we more than doubled our sampling effort by collecting recordings at 202 sites across eight parks. This generated over 450,000 recordings. The 2015 and 2016 data are being analyzed together, and we are working to improve the quality of data collected and our ability to analyze and interpret it.

The National Park Service dedicated \$3 million in 2015 and 2016 to address WNS-related priority issues in parks across the country. Monitoring in the Great Lakes Network parks is supported by a portion of those dedicated funds. ●



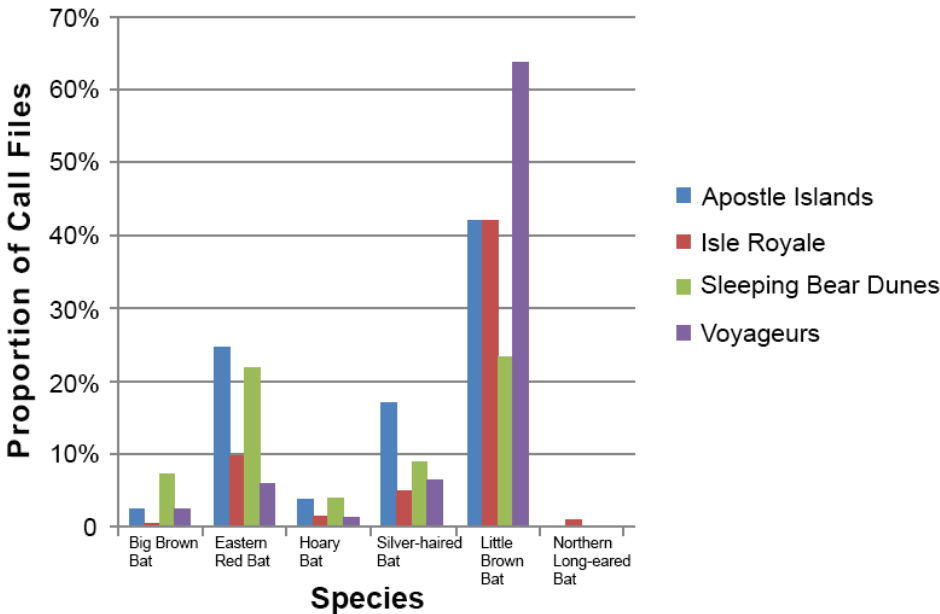
Two little brown bats, one healthy and one with white-nose syndrome. Photos by Brian Heeringa, USFS (left), and U.S. Fish and Wildlife Service (right).



A sonogram of a little brown bat's echolocation calls. NPS photo.



Northern long-eared bat. NPS photo/Paul Brown.



Proportion of call files collected per species at four network parks, 2015. The little brown bat was the most common species heard in all four parks.