

BATTILING 4,000

*Researchers work in barns and belfries
to bring bat science into the light*



As the Red Sox cruise their way through the 2007 baseball season, the boys of summer are hoping to bat their way into the World Series. But this story is about a different type of bat, and in particular the girls of summer that I have been researching for more than a decade.

It was early in the morning on a late-June day that already threatened to be hot and humid. By the time most people were just waking up to begin their days, I had been working for several hours at my study site in Peterborough. Such is the life of a bat biologist.

For the last 14 years, I have been studying a maternity colony of approximately 2,000 little brown myotis (*Myotis lucifugus*).

BY SCOTT REYNOLDS

Each summer, the adult females return to this barn to raise their young in relative peace. Although my research disturbs their early morning slumber, we seem to have developed a mutual understanding during our time together. The bats seem generally willing to tolerate me invading the inner sanctum of their space, as long as I make it quick and painless. In return, I will use the data I collect to learn about

their life history and determine what influences their ability to reproduce successfully. For me, there is also an implied responsibility to make sure that this information will be used to give these bats the best chance to raise their young successfully.

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Big brown bats happily use buildings for maternity roosts, as long as they don't get too hot. To avoid locking young bats inside, seal up buildings at summer's end.

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A ladder in a Peterborough barn (below) allows bat researchers to observe little brown myotis; the banded female known as R667452 and her colony-mates above are among those roosting in the joists.

My, Oh, Myotis

Sitting in the first floor of this barn listening to the incessant chatter of angry moms, I was given a treat. As I reached into the bag of bats that I had collected from the colony, I came face-to-face with R667452, one of the 4,000 bats I have banded at this colony. I first met R667452 in 1994, my second year working in Peterborough. I have caught her 12 more times since our first encounter and have even caught three of her daughters. Data collected from this bat and her colony-mates have begun to shed light and dispel myths surrounding the basic biology of these amazing creatures.

That was not the end of my surprises on this day, though. A few minutes later, I found a female bat with two thumbs on the same hand. This developmental error did not appear to slow her down at all, and the two thumbs were definitely cooler than the six-toed bat I had seen last year. Yet, even *this* treat was not to be the last...

As I worked my way to the bottom of the bag, I came across a very docile female; I remembered thinking about how pregnant she looked at the time I put her into the bag. But she was not pregnant any longer – or at least not really pregnant. I had taken her from the bag while she was giving birth to her newest son. Because bats are breech birthers, the first thing I saw was the large feet of her “pup.” But within minutes I could

see the belly, and then the shoulders, and finally the head. After making sure the pup looked healthy, I left the new mom to clean him up while I organized my equipment. When I returned, the blind pup (like many mammals, bats are born with their eyes closed) was already crawling around the bag looking for his mother.

Bat Basics

First and foremost, bats are not “kind of like birds” nor “flying rodents.” Bats (order *Chiroptera*) belong to the second-largest group of mammals in the world (bats represent approximately 25% of all the mammal species, second only to rodents, which make up almost 50%). They are an extremely successful and diverse group of mammals, being found in almost every habitat and on every continent but Antarctica.

Part of this success undoubtedly comes from bats’ ability to fly – they are the only true flying mammals; all other airborne mammals are gliders. Bat success also comes from their keen sense of “echolocation” – a form of acoustic vision or sonar that allows them to fly in complete darkness. Although it is unclear which adaptation came first, flying or echolocation, it is clear that the combined effect is to produce a group of mammals that are able to move across the landscape freed from the constraints of sunlight. Bats as a group eat virtually everything. There are three species of blood-licking vampire bats – the source of many myths and misconceptions – but most bat species rely almost exclusively on insects.

New Hampshire’s Bats

New Hampshire is home to eight species of insect-eating bats. During the summer months, particularly June and July, bats can be found



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throughout the state in virtually every habitat. At night, they can often be seen foraging over waterbodies, traveling along wooded paths or hunting around street lamps. During the day, they roost in a large variety of places, including under tree bark, in rock and tree crevices and in human structures. The most common house-roosting bat throughout the state is the little brown myotis, although the big brown bat is becoming more common in urbanized areas such as Concord, Manchester, Keene and even Bedford.

During the winter months, bats diverge in their strategies. Five of our bats spend the winter hibernating in mines or caves. This group includes the state-endangered eastern small-footed myotis (*Myotis leibii*). In New Hampshire, most of the known hibernacula are abandoned mines in Grafton County, although the biggest hibernaculum is Mascot Mine in Coos County. Because New Hampshire does not have natural caves, many of the bats that summer in New Hampshire fly to Vermont and New York for the winter. Despite decades of research, we still know very little about where bats hibernate and how bats

For more about New Hampshire's bats and conservation strategies, download the N.H. Wildlife Action Plan's Mammals (Fish and Game website – www.WildNH.com).

migrate from their summer and winter habitats. For example, only one of the over 4,000 bats I have banded in Peterborough has ever been found in a hibernaculum, and she was in New York!

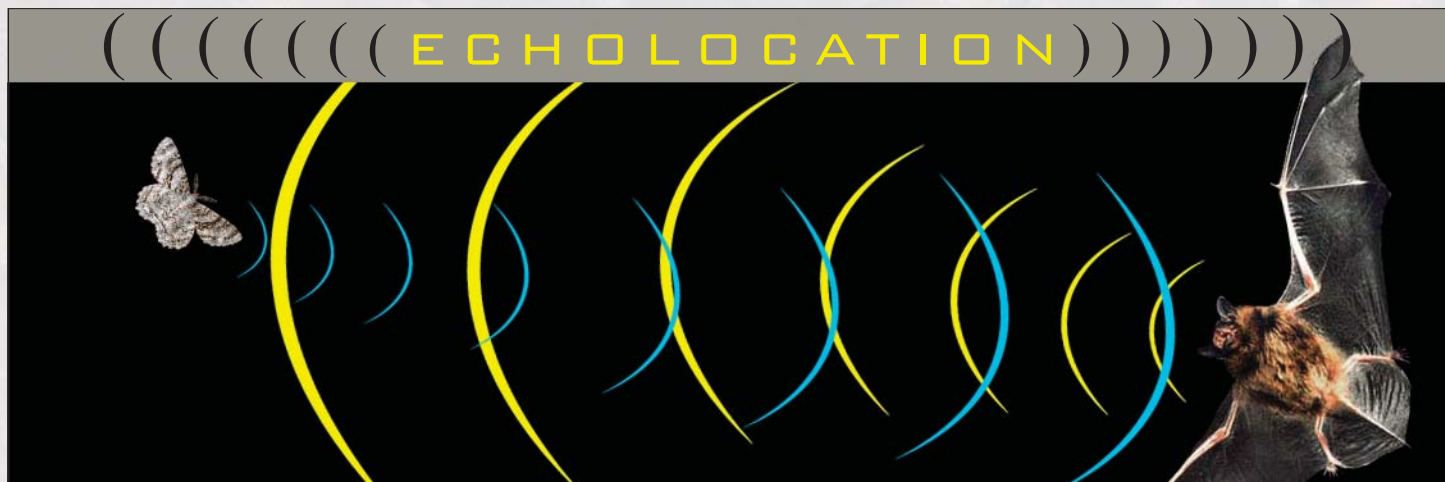
The three non-hibernating bat species found in New Hampshire are collectively referred to as migratory tree-roosting bats. These bats – the eastern red bat, hoary bat and silver-haired bat – are the largest bats found in the state (but still quite small) and also the least understood. We know that they can be found throughout the state during the summer months, they are present in larger numbers during the spring and fall migratory period, and they are generally not found in the state during the winter months. We also know that these bats appear to be susceptible to large-scale wind turbines, often accounting for more than 75% of all the bat fatalities that occur. It is

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Hoary bats prefer conifers for summer roosting, using primarily foliage for shelter.





The Best of the Beasts

Bats are superlative creatures – virtually everything they do is done to the extreme. For example:

 The smallest mammal in the world is a bat (only 2.4 grams, or 1/200 of a pound). The largest bats weigh over 1,000 grams (over two pounds) and have a wingspan of six feet. Fortunately, or unfortunately, depending on your perspective, these bats are primarily found in eastern Asia and Australia.

 The oldest known little brown myotis is an amazing 34 years old! – a similar-sized field mouse seldom lives more than two years.

 Bats have babies (“pups”) that are up to 35% adult size at birth and are fed exclusively on milk until they approach 90% adult size (after just a few months). This is analogous to a human mother giving birth to a 50-pound baby and breast-feeding it until it was in high school.

 Bats have the ability to adjust their heart rate over a larger range than any other animal. During winter hibernation, their heart will beat about 20 beats per minute. During flight, their heart can beat up to 1,000 beats per minute. Therefore bats can adjust their heart rates 50-fold, whereas most humans would die if their heart rate tripled.

Using their mouth or nose, bats emit high-pitched sounds like a natural sonar to locate food and navigate. When the sound hits an object, an echo comes back. Bats listen to and use these echoes to judge distance, movement and size of objects in their path.

—SR



Northern myotis

Bats In Need of Conservation

The bat species in the state Wildlife Action Plan that are known to live in New Hampshire include three that use the foliage of trees for maternal roosts, two that use cavities in trees, and one that uses rock crevices. Three overwinter in local caves or mines, and the others migrate to southern states.

SUMMER BREEDING

Eastern red bats and silver-haired bats roost in taller, more mature trees, while Northern myotis bats need older forests surrounding them. The Wildlife Action Plan lists increasing the amount of late successional or old-growth forests as an important strategy to protect these and other species. Since all the tree-roosting species, including the Eastern pipistrelle and hoary bat, seem to return to the same roost areas summer after summer, the loss and fragmentation of the forests can severely diminish their populations by removing the all-important maternity roosts. None of these bats produces many young per year – between one and three are born, but not all make it to maturity.

WINTER HIBERNACULA

Eastern pipistrelles, Northern myotis and state-endangered Eastern small-footed bats hibernate in caves or mines. These species, in addition to little brown myotis and big brown bats, are highly vulnerable during winter, surviving only on the fat they have stored in their bodies. Spelunkers – people who explore caves – may not even see the bats, but can easily disturb them with lights and noise. Even casual visitors to caves in the winter have a big impact, because the disturbance causes bats to use up precious stored energy.

OTHER THREATS

The three migrating bats – Eastern red bats, hoary bats and silver-haired bats – are exposed to many obstacles during their migration. A new and emerging threat is the rotating blades of wind turbines.

Eastern small-footed bats spend the summer in rock crevices, in rocky outcrops. Some human-made structures like dams and riprap slopes can provide habitat, but measures must be taken to avoid harming the bats during routine maintenance of those structures.

—Emily Brunkhurst,
Fish and Game Outreach Biologist


this susceptibility and our lack of understanding of these bats that prompted us to include all three of our migratory tree bats, plus four other types of bats, as Species of Greatest Conservation Need in the New Hampshire Wildlife Action Plan.

Bats in the System

Bats play a major role in a healthy ecosystem. In New Hampshire, bats are the primary control agents for nocturnal insect pests – a

little brown myotis can eat over half its body weight in one night. Because of their high metabolism, bats also play a role in recycling nutrients through an ecosystem. In other parts of the world, bats are important seed dispersers and flower pollinators. Despite these critical roles, most bat species are not protected from disturbance or killing; this is particularly true for the house-roosting bats and hibernating bats. Recently, Fish and Game's Nongame Program raised funds to set up a bat-friendly gate system at Mascot Mine that will prevent humans from disturbing the bats while they hibernate. More than 200 people contributed to the protection of the mine – New Hampshire's largest and only one of the state's seven known bat hibernacula – which houses over 1,500 bats of five species, including the state-endangered Eastern small-footed bat. Efforts like these are important for protecting hibernacula, but there are virtually no regulations to protect maternity colonies during the summer months, nor bat habitats in general.

Recently, Thomas Kunz (a world-renowned bat expert at Boston University) and I published a review of known maternity colonies throughout Massachusetts and New Hampshire. These data showed that most of the historically large maternity colonies of bats have been removed by poisoning, killing or physical exclusion. More recent colonies are often smaller, less stable and more likely to be abandoned. Over the last few decades, building practices have been improved to eliminate small entrance holes and people have become less likely to maintain abandoned buildings on their property; these changes have made it more difficult for house-roosting bats to raise their young. Non-sustainable forestry practices, likely habitat changes from global warming and the potential impact of commercial wind farms in New Hampshire pose additional threats to the tree-roosting bats.

In New Hampshire and New England, a small number of dedicated bat researchers, myself included, continue to study and monitor our local bats. They may not be as well-documented as most other mammals, but bats are an important component of our natural systems. As we learn more about their reproductive and habitat needs, I hope we can continue to work with others in the wildlife conservation community to protect bats and keep their populations sustainable. 

Dr. Scott Reynolds is a member of the Science Faculty at St. Paul's School in Concord, N.H., and founder of North East Ecological Services, a consulting firm that conducts bat-based ecological research for government, non-profit and industry clients.