ENDANGERED SPECIES GRANT PROJECT REPORT—INDIANA

Impacts of White-Nose Syndrome on a Bat Community Near the Indianapolis Airport

"Wing scoring" a bat to check for damage from WNS.

Current Status

Year 1.5 of a 1.5-year project

Funding Sources and Partners

Endangered Species Grant Program (E13R1)
Indiana State University
Indianapolis Airport Authority

Project Personnel

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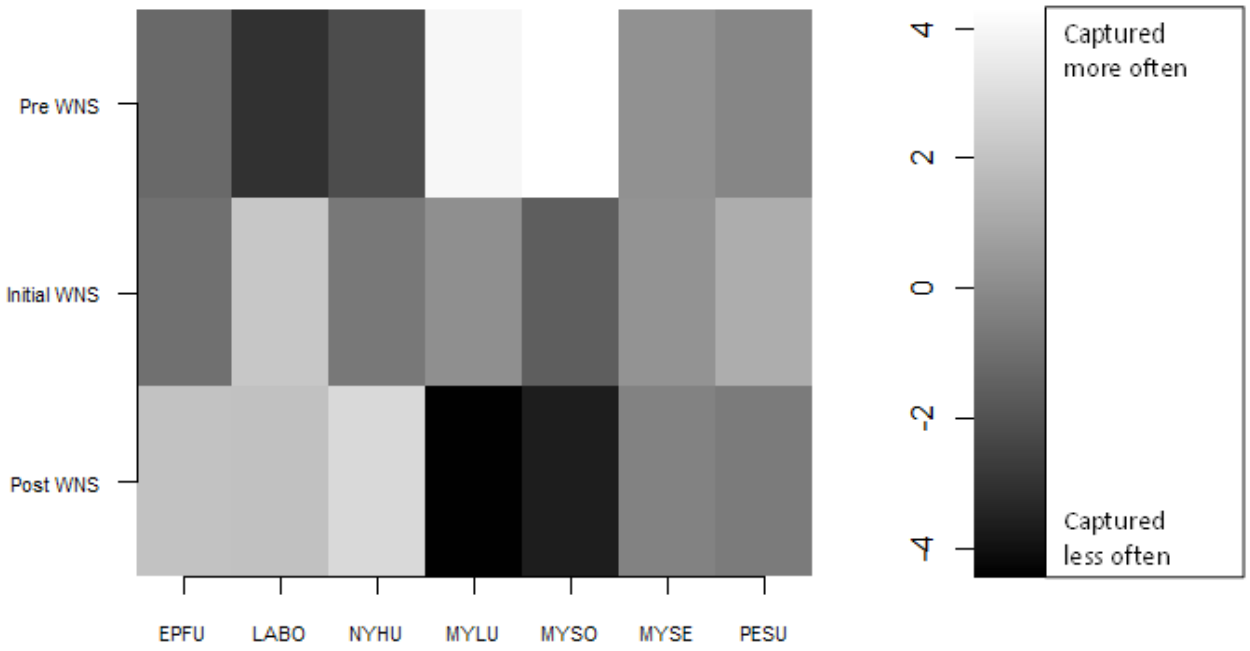
Background and Objectives

White-nose syndrome (WNS) is a disease that affects many species of bats that hibernate in caves. The disease is caused by a fungus that was likely introduced to the United States around 2006. Since then, six species of bats have suffered population declines, as documented by cave surveys. It has been suggested that declines of highly affected species might influence the composition of bats on the landscape. One prediction has even stated that the little brown bat *(Myotis lucifugus)* will be wiped out of the Northeast and Midwest because of WNS. This is an alarming prediction because the little brown bat was common before the onset of the disease.

WNS was detected in Indiana in 2011, but the fungus may have been present earlier. At the end of winter 2012-13, WNS had been detected in 34 caves in 10 Indiana counties. At least 16 of these are major bat hibernacula (habitat in which a bat hibernates). While we have not detected an overall decline in the bat population during summer survey work, we had not assessed individual species responses to WNS.

It is important to measure the effects of WNS in a well-studied bat community so that the impacts of WNS can be distinguished from other factors that might affect bat community composition. Indiana State University has gathered data on the bat community near the Indianapolis International Airport since 2002, with additional survey data available from 1997-99. These data were collected to fulfill the obligations of a Habitat Conservation Plan between the U.S. Fish and Wildlife Service (USFWS) and the Indianapolis Airport Authority. Each summer, from May 15 to August 15, we monitor 10 net sites along the East Fork of White Lick Creek, near Plainfield. Seven bat species are routinely captured at this study site: the big brown bat *(Eptesicus fuscus),* the little brown bat, the Northern long-eared bat *(Myotis septentrionalis),* the Indiana bat *(Myotis sodalis),* the tricolored bat *(Perimyotis subflavus),* the Eastern red bat *(Lasiurus borealis),*



Big brown (EPFU), red bats (LABO), and evening bats (NYHU) were caught less frequently than expected before WNS and more frequently than expected post-WNS. This is shown by the general black-to-white trend in the EPFU, LABO, and NYHU columns of the figure. The opposite is true of little brown bats (MYLU) and Indiana bats (MYSO). Northern long-eared bats (MYSE) and tri-colored bats (PESU) were captured at similar rates before and after WNS.

and the evening bat *(Nycticeius humeralis);* the first five of these species are known to be impacted by WNS.

Methods

Mistnetting Surveys—We compiled capture data from the Indianapolis Airport site for 2002–14. We standardized capture data by using only data from the 10 semi-permanent net sites, each of which is netted three times per summer. Net effort varies slightly from one survey to the next, so we calculated capture rates per net-night (one double-high 9-meter net and one triple-high 9-meter net open for five hours) for each site and night. We recorded sex, age, reproductive condition, mass (g), forearm length (mm) and wing damage due to WNS for all captured bats. Degree of ossification of the finger joints was used to assess age (juvenile or adult), and adults were banded with a unique aluminum forearm band. WNS wing-damage data have been collected for this project since 2011. While handling bats, we followed the guidelines of the American Society of Mammalogists for the use of wild mammals in research. All bats were released at the point of capture. We followed current WNS decontamination protocols as specified by USFWS.

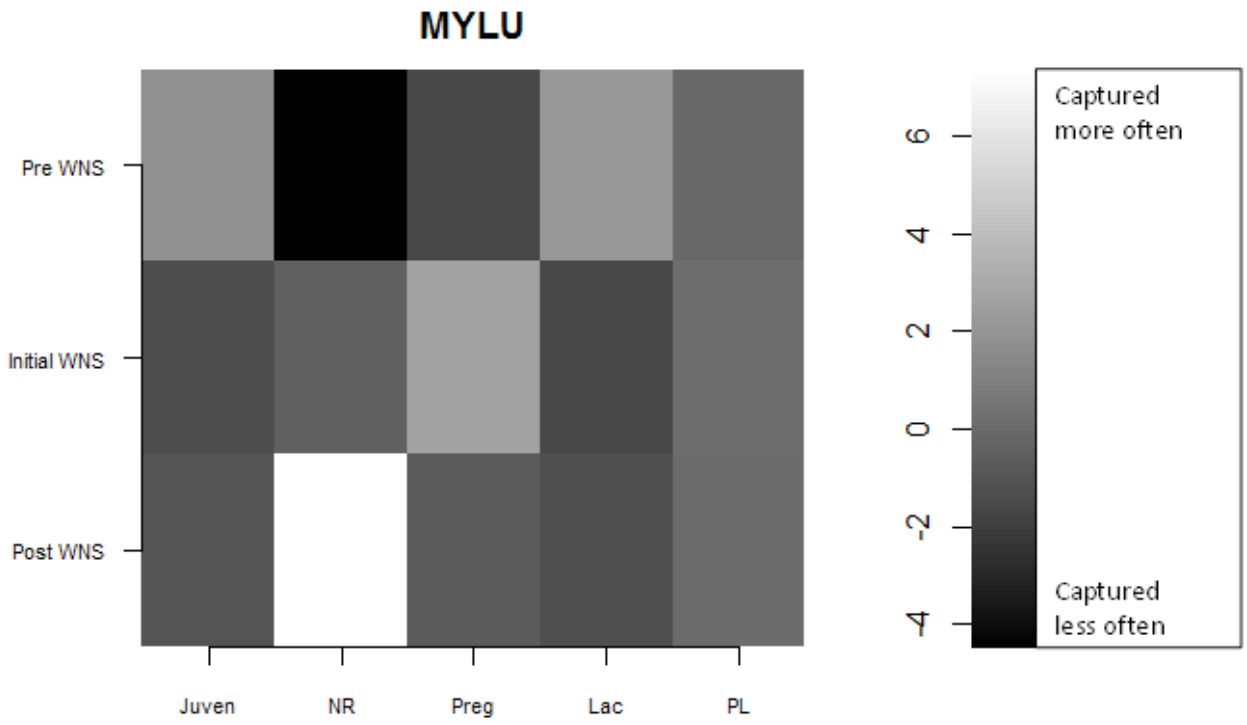
Analysis—Bat captures were grouped by species (big brown bats, red bats, Indiana bats, Northern long-eared bats, little brown bats and tricolored bats) and by time period (pre-WNS 2002-2010, initial-WNS 2011, and post-WNS 2012-2014) into a six-column by three-row table. We used a chi-squared analysis to test for changes in the relative frequencies at which species are caught. If one species of bat has been caught more (or less) often than in the past, the chi-square test will show significance. We also used the chi-squared test to check for changes in frequency of capture of each reproductive class (pregnant, lactating, post-lactating, or non-reproductive adult females or juveniles), grouping by species.

Results

We observed significant changes in the frequency at which species were caught. Before WNS arrived in Indiana, little brown bats and Indiana bats were caught more often than they are post-WNS. Conversely, big brown bats and red bats were caught more often after WNS than they were before. We did not detect a large change in capture rates for tricolored bats and Northern long-eared bats.

Since 2011, we have observed 752 bats with no signs of WNS while examining wing membranes, 183 bats have shown a wing score of one, eight bats a wing score of two, and one bat showed a wing score of three. A higher score correlates to more severe wing damage. These numbers are similar to previous studies of WNS wing membrane damage.

Post-WNS, we detected changes in the relative occurrence of reproductive class for every species except Indiana bats. The change in the frequency of detection of reproductive classes was most apparent for non-reproductive adults. Before WNS was present, few to zero non-reproductive adults were caught. Post-WNS, we captured more non-reproductive adults than expected based on random chance. This trend can be seen clearly when assessing changes in capture rates for little brown bats. We also observed a significant increase in the number of non-reproductive females captured for big brown bats, red bats, little brown bats, Northern long-eared bats, and tri-colored bats.



Little brown bats (MYLU) showed a significant change in relative frequency of capture. The largest difference is shown in the non-reproductive adult category.

	Big brown bat	Red bat	Little brown bat	Northern long-eared bat	Indiana bat	Evening bat	Tri-colored bat	**Total**
Pre WNS (2002-2010)	1	0	0	0	0	0	2	**3**
Initial WNS (2011)	0	0	0	0	0	0	0	**0**
Post WNS (2012-2014)	20	10	4	7	1	3	6	**51**

Number of non-reproductive adult female bats caught during long-term monitoring at the Indianapolis Airport from 2002–2014.

For every bat species, more non-reproductive adult females were captured post-WNS than during the other time periods. In the nine years of netting pre-WNS, only three non-reproductive adult females were captured. This contrasts starkly to the 51 captured in the three post-WNS years. Bats that are affected by WNS at winter hibernation sites are expending valuable energy to fight off the infection once they emerge from hibernation. One of the consequences of this resource expense is that bats may not have the energy necessary to undertake pregnancy and lactation and, therefore, may opt to forgo pregnancy after facing a WNS infection. In addition to the direct effects of WNS on bat populations, we will need to consider how this decline in reproductive output may affect population growth and stability, post-WNS.

While this epidemic has been devastating for little brown bats, Indiana bats, Northern long-eared bats, and tri-colored bats, our results suggest that some bat populations are stable or increasing. Three years after WNS was detected in Indiana, big brown bats are showing signs of resilience to the disease at our central Indiana study site. Evening bats and red bats are not known to be affected by the disease and show no signs of negative impact.

Cost: $50,000 for the complete 1.5-year project.