



Indiana Bat

Myotis sodalis



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CURRENT STATUS: In Pennsylvania, the Indiana bat is listed as endangered and protected under the state Game and Wildlife Code. It also is a “priority species” in the state’s Wildlife Action Plan. Nationally, it has been listed as an endangered species since March 1967.

POPULATION STATUS: The endangered Indiana bat (*Myotis sodalis*) is found in low numbers throughout much of the eastern United States from Oklahoma, Iowa and Wisconsin east to Vermont and south to northwestern Florida. Historically, in Pennsylvania, it was known to occur at only eight hibernation sites, all of which were natural caves. New locations have been identified, but that does not mean that the



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population is increasing. More effective sampling has resulted from increased effort and **improved knowledge of species’ behavior.** Indiana bats are now known to hibernate in 18 sites in 11 counties. All but one of those hibernacula are protected by bat-friendly gates. Three current hibernacula are caves formerly abandoned by Indiana bats to which they returned shortly after gates were installed. Based on recent surveys conducted by Game Commission biologists, the U.S. Fish and Wildlife Service estimates that about 1,000 Indiana bats hibernate in Pennsylvania. Nine Indiana bat summer maternity sites have been found in seven Pennsylvania counties and there have been mist-net captures in summer habitat in four counties.

IDENTIFYING CHARACTERISTICS: The Indiana bat closely resembles the very common little brown bat and less common northern long-eared bat, both of which also are *Myotis* species. Considerable experience is needed to accurately identify Indiana bats. Even experienced researchers use a combination of characteristics, not just one or two, because individuals within this species vary, as do the other bats. The facial area of the Indiana bat appears pink, rather than dark like similar *Myotis*. Its pinkish-brown fur

lacks luster and its ears and wing membranes have a dull appearance that does not contrast with the fur. The contrast between its back and belly fur is less pronounced than in little brown and northern long-eared bats. Indiana bats have small, delicate feet with short toe hairs that to do not extend beyond the toenails, and there is a small cartilage spur off the foot that supports the tail membrane. The total body length of an adult Indiana bat is 3½ to 5½ inches and its wingspan is 9½ to 10½ inches.

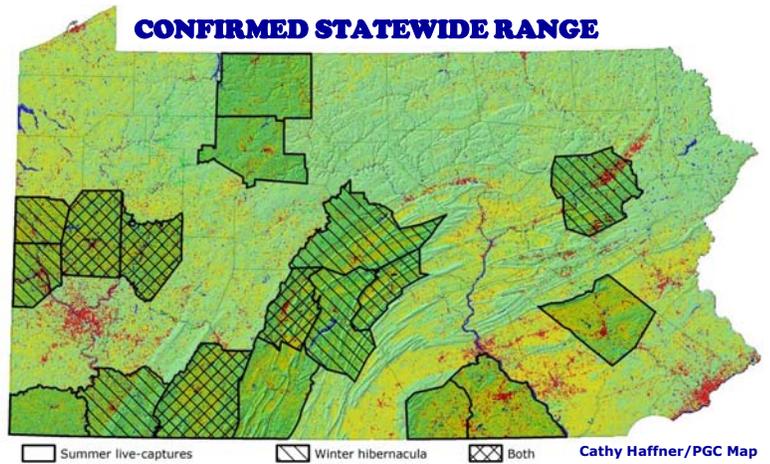
BIOLOGY-NATURAL HISTORY: True hibernators, Indiana bats enter hibernation sites in fall and survive on stored fat until spring. Hibernacula tends to be found in regions with well-developed limestone caverns and abandoned mines.

Of Pennsylvania's 18 known Indiana bat hibernacula, 11 are abandoned limestone mines and six are limestone caves. This species begins entering mine tunnels and caves in mid-September, with most in hibernation by early November. In areas with larger Indiana bat populations, they can be found in dense clusters of 250 or more bats per square foot. In Pennsylvania, hibernating Indiana bats are most often found mixed in among little brown bats, possibly due to low statewide numbers causing them to use little browns as surrogate roosting partners. Before going into hibernation, and again during the spring emergence, bats swarm around entrances to hibernation sites and rely on nearby surface habitat to forage for insects. Mating occurs in fall, but females store sperm through the winter and fertilization occurs in spring. Most Indiana bats use trees as roosts in summer. In mid-April to late May, females arrive at summer maternity sites where they form small colonies under loose bark. They give birth to one young per year from mid-June to early July and young bats are able to fly by mid-July to early August. Male Indiana bats are less selective, using trees of almost any size if they have loose bark or cavities. The maximum migration distance from hibernacula to summer habitats is estimated to be 320 miles.

The first Indiana bat summer maternity site documented in Pennsylvania is located in the attic of a decommissioned country church, where a small number of female Indiana bats spend the summer among tens of thousands of little brown bats. Other building maternity roosts were later found in Iowa, New

York, and New Jersey, but Pennsylvania's was the first. Maternity roosts in buildings are still the exception, not the rule. All of the state's other known Indiana bat maternity sites are trees.

PREFERRED HABITAT: Indiana bat hibernation sites have stringent requirements, including noticeable airflow and the lowest non-freezing temperatures possible. Only a small percentage of available hibernacula provide these temperatures. Indiana bat sites usually also have some standing or flowing water. Primary maternity roosts are trees (often large, dead ones) with exfoliating bark and sun exposure that results in high temperatures, while males seek cooler roosts. Most roosts are within ¾ mile of water. A multi-year PGC study of female Indiana bats from the



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church maternity colony found that their primary insect-foraging habitat was on gentle to moderate south-facing slopes covered by mixed oak or mixed northern hardwood forests.

REASONS FOR BEING ENDANGERED: Human entry into hibernation sites in winter is a primary threat because it disturbs bats and causes them to burn up their fat reserves. In Pennsylvania, most known Indiana bats have resorted to manmade structures for hibernation sites, but tunnels created by blasting are not as stable as natural caves and more prone to collapses that can alter interior habitats or result in warmer temperatures in the mine. Alterations to hibernacula and the surrounding habitat also threaten bat populations. Development, such as urban sprawl and highways, that removes surface habitat around hibernacula or summer sites results in longer commuting distances between foraging areas and day roosts. Highway traffic also can take a toll. During the foraging studies, PGC biologists found one road-killed Indiana bat and many dead little brown bats. They also found that female Indiana bats from the church crossed a highway up to eight times per night to return to the roost and nurse their pups. Wind turbines pose a threat to all bats. PGC spring migration telemetry found that female Indiana bats foraged high on ridge tops where temperatures were 10 to 20 degrees warmer, resulting in greater insect activity. The same bats also readily crossed ridges in their flight path. Unnatural predation, in the form of feral cats at entrances to hibernation sites during swarming periods, is another threat. Natural predation by screech owls and black snakes also is routinely observed, but that natural pressure is minimal compared to feral cats. Bats have a history of accumulating contaminants found in pesticides. This was particularly true when organochlorine pesticides such as DDT had a **strong presence in our environment. It's unclear if the pesticides that have replaced the now banned organochlorines are being bioaccumulated by bats.**

White Nose White-Nose Syndrome is an emerging threat causing the death of unprecedented numbers of cave bats across a rapidly increasing portion of the eastern United States.

MANAGEMENT PROGRAMS: PGC biologists conduct annual research of bat populations. This work includes: counts of hibernating bats, spring and fall live-trapping at hibernacula entrances, banding and recapture studies, migration telemetry to locate maternity colonies, summer mist-netting, installation of alternative roosts, and protection of important hibernacula and roosts. Significant Game Commission contributions to knowledge about Indiana bats in Pennsylvania include: the identification and detailed descriptions of foraging habitat and roosts used by the Canoe Creek Church maternity colony, a study of the commuting ecology of bats relative to highway design, discovery of previously unknown hibernation and summer sites, and gating of significant hibernacula. Private consultants and university researchers who conduct bat surveys submit reports to the PGC as a requirement of their state permits. Pennsylvania is coordinating a multi-



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state effort to develop a regional response to White Nose Syndrome.

Primary conservation and management needs listed in Pennsylvania's Wildlife Action Plan include: continued identification and protection of key habitats, searches for mine portals on abandoned mine lands scheduled for reclamation and their evaluation through live-trapping or interior surveys, and the development and evaluation of forest management plans to incorporate Indiana bat requirements for foraging and roosting habitat. Research needs include: the location, description and protection of additional maternity sites; artificial summer roosts as a management tool for areas that lack adequate natural roosts; study of the accumulation of environmental contaminants and their effects on bat populations; improved marking and recapture techniques; avoidance of human conflicts; and study of hibernacula temperatures through the use of dataloggers.

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