SOMETHING Batty

WRITTEN BY KRISTEN MACLEOD

SEARCHING FOR ANSWERS TO WHITE-NOSE SYNDROME WITH BAT ACOUSTICS IN WESTERN NORTH CAROLINA

It is a wet August evening before sundown, and the rain puddles are large, dark and still as I drive along Swannanoa River Road. It isn't too long before the showers come down again. Driving westward, I keep going in and out of rain, but I'm headed straight toward one small patch of blue sky. I am meeting Cordie Diggins of the N.C. Wildlife Resources Commission for the first time in the Home Depot parking lot, just off I-40 in Candler. We are going on an acoustic bat route.

Diggins pulls up in a white Trailblazer with yellow state tags. She is a fresh-faced brunette in her late 20s with a slim build and deep blue eyes. She helped create the North Carolina Bat Acoustic Monitoring Program. The program is a collaborative affair among a number of organizations: the N.C. Wildlife Resources Commission's Wildlife Diversity Program, the U.S. Fish and Wildlife Service's Asheville Field Office, the U.S. Forest Service (Pisgah and Nantahala National Forests), the Eastern Band of the Cherokee Indians, and the Blue Ridge Parkway (National Park Service). The main goal of this program is to monitor changes in bat species' distribution and bat activity throughout the mountain region. This evening we will be taking one of 32 routes across western North Carolina to collect data.

Western North Carolina is home to 13 different bat species. Some of these bats are tree bats, migratory species known to roost in trees and leaf litter. The other variety is the cave bat, which spends winter hibernation in caves and old mines. It is the cave bat that is causing alarm in the scientific community, because many are afflicted with a mysterious ailment called white-nose syndrome.

Unlike species that hibernate communally in caves, eastern red bats (*Lasiurus borealis*), such as this individual being examined by a biologist, overwinter beneath leaf litter on the ground and are not susceptible to white-nose syndrome.

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White-nose syndrome (WNS) was first discovered in the winter of 2006 in Howe's Cave near Albany, N.Y. It is named for the white fungus that grows on the muzzles, ears or wing membranes of the infected bats. Bats with WNS exhibit abnormal behavior during hibernation. For example, they may be seen flying during daytime hours in the winter when the temperatures are below freezing. The bats may also be found clustered close to the entrances of their hibernacula. Some bats are found emaciated and dehydrated; others are found with torn wing membranes. Still others have no recognizable signs, only that they are dead and white-nose positive.

It is unclear how or why this newly discovered fungus, *Geomyces destructans*, is attacking cave bats of various species. White-nose is spread through bat to bat transmissions during spring and fall swarming. It is also believed that humans may spread the disease by transporting fungal spores from infected sites to uninfected sites on clothing and caving gear. The U.S. Fish and Wildlife Service issued a voluntary moratorium on caving in white-nose positive states. When scientists and researchers enter caves, they wear fully protective white Tyvek suits. Afterward, they undergo an intense decontamination process.

"The solution is 10 percent Lysol or bleach, and we dunk our clothing, boots and other equipment for 10 minutes," Diggins says. This method has been tested in the lab to be certain the fungal spores will, in fact, be killed.

White-nose syndrome is caused by a fungus that actually grows on the living animal. The fungus hosts itself on the bats during hibernation, a time when the bats' body temperature and immune system are down, giving the fungus an advantageous period of time to grow. It is known that the fungus thrives in the cool, humid conditions characteristic of caves. It is also known that WNS has caused a bat holocaust of sorts: approximately 1.5 million bats have died in the Northeast alone in the last five years.

WNS is spreading and has been confirmed in 16 U.S. states: Connecticut, Indiana, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Tennessee, Vermont, Virginia, West Virginia, and now North Carolina. The fungus has

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beenconfirmed in three additional states: Delaware, Missouri and Oklahoma.

In February 2011, WNS was found in a retired Avery County mine, then in a cave in Grandfather Mountain State Park, marking the arrival of the disease in North Carolina. In March 2011, biologists confirmed white-nose positive species in Yancey County. In April, Transylvania and McDowell counties were confirmed, and Buncombe County was listed as suspect, meaning the fungus was found on a bat, but it was not invading live tissue. The six mountain bats affected by WNS are the little brown bat, Eastern small-footed bat, Northern long-eared bat, tri-colored bat, the big brown bat, and Indiana bat, the last being a federally endangered species. The Northern long-eared bat and the Eastern small-footed bat are currently being considered for listing under the Endangered Species Act due to population declines from WNS.

Oddly, European bats have also been found WNS positive; however, they do not exhibit the same behavioral changes seen in bats from the United States, and there have been no recorded WNS-related deaths in Europe. It is hypothesized that these species potentially co-evolved with the fungus. This puzzling bit of information adds another cryptic clue to the mystery of where white-nose came from and how it got to the U.S.

"It has been estimated," Diggins says, "that the regional decline in the Northeast's cave bat population is 73 percent, a staggering number." She continues, "It has been predicted through population modeling that the little brown bat, one of the most common bats in the East, could be extinct from New England in 16 years. The rate that they are decreasing is unprecedented. White-nose syndrome is capable of wiping out more than just one species of bat."

Some people think of bats as flying rodents. This could not be further from the truth. Bats are actually more closely related to humans than rodents. Unlike rodents, bats are long-lived (some species in North Carolina can live up to 30 years). In China, the bat is a symbol of long life and good luck. Unlike rodents, bats are slow to reproduce, and they may only give birth to one pup a year, although some tree bat species birth twins. In late spring and early summer, female bats give birth and nurse their young. With the rate at which WNS is killing bats, it may take decades for populations to recover, if they can at all.

So why are bats important? All North Carolina bats are insectivores. They consume vast quantities of insects on a nightly basis. Many eat their weight in insect mass on any given summer evening.

Diggins describes bats as a keystone species. "The keystone in an arch keeps the arch up, but remove the keystone and the arch collapses. Remove bats from an ecosystem, and the ecosystem may collapse."

It is clear that bat health is linked to human health. Bats provide global pest control, and, in the tropics, many are pollinators as well. Bats are helpers to agriculture and the forests through their natural and effective pest elimination. Without the aid of numerous bats, what might humans turn to? Pesticides — and Rachel Carson already proved many years ago in her book "Silent Spring" that this method is not advantageous to anyone or anything.

As the day's light fades, we drive into Pisgah National Forest. As we wind along the Davidson River, the trees grow shadowy and the light grows dim. We park near a group campsite, and the rush of water fills my ears. We exit the car and look up. Bats! There they are, swooping and diving, little, dark, shadowy figures in an evening sky.

(Top left) This bat has a case of white-nose syndrome. (Top right) Bats that hibernate communally, such as these big brown bats, are most susceptible to the fungal infection. Personnel from the Wildlife Commission and USFW collaborate on a winter survey of hibernating bats in Haywood County in western North Carolina.

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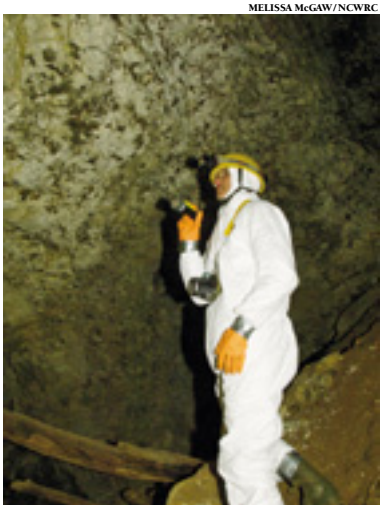

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An eastern red bat *(Lasiurus borealis)* forages over a Piedmont forest near dusk. It has been estimated that individual bats can consume over 1,000 mosquitoes per hour. (Bottom) These little brown bats *(Myotis lucifugus)* are shown hibernating together in a Haywood County cave. (Right) This tri-colored bat *(Pipistrellus subflavus)* is shown hibernating in a cave.

"Pips," Diggins says, a colloquial term for the goblin-faced tri-colored bats. "They're one of the first bats to come out at night, and they have that fluttery flight pattern." We watch them for a moment's time, even spying a large dragonfly in the mix.

"Better watch out!" Diggins says of the unassuming dragonfly.

In the trunk of the vehicle, she has what one might expect a wildlife technician to have for entering the field: a canvas hat, rubber boots and a large plastic tote labeled "Anabat," containing all the trinkets necessary for tonight's data collection. The Anabat is the sound device that will enable us to hear the bats, which are usually inaudible to the human ear. It is a handheld device about the size of a large flask of whiskey. Diggins turns the device on, and at first all we pick up is the piercing din of the evening's insect activity. Then we hear an almost sweet, chirruping sound.

"A bat," Diggins says, holding the device skyward. Bats use echolocation for commuting purposes, such as travelling from their day roost to their foraging site. Echolocation is also used for foraging. In simplest terms, echolocation is based on sound; bats emit sounds that strike objects and come back as echoes. A bat can interpret these echoes to tell what the object is, where it is located and how fast it is moving. Foraging is precisely what the skilled aerialists are doing as we watch them fly in the receding light.

"So we will be able to tell what a bat is doing by the sounds produced on the Anabat?" I ask.

"We will definitely be able to say 'OK, that guy just got a bug,'" Diggins answers. "We will also be able to tell the search phase, the approach phase—when they zero in on something—and then the terminal phase, or feeding buzz. It sounds like a zipper being zipped up really quickly."

I help Diggins place a car mount for the ultrasonic microphone on top of the vehicle. It is something she constructed herself—a wooden frame with a piece of PVC to place the microphone in.

"I like to believe I have some carpentry skills," she says modestly.

We secure the car mount to the roof with a thick nylon cord. We hook the microphone to the Anabat, then hook the Anabat to her computer, which has a program called Ana-Look installed on it. Using her laptop, we will be able to view an ever-changing sonogram of black dots and lines that will record the

frequencies in kilohertz made by the foraging bats. Diggins fills out a data sheet — date (8/12/11), time (9:06pm), temperature (72 degrees), cloud cover (100 percent) and moon visibility (completely obscured). I am given the task of holding the laptop, and we set out on the route called "Balsam Mountains." All bat routes begin half an hour after sundown and are driven at 20 miles per hour. We begin on a slightly washed out dirt road with our high beams on, flashers flashing and additional reflectors affixed to the rear of the car.

"When we get to the [Blue Ridge] Parkway this pace is going to feel like we're creeping, but back here it is going to feel like we're going really fast," Diggins says.

In the forest, the insect noise is still high, and we turn the volume down on the Anabat for our own sanity. However, bat activity is apparent: the lines on the computer spike with each tweet and chirp. Bats occasionally swoop into the car's headlights, giving us a quick glimpse of the creatures we are here to monitor. Up on the Parkway, the route continues, straddling Jackson and Haywood counties. In the spruce forest, the insect noise is almost nonexistent. The bat radar is now a peaceful crackle. We end our route exactly one hour after we started. It is 60 degrees, the coolest weather I've felt in a while, and the clouds have drawn back to reveal an almost-full moon. We pull off at an overlook to disengage the equipment. The fog is rolling along the road in low, soft billows. Diggins takes the laptop and scrolls back through some of the frequencies.

"Some good bat activity," she says. She peers at a series of small marks resembling a backward "J." "Probably a tri-colored."

After a few more minutes of reviewing, she closes the computer, with the files from tonight's data collection saved to the bat library for future use and further analysis.

What does WNS mean for western North Carolina? Again, no one really knows.

"Here," Diggins says, "the winters are milder. There is potential that white-nose syndrome won't produce the effects it has produced up North, but at this point it is all speculation. We have to wait and see. All we can do right now is monitor our bats and make sure we are not spreading white-nose to other sites." ⬘

Kristen MacLeod is an Asheville writer. This is her first story for Wildlife in North Carolina.

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