



## Bats

Bats are the only mammals that fly. Their wings are thin membranes of skin stretched from fore to hind legs, and from hind legs to tail. The name of their order, *Chiroptera*, means “hand-winged.” Their long, slender finger bones act as wing struts, stretching the skin taut for flying; closed, they fold the wings alongside the body.

### Biology

Pennsylvania bats range in size from the hoary bat (length, 5.1 to 5.9 inches; wingspread, 14.6 to 16.4 inches; weight, 0.88 to 1.58 ounces) to the tricolored bat (length, 2.9 to 3.5 inches; wingspread, 8.1 to 10.1 inches; weight, 0.14 to 0.25 ounces). Nine species of bats regularly occur in Pennsylvania; six hibernate in Pennsylvania and three primarily migrate south for the winter. Two additional species, evening bats and Seminole bats, are rare visitors from the South.

All Pennsylvania bats belong to family *Vespertilionidae*. They are insect eaters, taking prey on the wing. Some species specialize in feeding over water, while others specialize in gleaning insects off leaves or even occasionally landing on the ground to seize prey. A bat consumes up to 25 percent of its weight at a single feeding, with the smaller, hibernating species estimated to consume nearly a million insects per bat per year.

The eyes of our bats are relatively small, but their ears are large and well-developed. Bats can see quite well, but unique adaptations help them fly and catch prey in total darkness. While in flight, a bat utters a series of high-pitched squeaks (so high, in fact, they are almost always inaudible to humans), which echo off nearby objects – bushes, fences, branches, insects – and bounce back to the bat’s ears. These sound pulses might only be 2.5 milliseconds in duration. Split-second reflexes help the creature change flight direction to dodge obstructions or intercept prey.

### big brown bat



While in flight, a bat may use the skin between its legs to scoop a small insect out of the air and transfer it to its mouth. Larger bats may grab an insect with their mouth, often disabling it with a quick bite, then carry it to the ground or to a perch for eating. If an insect takes last second evasive action, the bat may flick out a wing, nab its prey, and draw the insect back to its mouth. Bats have sharp teeth to chew their food into tiny, easily digested pieces.

Most bats mate in late summer or early fall, although some breed in winter. The male’s sperm is stored in the female’s reproductive system until spring, when fertilization occurs. The young, born in summer, are naked, blind, and helpless. They are nursed by their mothers as are other mammals, and by six weeks of age, most are self-sufficient and nearly adult size.

The reproductive potential of bats is low. Most bats, including the smaller species, usually bear a single young per year; the larger species may have up to four. There is only one litter per year.



**little brown bat**

None of Pennsylvania's bats routinely fly during the brighter hours of daylight, preferring to make their feeding flights in late afternoon, evening and early morning. However, it's not unusual to see a bat flying during the day. Roost disturbance and heat stress might cause bats to take wing during daylight hours. During the day, they roost singly, in pairs, in small groups, or in large concentrations, depending on the species. They seek out dark, secluded spots such as caves, hollow trees and rock crevices. They may also congregate in vacant buildings, barns, church steeples and attics; some hide among the leaves of trees. They hang upside down, by their feet when roosting.

In fall, winter and early spring, insects are not readily available to bats in Pennsylvania and other northern states. At this time, three species migrate south; six others hibernate underground, usually in caves.

Excepting the three that migrate, our cave bats are true hibernators. Throughout winter, they eat nothing, surviving by slowly burning fat accumulated during summer. A hibernating bat's body temperature drops close to the air temperature; respiration and heartbeat slow; and certain changes occur in the blood. Bats can be roused fairly easily from hibernation, and often are able to fly 10 to 15 minutes after being handled. Most favor cave zones having the lowest stable temperature above freezing. During winter, bats might awaken and move about within a cave to zones of more optimum temperature. In many caves, bats of several species hibernate together.

Perhaps because of their nocturnal nature, secretive habits and unique appearance – not to mention superstitions – bats long have been misunderstood and sometimes feared. A number of misconceptions exist about them. They include: Bats are prone to rabies; their droppings are a dangerous source of tuberculosis and other diseases; they are aggressive and often attack people; they are dirty and ridden with lice.

Bats are no more apt to contract rabies than other warm-blooded animals. (People should not, however, handle bats, especially those found on the ground or in the open during the day.) There is no evidence to suggest that bats – or their droppings, called "guano" – transmit tuberculosis to man. A host of scientific studies indicate that healthy bats do not attack people, and even rabid bats rarely become aggressive. Bats need to keep themselves extremely clean to fly. They host no more parasites than other animals, and parasites that do afflict bats are very specialized and rarely pose problems to humans. Histoplasmosis, caused by a soil fungus that can grow in accumulated bird and bat droppings, does not, as a rule, survive in hot dry attics. However, as a precaution, it's recommended that you wear a respirator when stirring up dust in bat quarters or cleaning out large accumulations of droppings.

Colonial bats might congregate at favorite roosting sites, often in buildings. While these bats do no real harm to human occupants, their droppings, odor and noise may become a nuisance. To exclude bats correctly might take two years. The first summer you should watch the home at dusk to see where the bats are exiting. Try to get a count of the number of bats. If possible, erect a well-placed bat box of good design before August. The box should be large enough to accommodate the bats you plan to evict. When the bats leave in the fall, seal all entrances. Next spring, when they return, they are likely to move into the bat box, rather than search for a new way into your home, or your neighbor's. Do not seal bats out during June or July because you will trap flightless young inside.

Exterminating is a questionable practice. Poisons used on bats can be dangerous to humans, and may cause sickened bats to scatter and fall to the ground, where they are more likely to come into contact with people and pets. Currently no pesticides are approved for use on bats. Reputable pest-control operators use bat-exclusion techniques.

To counterbalance their low reproductive rates, bats are relatively long-lived. Some have been banded, released and recaptured more than 30 years later.

Because they feed in mid-air and are active at dusk and at night, bats are not often caught by predators. Owls and hawks take some, as do house cats, raccoons and foxes. Rat snakes occasionally eat roosting bats. Other causes of mortality include cave floodings and accidents.

The greatest threat to bats comes from humans in the form of highway mortalities, wind farms, introduced disease, and disturbances while hibernating. Highway mortality can occur when bats are crossing or foraging near highways in forest habitats, particularly where forested streams cross under roads. The recent addition of large windmills across many ridgetops and high plateaus is also killing bats, with about

75 percent of the bat mortality from wind turbines affecting migratory bats. Estimates of bat mortality below wind turbines are difficult to obtain; some wind facilities have claimed an average greater than 50 bats per turbine, per year. The majority of the mortality occurs during a short time period from late July through September. In the fall, the migratory bats that spent the summer north of Pennsylvania begin to migrate south for the winter. Recent research has clearly shown that a small restriction for operating the turbines during this time period under very low wind speed conditions can significantly decrease bat mortality due to windmills.

The biggest threat to our bats during hibernation is a relatively new disease called white-nose syndrome. This is an exotic fungus that causes fungal infections on the wing membranes and other exposed skin, eventually leading to death in most bats that encounter it. It has been shown that infected bats arouse too frequently and burn through their winter fat supply too fast, and also suffer from dehydration. Mortality has been severe, with an overall decline of 99 percent for all six species that are found to hibernate in Pennsylvania. The three species that do not hibernate, often referred to as migratory bats, have not been confirmed to contract white-nose syndrome.

In winter, hibernating bats may be aroused by people exploring caves; repeated disturbances force bats to squander precious calories needed for overwintering. Cave disturbances during the winter season are now even more problematic due to the cumulative effects with White-nose Syndrome. Hibernacula might also be closed or modified to become less suitable for bats.

Some scientists suspect that widespread use of pesticides also harms bat populations.

## Little Brown Bat (*Myotis lucifugus*)

The little brown, is found statewide. Length, including the tail, is 3.1 to 3.7 inches; wingspread, 8.6 to 10.5 inches; weight ranges from 0.25 to 0.35 ounces, and is greatest just before hibernation. Females are slightly larger than males. Color: a rich brown approaching bronze, usually with a dark spot on the shoulders. The fur is dense, fine and glossy; the wings are black and bare.

This bat eats a wide variety of flying insects, including nocturnal moths, bugs, beetles, flies and mosquitoes. Insects are regularly caught with the wing or tail membrane, and transferred to the mouth. An individual emerges from its day roost at dusk, and usually seeks a body of water, where it skims the surface for a drink, and then hunts insects. Bats examined within an hour of taking flight often have full stomachs weighing one-fifth of their body weight. The little brown bat makes several feeding flights each night, and is capable of catching 1,200 insects per hour. A nursing female may eat her own weight in insects nightly.

In October and November, little brown bats leave their summer roosts and move to tunnels, mine shafts and caves. Here, clinging to the ceilings and clustered against one another, they hibernate. In spring, they emerge in April and May. They return to the same hibernation and summer roost sites year after year.

Females disperse from the hibernation roosts, and gather in summer nursery colonies of 10 to 1,000 individuals in attics, barns and other dark, hot retreats. Males are solitary, roosting in hollow trees, under loose bark, behind loose siding and shingles and in rock crevices.

A single young is born to each female in June or early July. After four weeks, the young bat is fully grown, and ready to leave the colony. Females mature sexually at about eight months of age, while males mature in their second summer. Little brown bats might live more than 30 years.



**northern long-eared bat**



Indiana bat

## Northern Long-eared Bat

### (*Myotis septentrionalis*)

Similar in size and color to the little brown bat, the northern long-eared bat can be distinguished by its longer tail and narrower and longer ears. It ranges in forested areas throughout the state, but is much less common than the little brown bat; its distribution is considered local and irregular. Length, 3 to 3.7 inches; wingspread, 9 to 10.7 inches; weight, 0.25 to 0.32 ounces.

Biologists have learned little of the ecology and behavior of the northern long-eared bat, although they suspect feeding habits are similar to those of the little brown. Long-eared bats roost singly or in small colonies in caves, behind window shutters, under loose tree bark and in cliff crevices. Female long-eareds gather in nursery colonies in attics, barns and in the cavities or beneath the bark of trees. Probably, a single young is born in July. Long-eared bats return to caves in fall, often sharing space with little brown bats, big brown bats and tricolored bats.

When all of Pennsylvania's main hibernation sites became contaminated with white-nose syndrome, 99 percent of the long-eared bats using those locations died. Long-eareds being seen on summer landscapes are believed to have survived due to an individual preference for solitary, non-traditional hibernation sites.

## Indiana Bat (*Myotis sodalis*)

The Indiana bat resembles the little brown bat, but has a pinkish cast to its fur, giving it a light purple-brown coloration. Length, 2.9 to 3.7 inches; wingspread, 9.4 to 10.3 inches; weight, 0.18 to 0.28 ounces. Sexes are equal in size.

Indiana bats roost in trees in summer; and rarely are found to roost in buildings. In winter, some 97 percent of the total species population hibernates in certain large caves in Missouri, Kentucky, Indiana and Illinois. Pennsylvania is on the fringe of the species' range. In our state in recent years, Indiana bats have been found wintering in 19 sites (limestone caves, abandoned mines and tunnels). Populations of *Myotis sodalis* are dwindling throughout its range, and it is on the federal endangered-species list. Following major declines due

to white-nose syndrome, there were as few as 25 known left hibernating in the state in late 2015.

The Indiana bat hibernates in clusters of about 250 bats per square foot on the ceilings and side walls of caves. In this formation, the bats are vulnerable to disturbance by cave explorers: when a bat on the edge of the cluster is awakened, it moves about, starting a ripple of activity that spreads throughout the group. A winter of repeated disturbances causes bats to burn vital fat stores, and they might run out of energy before spring.

Females of this species are believed to bear a single young in late June. Feeding habits are probably similar to those of the little brown bat.

## Small-footed Bat (*Myotis leibii*)

This species is one of the smallest in North America: length, 2.8 to 3.3 inches; wingspread, 8.3 to 9.7 inches; weight, 0.18 to 0.28 ounces. As the name implies, it has a very small foot when compared with other bats. When viewed from the front, the bat has a distinct black mask that stretches from ear tip to ear tip. In Pennsylvania, this bat is rare, and the population is thought to be decreasing. It is included on Pennsylvania's threatened-species list. Summer roosts are primarily rock cliffs, boulder fields, rock-strewn abandoned mine lands and even rocky road cuts. On rare occasions, they might be found in buildings or tree cavities.

The small-footed bat resembles the little brown bat, but has a golden tint to its fur. Feeding and breeding habits probably



small-footed bat

parallel those of the other small, closely related bats. The small-footed bat waits until November to enter caves for hibernating, and emerges in March. It hibernates in narrow cracks in the wall, floor or roof, singly and in groups of up to 50 or more. It usually stays close to entrances where the temperature is just above freezing.

### Silver-haired Bat (*Lasionycteris noctivagans*)

A medium-sized bat: length, 3.7 to 4.5 inches; wingspread, 10.5 to 12.1 inches; weight, 0.25 to 0.35 ounces. The fur is soft and long; the sexes are colored alike, blackish-brown tipped with white, for a bright, frosted appearance.

The silver-haired bat inhabits wooded areas bordering lakes and streams. It roosts in dense foliage, behind loose bark or in a hollow tree – rarely in a cave. It begins feeding earlier than most bats, often before sunset. Silver-haired bats do not hibernate in Pennsylvania, migrating farther south. In summer, a few may breed in the cooler, mountainous sections of the state, but most go farther north.

### Tricolored Bat (*Perimyotis subflavus*)

The tricolored bat, previously known as the eastern pipistrelle, also is called the pygmy bat because of its small size: length, 2.9 to 3.5 inches; wingspread, 8.1 to 10.1 inches; weight, 0.14 to 0.25 ounces. Its fur is yellowish brown, darker on the back. The back hairs are tricolored: gray at the base, then a band of yellowish brown, and dark brown at the tip.

Tricolored bats take wing early in the evening and make short, elliptical flights at treetop level. In summer, they inhabit open woods near water, rock or cliff crevices, buildings and caves. They hibernate from September through April or early May, deep inside caves and away from the openings, in zones where the temperature is about 52 to 55 degrees. They sleep soundly, often dangling in the same spot for months.

Tricoloreds eat flies, grain moths and other insects. They breed in November, and young – usually two per litter – are born in June or July. Tricoloreds live 10 to 15 years and are found throughout Pennsylvania, except in the southeastern corner.

### Big Brown Bat (*Eptesicus fuscus*)

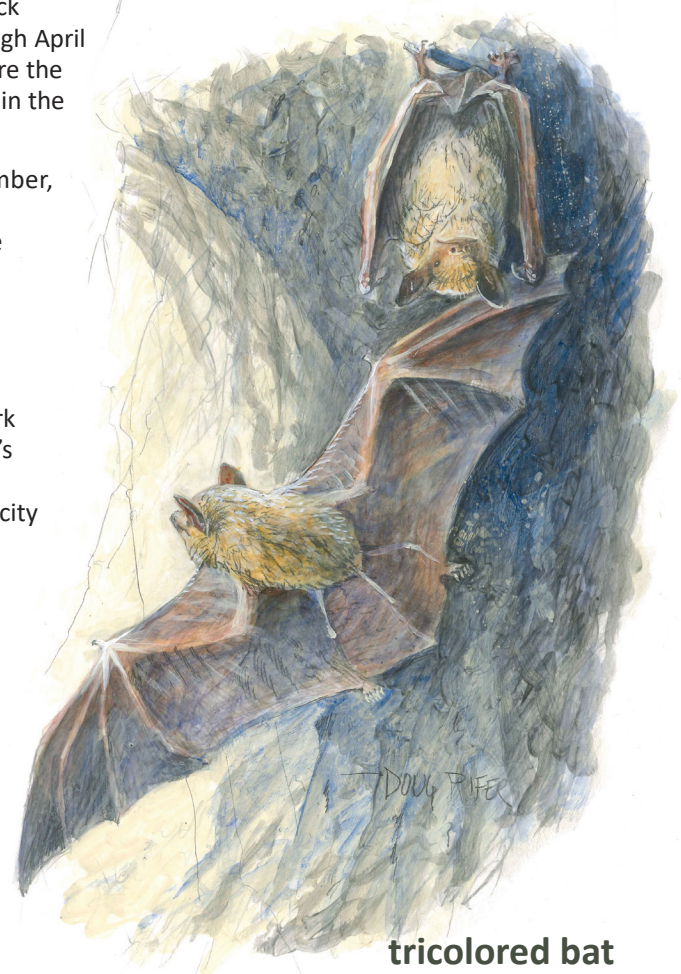
Second in size to the hoary bat, the big brown is 4.1 to 4.8 inches long; wingspread, 12.1 to 12.9 inches; weight, 0.42 to 0.56 ounces. The fur is dark brown, and the face, ears and flight membranes are blackish. Pennsylvania's most common bat, the big brown ranges throughout the state in diverse habitats: attics, belfries, barns, behind doors and shutters, hollow trees, in city and country.

Big brown bats fly at dusk, and generally use the same feeding grounds each night. They fly in a nearly straight course 20 to 30 feet in the air, often emitting an audible chatter. Major foods include beetles and true bugs (junebugs, stinkbugs and leafhoppers), many of which are major agricultural pests. A colony of 150 big brown bats can eat enough cucumber beetles during the summer to protect farmers from 18 million rootworm larvae.

Among the last bats to enter hibernation, big brown bats seek out caves, buildings, mines and storm sewers in October, November or December. They hang close to the mouths of caves. They emerge in March and April. Females bear young in June, usually two per litter. As young mature and leave the nursery colony, adult males enter and take



silver-haired bat



tricolored bat

up residence. Big brown bats have lived up to 19 years in the wild.

## hoary bat

### Red Bat (*Lasiurus borealis*)

A bright rusty coat and long, pointed wings distinguish this species. Length is 3.7 to 4.8 inches; wingspread, 11.3 to 12.9 inches; and weight, 0.28 to 0.49 ounces. Individuals roost singly in trees (except for females with young), often on forest edges, in hedgerows and shrubby borders; they seem to prefer American elms. Rarely do they use caves or buildings.

Red bats start flying early in the evening, preying on moths, flies, bugs, beetles, crickets and cicadas, which they take from air, foliage and ground. Strong fliers, red bats are considered migratory, although their patterns are little known. The sexes may migrate separately. Red bats start south in September or October, flying at night. They can withstand body temperatures as low as 23 degrees.

Females bear one to five young (usually two or three) in their treetop roosts. For the first few days, the young remain clinging to their mother when she flies out on hunts. Young are able to fly at three to four weeks, and are weaned when five to six weeks old. Longevity is about 12 years. The red bat ranges across Pennsylvania.

### Hoary Bat (*Lasiurus cinereus*)

The largest bat of the eastern forests, the hoary is 5.1 to 5.9 inches long; has a 14.6 to 16.4-inch wingspread; and weighs 0.88 to 1.58 ounces. The fur is dark brown, heavily tinged and white. The species ranges across the state, but is uncommon.

Hoary bats roost in trees. They prefer conifers, but also use deciduous trees in woodlots, forest edges and farmland. They choose protected sites 12 to 40 feet above the ground. Strong, swift fliers, they take to the air later than most other bats. They prey mostly on moths, but also take beetles and mosquitoes.

Hoary bats migrate to warmer climates in winter. In spring, they return and raise young. The young are born from mid-May to early July, usually two to a litter. Females have two pairs of breasts and sometimes have three or four pups in a litter. The female gives birth while hanging in a tree. Young grow rapidly and are able to hunt for themselves in about a month.

Note: The Seminole Bat (*Lasiurus seminolus*) and Evening Bat (*Nycticeius humeralis*) have been found a few times in Pennsylvania, but are not considered regular residents. In recent years, more than a dozen Semiole bats have been found dead underneath Pennsylvania wind turbines and three pregnant Evening bats have been captured during the mid-summer maternity season.



## red bat



## Bats and Your Home

Homeowners having problems with bats may be interested in the booklet, *A Homeowner's Guide to Northeastern Bats and Bat Problems*, by Lisa M. Williams-Witmer and Margaret C. Brittingham, Publication Distribution Center, Pennsylvania State University, 112 Agricultural Administration Building, University Park, PA 16802. It is also available at local Penn State county extension offices.