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Investigating White-Nose Syndrome in Bats

A devastating, emergent disease afflicting hibernating bats has spread from the northeast to the mid-Atlantic region of the United States at an alarming rate. Since the winter of 2006–2007, hundreds of thousands of insect-eating bats from at least nine states have died from this new disease, named White-Nose Syndrome (WNS). The disease is named for the white fungus often seen on the muzzles, ears, and wings of bats. This disease poses a threat to cave hibernating bats of the United States and potentially all temperate regions of the world. USGS scientists from the National Wildlife Health Center (NWHC) and the Fort Collins Science Center (FORT), in collaboration with the New York State Department of Environmental Conservation, the U.S. Fish and Wildlife Service, and others have linked a newly described, cold-loving fungus to WNS (Blehert and others, 2009).

Affected bats were first photo-documented by a recreational caver in Howes Cave near Albany, N.Y., during the winter of 2005–2006. As of March 2009, WNS has also been found in New Hampshire, Vermont, Massachusetts, Connecticut, Pennsylvania, New Jersey, West Virginia, and Virginia, threatening the already endangered Indiana bat (*Myotis sodalis*) and Virginia big-eared bats (*Corynorhinus townsendii virginianus*), as well as several other bat species. If WNS continues to spread, the endangered gray bat (*Myotis grisescens*) will also be at risk for severe population declines.

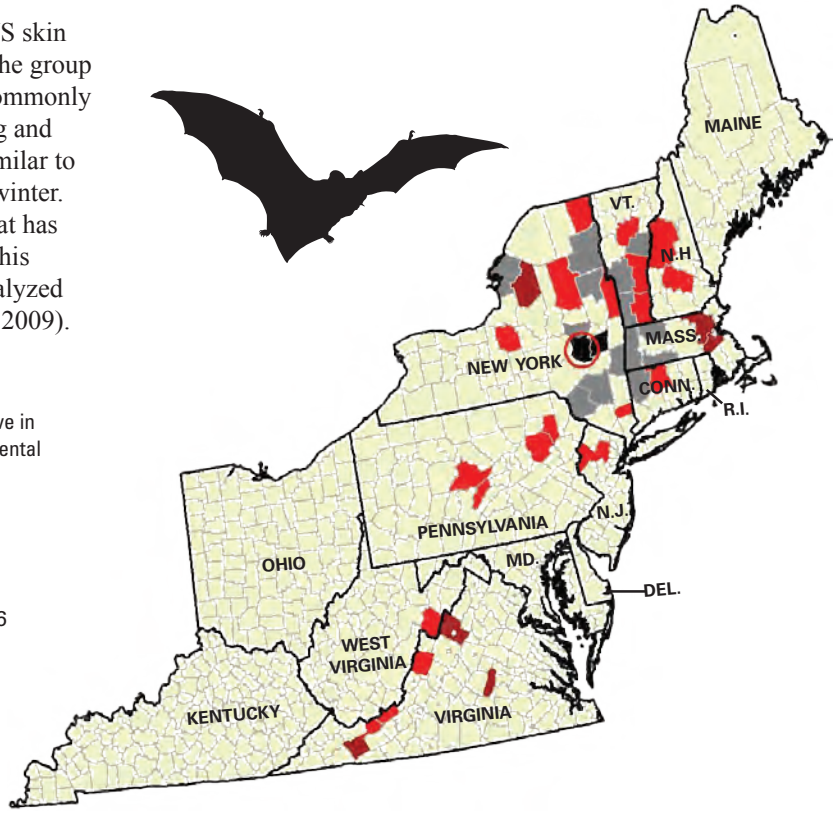
NWHC scientists isolated a fungus causing the WNS skin infection in April 2008 and identified it as a member of the group *Geomyces* (Blehert and others, 2009). These fungi are commonly found in association with soil and are capable of growing and reproducing at refrigerator temperatures around 40°F, similar to the conditions of caves where bats hibernate during the winter. The fungus is a newly described species of *Geomyces* that has been named *G. destructans* (Gargas and others, 2009). This fungus had infected the skin of 90 percent of the bats analyzed from all the states affected by WNS (Blehert and others, 2009).

Top image: Brown bats with White-Nose Syndrome in a hibernation cave in New York. (Photo by Nancy Heaslip, New York Department of Environmental Conservation)

A. Klein, USGS NWHC

USGS staff necropsy a little brown bat at the National Wildlife Health Center.

Additionally, many of the affected bats were emaciated and had left their hibernacula during winter, several months before normal spring emergence. *Geomyces destructans* invades the skin of bats, producing ulcers (Meteyer and others, 2009) and may alter hibernation arousal patterns, which can cause emaciation.



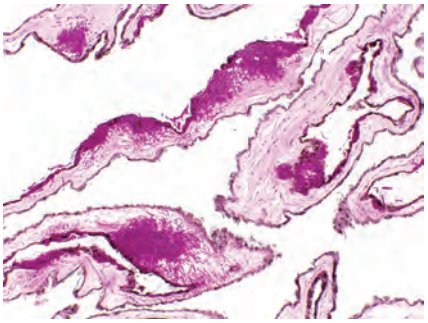
Occurrence of bat White-Nose Syndrome in the United States, by county. (Cal Butchkoski, Pennsylvania Game Commission)

A. Hicks, New York Department of Environmental Conservation

A little brown bat found in a New York cave shows fungal growth on its muzzle, ears, and wings.

Researchers do not yet know if WNS emerged because *G. destructans* was introduced into caves or if the fungus already existed in caves and began infecting bats for some other reason. WNS is likely spread by contacts among bats and with their environments. However, movements of humans and other animals between caves could also promote the spread of WNS. Hibernating bats drop their metabolism and temperatures to within a few degrees of cave temperature, ideal for growth of *Geomyces destructans*. Scientists are currently working to determine if fungal infection is the sole cause of WNS-associated bat mortality.

Bats are adapted to high rates of survival and produce few offspring. Most of the WNS-affected bat species are long-lived (10 to 20 years) and have a single pup per year. Subsequently, bat populations do not fluctuate widely in numbers over time, and it is unlikely that species of bats affected by WNS will recover quickly. The sudden and widespread mortality associated with WNS is unprecedented in hibernating bats, among which widespread disease outbreaks have not been previously documented. In temperate regions, bats are primary consumers of insects; however, the true ecological consequences of the large-scale population reductions currently under way among hibernating bats are not yet known. Parallels can be drawn between the threat posed by WNS and chytridiomycosis, a lethal fungal skin infection that has recently caused precipitous global population declines among amphibians.



C. Meteyer, USGS NWHC

A microscopic image of folded wing membrane from a bat infected with WNS. The dark colored elements are fungal hyphae invading wing connective tissue.

Future WNS Research Directions

- Determine the origin of the WNS fungus.
- Predict the potential for future WNS spread.
- Investigate *G. destructans* pathogenesis mechanisms.
- Develop strategies for WNS control and mitigation.
- Identify bat survival strategies. Are there resistant bats?

References

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Current Studies

In addition to the ongoing investigation to document the occurrence and spread of WNS, the NWHC has initiated several studies, in collaboration with partners, to enhance WNS diagnostic capabilities and to increase our understanding of *Geomyces destructans,* the fungus that causes the WNS skin infection. A rapid and specific test for detection of the WNS-associated fungus is under development. An infection trial is under way to identify mechanisms by which *G. destructans* may be transmitted bat-to-bat and to determine if the fungus is the sole cause of WNS. In addition, an environmental survey of caves is under way to characterize the distribution of *G. destructans* in the eastern U.S. and to determine the role that cave sediments may play in the WNS transmission cycle. USGS researchers at FORT are providing expertise in bat ecology, as well as planning studies aimed at forecasting the spread of WNS, and determining if and how bats survive exposure.

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