

# EASTERN BAT SPECIES OF CONCERN TO MINING

Michael J. Harvey  
Department of Biology  
Tennessee Technological University  
Cookeville, Tennessee

## Abstract

Forty-five species of bats inhabit the United States. Twenty species occur in the eastern United States, herein defined as those 31 states east of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. Mines provide important winter and/or summer habitat for several of these species. Ten eastern United States species, often referred to as cave bats, usually inhabit caves and/or mines during all or part of the year. Three eastern cave/mine bat species, Indiana bat (*Myotis sodalis*), gray bat (*Myotis grisescens*), and Townsend's big-eared bat (*Corynorhinus townsendii*) are considered endangered by the U.S. Fish and Wildlife Service, as well as by most state wildlife agencies (U.S. Fish and Wildlife Service 1982, 1984, 1995, 1999). Three additional eastern cave/mine species, southeastern bat (*Myotis austroriparius*), eastern small-footed bat (*Myotis leibii*), and Rafinesque's big-eared bat, *Corynorhinus rafinesquii* are considered to be of special concern and may be proposed for listing as endangered or threatened in the near future. The other four eastern cave/mine species, big brown bat (*Eptesicus fuscus*), little brown bat (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*), and eastern pipistrelle (*Pipistrellus subflavus*) are thought to be declining in portions of their ranges.

The additional 10 eastern United States bat species (Jamaican fruit-eating bat, *Artibeus jamaicensis*; silver-haired bat, *Lasiurus noctivagans*; eastern red bat, *Lasiurus borealis*; hoary bat, *Lasiurus cinereus*; northern yellow bat, *Lasiurus intermedius*; Seminole bat, *Lasiurus seminolus*; evening bat, *Nycticeius humeralis*; Wagner's mastiff bat, *Eumops glaucinus*; Pallas' mastiff bat, *Molossus molossus*; and Brazilian free-tailed bat, *Tadarida brasiliensis*), usually referred to as tree bats, seldom enter caves or mines.

Certain mining activities, especially those involving deforestation and those resulting in stream degradation, can be detrimental to bats. All eastern United States bats are dependent, to some degree, on forest for shelter, roost sites, and/or foraging areas. Good quality water sources provide drinking water and are important to bats as sources of aquatic insects and foraging habitat.

## Eastern U.S. Bat Species

Following are brief species accounts of the 10 eastern United States bats that inhabit caves and/or mines. Accounts are similar to those in Harvey et al. (1999), with additional information added.

### **Indiana Bat – *Myotis sodalis* – Endangered**

Weight is 6-9 grams (0.2-0.3 ounce), wingspan is 24-28 centimeters (9-11 inches). Distribution includes cave regions in the eastern United States and, during summer, areas to the north, of cave regions. Indiana bats usually hibernate in large dense clusters of up to several thousand individuals in sections of the hibernation cave or mine where temperatures average 3-6°C (38-43°F) and with relative humidities of 66-95 percent. They hibernate from October to April, depending on climatic conditions. Females depart hibernation sites before males and arrive at summer maternity roosts in mid-May. The summer roost of adult males often is near maternity roosts, but where most spend the day is unknown. Others remain near the hibernaculum, and a few males are found in caves during summer. Between early August and mid-September, Indiana bats arrive near their hibernation sites and engage in swarming and mating activity. Swarming at cave or mine entrances continues into mid- or late October. During this time, fat reserves are built up for hibernation. When pregnant, females eat soft-bodied insects; they eat moths when lactating, and moths, beetles, and hard-bodied insects after lactation. Males also eat a variety of insects. One baby is born in June, and is raised under loose tree bark, often in wooded streamside habitat. Life spans of nearly 14 years have been documented. The present total population of this endangered species is fewer than 360,000, with more than 85 percent hibernating at only nine locations, making them extremely vulnerable to destruction. Most important hibernation caves have been gated. However, populations continue to decline in spite of protection and recovery efforts. Relatively large numbers of Indiana bats hibernate in several abandoned mines in Missouri, Illinois, and Ohio.

Until recently, Indiana bat maternity colonies were not known to exist in the southeastern United States, although a few reproductively active females had been reported, primarily in Kentucky. During the summer of 1999, a maternity colony was discovered in the Nantahala National Forest in western North Carolina; during the summer of 2000 an additional maternity colony was found in Great Smoky Mountains National Park in eastern Tennessee.

### **Gray Bat – *Myotis grisescens* – Endangered**

Weight is 8-11 grams (0.3-0.4 ounce), wingspan is 27-32 centimeters (11-13 inches). Distribution includes cave regions of Arkansas, Missouri, Kentucky, Tennessee, and Alabama, with occasional colonies found in adjacent States. Gray bats are primarily cave residents year-round, but different caves usually are occupied in summer and winter. Few have been found roosting outside caves or cave-like habitats. They hibernate primarily in deep vertical caves with large rooms acting as cold-air traps (5-11°C or 42-52°F). In summer, females form maternity colonies of a few hundred to many thousands of individuals, often in large caves containing streams. Maternity colonies occur in caves that, because of their configuration, trap warm air (14-25°C or 58-77°F) or provide restricted rooms or domed ceilings capable of trapping combined body heat from clustered individuals. Because of their specific habitat requirements, fewer than 5 percent of available caves are suitable for gray bats. Males and non-reproductive females form bachelor colonies in summer. Gray bats primarily forage over water of rivers and lakes. Moths, beetles, flies, mosquitos, and mayflies are important in the diet, but gray bats also consume a variety of other insects. Mating occurs in September and October,

and females enter hibernation immediately after mating, followed by males. Females store sperm through winter and become pregnant after emerging from hibernation. One baby is born in late May or early June, and begins to fly within 20-25 days of birth. Life span may exceed 14-15 years. Listed as endangered, about 95 percent of these bats hibernate in only eight caves, making them extremely vulnerable to destruction. Most important gray bat hibernation caves, and several summer caves, are now protected by gates or fences. Populations appear to be increasing throughout most of their range. Gray bats are known to inhabit some mines.

### **Townsend's Big-eared Bat – *Corynorhinus townsendii* – Endangered**

Weight is 8-14 grams (0.3-0.5 ounce), wingspan is 30-34 centimeters (12-13 inches). Distribution includes western Canada, the western United States to southern Mexico, and a few isolated populations in the eastern United States. These bats hibernate in caves or mines where the temperature is 12°C (54°F) or less, but usually above freezing. Hibernation sites in caves often are near entrances in well-ventilated areas. If temperatures near entrances become extreme, they move to more thermally stable parts of the cave. They hibernate in clusters of a few to more than 100 individuals. During hibernation, the long ears may be erect or coiled. Solitary bats sometimes hang by only one foot. Maternity colonies usually are located in relatively warm parts of caves/mines. During the maternity period, males apparently are solitary. Where most males spend the summer is unknown. No long-distance migrations are known. Like many other bats, they return year after year to the same roost sites. It is believed to feed entirely on moths. Mating begins in autumn and continues into winter, sperm are stored during winter, and fertilization occurs shortly after arousal from hibernation. One baby is born in June. Babies are large at birth, weighing nearly 25% as much as their mother. They can fly in 2.5-3 weeks and are weaned by 6 weeks. Life span may be 16 or more years. The two subspecies in the eastern United States, *C. t. virginianus* (Virginia big-eared bat) and *C. t. ingens* (Ozark big-eared bat), are considered endangered. Two western subspecies, *C. t. townsendii* (Townsend's big-eared bat) and *C. t. pallescens* (western big-eared bat), are of special concern. A few have been reported inhabiting mines.

The endangered subspecies *Corynorhinus townsendii virginianus*, Virginia big-eared bat, inhabits caves in Virginia, West Virginia, Kentucky, and North Carolina. The total population numbers only ca. 20,000. The endangered subspecies *Corynorhinus townsendii ingens*, Ozark Big-eared bat, is currently known to exist only in northwestern Arkansas and eastern Oklahoma. The total population is estimated to number less than 1500.

### **Southeastern Bat – *Myotis austroriparius* – Special Concern**

Weight is 5-8 grams (0.2-0.3 ounce), wingspan is 24-29 centimeters (9-11 inches). Distribution includes the southeastern United States from southern Illinois and Indiana to northeastern Texas and northern Florida. Caves are favorite roosting sites, although buildings and other shelters sometimes are used. Maternity colonies comprised of thousands of individuals inhabit caves. Throughout much of the South, these bats reside in buildings and hollow trees, but in the northern part of their range they roost primarily in caves. In winter, they leave the maternity caves and take up residence in small groups

at outdoor sites. Predators include opossums, snakes, and owls, but by destruction of roosting sites and killing of these bats humans are the major threat to the species. Southeastern bats usually are associated with bodies of water, over which they feed. They forage low, close to the water's surface. A variety of insects are consumed, but the diet of this species has not been studied. Mating time is unknown, but about 90 percent of pregnant females bear twins in late April or mid-May. The production of twins is unique among bats of the genus *Myotis* in the United States; all other *Myotis* usually produce one baby. Clusters of babies often are separate from adult females during the day. Young bats can fly when 5-6 weeks old. Once common, populations of the southeastern bat have decreased significantly; it is now considered a species of special concern.

### **Eastern Small-footed Bat – *Myotis leibii* – Special Concern**

Weight is 3-5 grams (0.1-0.2 ounce), wingspan is 21-25 centimeters (8-10 inches). Distribution is from eastern Canada and New England south to Alabama and Georgia and west to Oklahoma. This is one of the smallest bats in the United States. Eastern small-footed bats hibernate in caves or mines and are among the hardiest of bats. They are one of the last to enter caves/mines in autumn and often hibernate near cave or mine entrances where temperatures drop below freezing and where humidity is relatively low. Several have been found hibernating in cracks in cave floors and under rock slabs in quarries and elsewhere. The tolerance for cold, relatively dry places for hibernation is remarkable for such a small bat. In summer, they often inhabit buildings and caves; one small summer colony was behind a sliding door of a barn. Small colonies have also been found in bridges. They often fly repeated patterns within less than 1 meter (3 feet) of the floor of a cave or crevice, hang up on the wall, and then fly again. These bats emerge to forage shortly after sunset, and fly slowly and erratically, usually 1-3 meters (3-10 feet) above the ground. Apparently these bats fill their stomachs within an hour after beginning to forage in the evening. They consume flies, mosquitos, true bugs, beetles, ants, and other insects. One baby is born in late spring or early summer. Nursery colonies of up to 20 bats have been reported from buildings. Life span is unknown, but may be more than 9 years. It is uncommon throughout most of its range and is a species of special concern.

### **Rafinesque's Big-eared Bat – *Corynorhinus rafinesquii* – Special Concern**

Weight is 8-14 grams (0.3-0.5 ounce), wingspan is 26-30 centimeters (10-12 inches). Distribution is the southeastern United States. This species is one of the least known of all bats in the eastern United States. In the northern part of its range, it hibernates in caves, mines, or similar habitats, including cisterns and wells. In contrast, Rafinesque's big-eared bats usually are not found in caves during winter in the more southern parts of their range. Maternity colonies usually are found in abandoned buildings, sometimes in rather well-lighted areas. They usually consist of few to several dozen adults. Maternity colonies are found more rarely in caves and mines. Males generally are solitary during summer, roosting in buildings or hollow trees. When approached in summer, these bats are immediately alerted and begin to wave their ears, apparently trying to keep track of the intruder. This species and the eastern pipistrelle bat choose more open and lighted day roosts than other kinds of bats. Both species commonly hang in the open in plain

sight. Rafinesque's big-eared bats emerge late in the evening to forage; apparently it does not forage at twilight. Its flight is remarkably agile. Moths and other night-flying insects are eaten. One baby is born in late May or early June in the northern part of the range and about mid-May in the South. The young shed their milk teeth in mid-July and reach adult size by August or early September. This species is uncommon over most of its range and is of special concern. Some of the largest known colonies of this species (numbering in the hundreds) inhabit abandoned copper mines, during both summer and winter, in Great Smoky Mountains National Park.

### **Big Brown Bat – *Eptesicus fuscus***

Weight is 14-21 grams (0.5-0.7 ounce), wingspan is 32-40 centimeters (13-16 inches). Distribution is from southern Canada through southern North America into South America, including many islands in the Caribbean. These bats are closely associated with humans and are familiar to more people in the United States than any other species of bat. Most summer roosts are in attics, barns, bridges, or other man-made structures, where colonies of a few to several hundred individuals gather to form maternity colonies. They move into caves, mines, and other underground structures to hibernate only during the coldest weather. Where most of these bats spend the winter remains unknown. They emerge at dusk and fly a steady, nearly straight course at a height of 6-10 meters (20-33 feet) in route to foraging areas. Their large size and steady flight make them readily recognizable. Apparently, some individuals use the same feeding ground each night, for a bat can sometimes be seen following an identical feeding pattern on different nights. After feeding, the bat flies to a night roost to rest; favored night roosts include garages, breezeways, and porches of houses. These bats consume beetles, ants, flies, mosquitos, mayflies, stoneflies, and other insects. Mating occurs in autumn and winter, females store sperm, and fertilization takes place in spring. In the eastern United States, big brown bats usually bear twins in early June. In the western United States, usually only one baby is born each year. It is common throughout most of its range.

### **Little Brown Bat – *Myotis lucifugus***

Weight is 7-14 grams (0.3-0.5 ounce), wingspan is 22-27 centimeters (9-11 inches). Distribution is from central Alaska to central Mexico. The little brown bat usually hibernates in caves and mines. During summer, it often inhabits buildings, usually rather hot attics, where females form nursery colonies of hundreds or even thousands of individuals. Where most males spend the summer is unknown, but they likely are solitary and scattered in a variety of roost types. Colonies usually are close to a lake or stream. This species seems to prefer to forage over water, but also forages among trees in rather open areas. When foraging, it may repeat a set hunting pattern around houses or trees. It eats insects, including gnats, crane flies, beetles, wasps, and moths. Insects usually are captured with a wing tip, immediately transferred into a scoop formed by the forwardly curled tail and interfemoral membrane, and then grasped with the teeth. Mating occurs in autumn, but also may occur during the hibernation period. One baby is born in May, June, or early July. When the mother is at rest during the day, she keeps the baby beneath a wing. Life span may be more than 20 years. This species is one of the most common bats throughout much of the northern United States and Canada, but is scarce or only locally common in the southern part of its range. A subspecies found in

the southwestern United States, *M. l. occultus* (Arizona bat), is considered to be of special concern.

**Northern Long-eared Bat – *Myotis septentrionalis***

Weight is 6-9 grams (0.2-0.3 ounce), wingspan is 23-27 centimeters (9-11 inches). Distribution includes southern Canada and the central and eastern United States southward to northern Florida. Northern long-eared bats hibernate in parts of caves and mines that are relatively cool, moist, and where the air is still. Hibernation may begin as early as August and may last for 8-9 months in northern latitudes. In summer, they roost by day in a variety of shelters, including buildings and under tree bark and shutters, but at night they commonly use caves as night roosts. Northern long-eared bats seem much more solitary in their habits than other members of the genus *Myotis*, and they generally are found singly or in small groups containing up to 100 individuals. Although they frequently hang in the open, they seem to prefer tight crevices and holes. Sometimes only the nose and ears are visible, but they can be distinguished from most other species of *Myotis* by their long ears. These bats forage mainly on forested hillsides and ridges rather than in streamside and floodplain forests. They consume a variety of small night-flying insects. Presumably most mating occurs in autumn prior to hibernation. Apparently small nursery colonies are formed in June and July where pregnant females give birth to one baby. Mothers may be able to retrieve their young that fall from roost sites. Life span may be more than 18 years. This species is common over much of its range.

**Eastern Pipistrelle – *Pipistrellus subflavus***

Weight is 6-8 grams (0.2-0.3 ounce), wingspan is 21-26 centimeters (8-10 inches). Distribution includes eastern Canada, most of the eastern United States, and southward through eastern Mexico to Central America. Caves, mines, and rock crevices are used as hibernation sites in winter, and occasionally as night roosts in summer. These bats rarely occur in buildings, and apparently most roost in trees in summer. This species inhabits more caves and mines in eastern North America than any other species of bat, usually hanging singly in warmer parts of the cave/mine. An individual may occupy a precise spot in a cave/mine on consecutive winters; it usually has several spots in which it hangs, shifting from one to another during the winter. This bat emerges from its daytime retreat early in the evening. It is a weak flier and so small that it may be mistaken for a large moth. Eastern pipistrelle bats usually are solitary, although occasionally in late summer four or five will appear about a single tree. The flight is erratic and the foraging area is small. It often forages over waterways and forest edges and eats moths, beetles, mosquitos, true bugs, ants, and other insects. Mating occurs in autumn, sperm are stored during winter, and fertilization takes place in spring. These bats usually bear twins in late spring or early summer. Babies are born hairless and pink with eyes closed, and they are capable of making clicking sounds that may aid their mothers in locating them. They grow rapidly and can fly within a month. This species is common throughout its range.

### Literature Cited

- Harvey, M.J., J.S. Altenbach, and T.L. Best. 1999. Bats of the United States. Arkansas Game and Fish Commission, Little Rock. 64 pp.
- U.S. Fish and Wildlife Service. 1982. Gray bat recovery plan.
- U.S. Fish and Wildlife Service. 1984. A recovery plan for the Ozark big-eared bat and the Virginia big-eared bat.
- U.S. Fish and Wildlife Service. 1995. Ozark big-eared bat revised recovery plan.
- U.S. Fish and Wildlife Service. 1999. Indiana bat (*Myotis sodalis*) revised recovery plan (Agency Draft).

---

Dr. Michael J. Harvey is Professor Emeritus and Senior Affiliate Faculty member in the Department of Biology at Tennessee Technological University, Cookeville where he also served as Chairman of the department. He holds a Ph.D. from the University of Kentucky, M.A. from Stephen F. Austin State University, Texas, and B.S. degree from Eastern Illinois University, Charleston (1958). He is author of Bats of the Eastern United States (1992) and coauthor of Bats of the United States (1999), as well as author of numerous additional publications concerning bats. He has been awarded numerous research grants and contracts, most dealing with distribution, status, ecology, and management of endangered bats.