



Common Name: INDIANA BAT

Scientific Name: *Myotis sodalis* Miller and Allen

Other Commonly Used Names: Indiana myotis, social myotis

Previously Used Names: none

Family: Vespertilionidae

Rarity Ranks: G2/S1

State Legal Status: Endangered

Federal Legal Status: Endangered

Description: The dorsal hair of the Indiana bat is dark chestnut gray to pinkish gray, darker at the base, and lacks luster. Individual hairs have three bands of color. The ears and wing membranes also have a flat coloration that does not contrast with the fur. The underfur is somewhat lighter colored with a pinkish cast. The hairs on the relatively small (9 mm, $\frac{3}{8}$ inch) feet are short and inconspicuous and the calcar (a spur of cartilage arising from inner side of ankle and running along part of outer wing) is keeled. The total length is 41 - 49 mm ($1\frac{5}{8}$ - $1\frac{7}{8}$ inches), the forearm length is 35 - 41 mm ($1\frac{3}{8}$ - $1\frac{5}{8}$ inches), the wingspread is 24 - 27 cm ($9\frac{3}{8}$ - $10\frac{5}{8}$ inches), and the weight is about 5 - 8 grams (about $\frac{1}{4}$ ounce).

Similar Species: In general, the Indiana bat closely resembles the little brown bat (*Mysotis lucifugus*). Characters of the latter that help distinguish it are a slightly larger (10mm) foot, toe hairs that extend beyond the knuckles, a keel-less calcar, and burnished bronze hair tips.

Habitat: Indiana bats gather in large groups in suitable caves to hibernate, more than 85% of the population in just nine caves in Indiana, Missouri, and Kentucky. These bats need winter caves with a stable temperature of 4 - 8°C (39 - 46°F) that contain standing water which maintains relative humidity above 74%. The bats usually cluster fairly near the entrance and awaken periodically throughout the winter. During the summer, Indiana bats roost in trees, usually under loose, exfoliating bark as found on shagbark hickories and dead hardwoods, or in hollow trees. The roost sites are typically at a woodland edge where the tree is warmed by the sun. The bats forage in the surrounding riparian, floodplain, and upland forest, and sometimes over open areas and water as well.

Diet: Diet consists of flying insects, including moths, flies, mosquitoes, midges, beetles, bees, wasps, ants, caddis flies, and stoneflies.

Life History: Little is known about the summer behavior of Indiana bats, because they are secretive and widely distributed. The first maternity colony was not discovered until 1974. In late March, females emerge from hibernacula and disperse to their summer ranges, usually northward, at least from midwestern caves. From mid-April to mid-May, they begin to gather in maternity colonies numbering 25 - 100 under loose bark or in hollow trees. Each female gives birth to a single young in June or early July. The young are able to fly in about four weeks. Males emerge from hibernation a little behind the females. Some disperse and some remain near the hibernacula. Males roost singly or in small groups. They tend to forage in the canopy of floodplain forests and wooded hillsides, whereas the females forage lower in riparian and floodplain forests. Migration to hibernacula begins in August. Upon arrival, the bats "swarm," a behavior in which great numbers of bats fly in and out of cave entrances throughout the night, with only a few bats actually roosting in the caves during the day. Swarming continues for several weeks and is related to mating activity. During this time, the bats also are building up fat reserves upon which they will depend during the winter. Breeding occurs mainly in early October; females store sperm throughout the winter, and fertilization occurs in the spring shortly after emergence. Some breeding activity also occurs in the spring. Almost all bats are in hibernation by late November. They hang from the cave roof in tight clusters with densities of about 3,200 bats per square meter (yard). Individuals awaken and become active within the cave every 8 - 10 days, so they are a little less susceptible to disturbance during hibernation than are some other species. Bats of this species are known to live at least 20 years.

Survey Recommendations: Guidelines for hibernacula surveys and summer mist-net surveys are given in Appendices 4 and 5, respectively, of the Indiana bat recovery plan. There are no known significant hibernacula (that is, with large numbers of bats) in Georgia for this species, but any survey of wintering bats should be conducted very carefully to avoid disturbance that could lead to awakening. If Indiana bats are encountered, Georgia Department of Natural Resources and U.S. Fish and Wildlife Services should be notified immediately and survey efforts at that site should be suspended pending further authorization. Proper surveying of a known hibernacula should be conducted by experienced, authorized personnel during January 15–February 15. Small clusters of bats can be counted individually; the numbers of individuals in larger clusters can be determined using photography or estimated by multiplying the measured area of the cluster by a density factor, which typically ranges from 300 to 484 bats per square foot. Mist-net surveys should be conducted during May 15–August 15. Capture of pregnant or lactating females or young of the year during this period indicates the nearby presence of a nursery colony. Nets should be the finest mesh commercially available; currently this is 2-ply, 50 denier nylon with 38mm mesh. Nets should be set over streams or in open travel corridors in wooded areas, one net site per km of stream or corridor, or 2 net sites per square km in non-corridor areas. Minimum survey effort per site should be 4 net-nights consisting of at least 2 nights of netting (starting at sunset and lasting at least 5 hrs) and at least 2 net locations (separated by 30 m or more) per night. Nets should be checked every 10 minutes.

Range: This species is known to occur throughout much of the midwestern and eastern U.S. but has been documented in Georgia from only two caves in Dade County in the northwestern part of the state. The Georgia records are from fall and winter collections; the nearest known maternity colonies are in southern Kentucky. The species has been virtually eliminated from much of its former range.

Threats: Cave disturbance and alteration, including installation of poorly designed gates, along with vandalism and pesticides, have contributed to the decline of Indiana bats. Clearing of riparian forests has probably also been a factor, as has intensive research involving capturing and banding, which is now avoided. Significant natural factors include flooding of occupied caves, exposure to freezing temperatures during especially harsh winters, cave ceiling collapse, and destruction of tree roosts by severe weather. Based on hibernacula surveys, the total population has declined from an estimated 808,000 in 1960 to 589,000 in 1980, and to 352,000 in 1995. Most current declines appear to be during the summertime or during migration as a result of unknown causes.

Georgia Conservation Status: There are very few records of this species in Georgia, and no known occupied habitat.

Conservation and Management Recommendations: Georgia has no known occupied habitat at this time. It is possible that small numbers of winter residents and transient individuals occur in the state. Protection of occupied caves, if any unprotected ones are found, would be important. In other areas, proper gating of caves minimizes disturbance at roost sites. Forest management activities at summer roost sites should ensure that forested foraging habitat is available, that no

roost trees are destroyed, and that a continuous supply of suitable roost trees are available. Since roosts are often in dead trees, each one is available for only a few years before it falls.

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Date Compiled or Updated:

J. Ozier, Aug. 2008: original account

K. Owers, Sept. 2009: updated status and ranks, added picture