

## Indiana bat, *Myotis sodalis*

**Status:**

**State:** Endangered

**Federal:** Endangered

### Identification

The Indiana bat is a medium-sized member of the genus *Myotis*. The head and body length ranges from 41 to 49 mm (1 5/8 - 1 7/8 in.), while the forearm length ranges from 35 to 41 mm (1 3/8 - 1 5/8 in.) (US FWS 1999). The species closely resembles the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*Myotis septentrionalis*). The Indiana bat has a



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strongly keeled calcar, a foot spur of cartilage that supports the membrane between the foot and tail. Its hind feet tend to be small and delicate with fewer, shorter hairs (that do not extend beyond the toenails) than the little brown and northern long-eared bats. The fur lacks luster, and the ears and wing membranes have a dull appearance and flat coloration that do not contrast with the fur. The chest and belly fur is lighter than the dull, pinkish-brown fur on the back, but does not contrast as strongly as does that of the little brown bat or northern long-eared bat. The skull is marked lengthwise by a small sagittal crest, and the braincase tends to be smaller, lower, and narrower than that of the little brown bat. The little brown's fur is bronze, and, on average, the little brown has a longer body and weighs more.

### Habitat

Indiana bats hibernate in limestone caves and open, abandoned mine shafts (hibernaculum) from October to April. *M. sodalis* is highly selective of hibernation sites. Medium sized caves with large, shallow passageways are preferred. During midwinter, ideal conditions inside caves include an average temperature of 37-43° Fahrenheit (Evans, et. al.) and a relative humidity of 87% (Barbour and Davis 1969). Throughout hibernation, bats periodically move to the coldest parts of the cave. Some individuals also remain active, awakening approximately every 8-10 days. These bats may return to any of the hibernating clusters (Barbour and Davis 1969).

When Indiana bats hibernate together, their densities can range from 300 to 484 bats per square foot (Tuttle 1999). They often hibernate with other species. At the Hibernia Mine in New Jersey, Indiana bats hibernate primarily with little brown bats, as well as big brown (*Eptesicus fuscus*), northern long-eared, and eastern pipistrel (*Pipistrellus subflavus*) bats.

During the summer, females occupy maternity roosts of up to 100 females in riparian and flood plain forests under the loose bark of dead or dying trees. They have also been found under the loose bark of living trees and in cavities of dead trees. The use of upland habitats is also becoming more common for some populations. A study by

Garner and Gardner (1992) indicated that 75% of roost trees were upland species, while the other 25% were flood plain species. Species used as roost sites include, but are not exclusive to, American elm (*Ulmus americana*), slippery elm (*Ulmus rubra*), bitternut hickory (*Carya cordiformis*), shagbark hickory (*Carya ovata*), sweet pignut hickory (*Carya ovalis*), northern red oak (*Quercus rubra*), post oak (*Quercus stellata*), white oak (*Quercus alba*), silver maple (*Acer saccharinum*), sugar maple (*Acer saccharum*), cottonwood (*Populus deltoides*), green ash (*Fraxinus pennsylvanica*) and sassafras (*Sassafras albidum*) (Evans, et. al.). One colony was also found roosting in the cavity of a dead sycamore (*Platanus occidentalis*) (Kurta, et al. 1993).

Maternity colonies may establish both primary and alternate roost sites, which differ in location and in the number of bats using the roost site. Since the temperature of the roost site is important, primary roosts are located in areas that can be heated by the sun, such as in openings or at the edges of forests. Alternate roost sites are also located in forest interiors, and are used when temperatures are above normal or when it is raining (U.S. Fish and Wildlife Service 1999). During the summer, males roost alone or in small groups, usually near female roosts. However, some adult males occupy caves during the summer as well (US FWS 1999; Harvey 1992).

Trees located within the flood plain and along the sides of streams are particularly important in providing areas in which to forage for insects. Open bodies of water, such as lakes and reservoirs, are also used as foraging areas. During the summer, females and juveniles forage in riparian and flood plain areas. Pregnant and lactating females also prefer open bodies of water and have been known to fly up to 1.5 miles from upland roosts. Foraging also occurs in the canopy of upland trees and over clearings with early successional vegetation (US FWS 1999).

## **Status and Conservation**

The Indiana bat was listed as endangered by the federal government in 1967 because of declines in their numbers that were documented at their seven major hibernacula in the Midwest. It was automatically added to the New Jersey endangered species list following passage of the state Endangered and Nongame Species Act in 1973. At the time of the federal listing, about 85% of the entire population hibernated at only seven sites, and fully half of the entire population hibernated in only two caves.

Human disturbance at these sites was considered to be a major factor in the bats' population decline. Since then, steps have been taken to protect most of the major hibernating sites, as well as minor sites, such as Hibernia Mine. In Indiana, bat numbers in 2001 appeared to be stable to slightly increasing. In Kentucky, their numbers appeared to be declining, but not so rapidly as in Missouri. There, the U.S. Fish and Wildlife Service termed the situation "catastrophic." Between 1975 and 1995, the number of Indiana bats at the major hibernating sites declined from more than 120,000 to nearly 20,000. In wake of such declines, some researchers believe the Indiana bat might be extirpated from Missouri--and possibly Iowa, where most of the bats hibernating in Missouri spend their summers--within the next 10 to 20 years (US FWS 2001).

Throughout the range of the Indiana bat, most of the major caves and abandoned mines that are used for hibernation have been gated or protected in other ways to guard against human disturbance during winter.