

Indiana Bat



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Photo credits: Jesse W. Jaycox

Scientific Name *Myotis sodalis*
Miller and Allen, 1928

Family Name Vespertilionidae
Evening Bats and Vesper Bats

Did you know?

The Indiana bat hibernates in mines and caves, but males and females roost in crevices and under the bark of trees during the warmer months of the year. Female Indiana bats form maternity colonies, giving birth and raising their young in these tree roosts.

Summary

Protection Endangered in New York State, Endangered federally.

This level of state protection means: A native species in imminent danger of extirpation or extinction in New York (includes any species listed as federally Endangered by the United States). It is illegal to take, import, transport, possess, or sell an animal listed as Endangered, or its parts, without a permit from NYSDEC. 1) Any native species in imminent danger of extirpation or extinction in New York. 2) Any species listed as endangered by the United States Department of the Interior.

This level of federal protection means: Listed as Endangered in the United States by the US Department of Interior.

Rarity G2, S1

A global rarity rank of G2 means: Imperiled globally because of rarity (6 - 20 occurrences, or few remaining acres, or miles of stream) or very vulnerable to extinction throughout its range because of other factors.

A state rarity rank of S1 means: Typically 5 or fewer occurrences, very few remaining individuals, acres, or miles of stream, or some factor of its biology makes it especially vulnerable in New York State.

Conservation Status in New York

This species was federally-listed as endangered prior to the start of white-nose syndrome and subsequently suffered population declines of 71% from 2007-2015. Many of the general areas where maternity and bachelor colonies are known to occur are in areas that are subject to increasing development.

Short-term Trends

The maximum total count increased from approximately 13,000 to 41,000 Indiana bats from 2001-2006. This increase in numbers was largely the result of discovery of new hibernacula and improved methods of counting overwintering bats but may also have reflected an increase in the overall size of the population. Winter hibernacula surveys from 2007-2015 documented population declines of 71%.

Long-term Trends

The long-term trends are unknown but is likely greater than a 70% reduction in population numbers since historic times; despite an apparent increase, or at least stable period, from 2001-2006.

Conservation and Management

Threats

Indiana bats had suffered significant past declines and were listed as endangered in 1967 (USFWS 2014). Past disturbances to winter hibernacula were thought to have resulted in decline since they hibernate in limited locations and are susceptible to disturbance. Currently, the largest threat to Indiana bats in New York is white-nose syndrome (WNS) which was first discovered among bats in a cave in Schoharie County, New York in 2006. White-nose syndrome is caused by a fungus *Pseudogymnoascus destructans* (previously *Geomyces destructans*) that is often visible on the bats' muzzle and wings (Blehert et al. 2009). The fungus may invade hair follicles and cause lesions under the skin (Blehert et al. 2009). Bats wake from hibernation to groom and consequently burn fat reserves that are needed to survive the winter and they become emaciated (Blehert et al. 2009). Extensive damage to their wing membranes and dehydration may also be contributing factors to mortality (U.S. Fish and Wildlife Service 2013).

Tree cutting can impact this species when felled trees contain colonies or roosting individuals. There are very few colonies left in New York so loss of summer roosts containing bats is even more devastating to dwindling populations. Habitat loss from development is also a threat which can limit suitable habitat.

Bats may be particularly sensitive to environmental toxins including those found in herbicides and pesticides. Although no studies have targeted Indiana bats in New York directly, elevated levels of persistent organic pollutants including especially PCBs, DDT, Chlordanes, and PBDEs have been found in a similar species, the little brown bat, in the Hudson River Valley in New York (Kannan et al. 2010). The levels found in the bats were only 1 to 3 times less than lethal concentrations reported from previous studies (Kannan et al. 2010). Lesser toxin levels may be expected in Indiana bats since little brown bats typically consume a greater percentage of prey with an aquatic life stage. Bats are highly susceptible to DDT residue and this chemical was widely used as a pesticide to control bat infestations in houses in the 1940s (USGS 2013). It was widely used as an agricultural pesticide in the 1950s and 60s until its agricultural use was banned in 1972. Since DDT is highly persistent (soil half-life is 2-15 years, aquatic half-life is about 150 years) (NPIC 1999), it can pose a threat to bats when there is exposure to trace residues in the environment (USGS 2013). Extensive applications of insecticides and some bio control methods, such as Btk, could also pose an indirect risk to Indiana bats by reducing availability of prey.

If proper precautions are not used, cavers and researchers entering hibernacula may

cause disturbance that rouses bat colonies or transport the fungus that causes WNS on their clothing (NatureServe 2013). Other potential threats may include climate change, commercial cave development, flooding and hibernacula collapse; habitat loss and fragmentation from development, hydraulic fracturing, and construction of new wind facilities; and direct mortality from wind facilities (U.S. Fish and Wildlife Service 2013).

Conservation Strategies and Management Practices

Continue to monitor populations at hibernacula every other year as recommended by the United States Fish and Wildlife Service.

Research Needs

Additional research is needed to locate new maternity and bachelor colonies and to determine habitat use surrounding these areas.

Habitat

Indiana bats hibernate in caves and mines during the winter. Predominately female Indiana bats radio-tracked from hibernacula in Jefferson, Essex, and Ulster Counties were found to move between approximately 12 and 40 miles to roost location on their foraging grounds. The roosts consisted of living, dying, and dead trees in both rural and suburban landscapes.

Associated Ecological Communities

Appalachian Oak-hickory Forest

A hardwood forest that occurs on well-drained sites, usually on ridgetops, upper slopes, or south- and west-facing slopes. The soils are usually loams or sandy loams. This is a broadly defined forest community with several regional and edaphic variants. The dominant trees include red oak, white oak, and/or black oak. Mixed with the oaks, usually at lower densities, are pignut, shagbark, and/or sweet pignut hickory.

Beech-maple Mesic Forest

A hardwood forest with sugar maple and American beech codominant. This is a broadly defined community type with several variants. These forests occur on moist, well-drained, usually acid soils. Common associates are yellow birch, white ash, hop hornbeam, and red maple.

Calcareous Cliff Community

A community that occurs on vertical exposures of resistant, calcareous bedrock (such as limestone or dolomite) or consolidated material; these cliffs often include ledges and small areas of talus.

Calcareous Talus Slope Woodland

An open or closed canopy community that occurs on talus slopes composed of calcareous bedrock such as limestone or dolomite. The soils are usually moist and loamy; there may be numerous rock outcrops.

Deep Emergent Marsh

A marsh community flooded by waters that are not subject to violent wave action. Water depths can range from 6 in to 6.6 ft (15 cm to 2 m). Water levels may fluctuate seasonally,

but the substrate is rarely dry, and there is usually standing water in the fall.

Floodplain Forest

A hardwood forest that occurs on mineral soils on low terraces of river floodplains and river deltas. These sites are characterized by their flood regime; low areas are annually flooded in spring, and high areas are flooded irregularly.

Hemlock-northern Hardwood Forest

A mixed forest that typically occurs on middle to lower slopes of ravines, on cool, mid-elevation slopes, and on moist, well-drained sites at the margins of swamps. Eastern hemlock is present and is often the most abundant tree in the forest.

Limestone Woodland

A woodland that occurs on shallow soils over limestone bedrock in non-alvar settings, and usually includes numerous rock outcrops. There are usually several codominant trees, although one species may become dominant in any one stand.

Maple-basswood Rich Mesic Forest

A species rich hardwood forest that typically occurs on well-drained, moist soils of circumneutral pH. Rich herbs are predominant in the ground layer and are usually correlated with calcareous bedrock, although bedrock does not have to be exposed. The dominant trees are sugar maple, basswood, and white ash.

Associated Species

Big Brown Bat (*Eptesicus fuscus*)
Eastern Small-Footed Myotis (*Myotis leibii*)
Little Brown Bat (*Myotis lucifugus*)
Northern Myotis (*Myotis septentrionalis*)
Eastern Pipistrelle (*Perimyotis subflavus*)

Identification Comments

Identifying Characteristics

The Indiana bat is a small bat, approximately 2 inches (51 mm) in length and weighing approximately 0.2 to 0.3 ounces (6-9 grams) (Harvey et al. 1999; NYSDEC 2006). The pelage is very fine and fluffy and is dark gray to grayish-brown in color and the nose is pinkish in color (NYSDEC 2006). The feet have few hairs that do not extend beyond the tips of the toes. Indiana bats have a keeled calcar, which is a cartilaginous projection from the foot which helps support the membrane between the foot and the tail (NYSDEC 2006).

Characteristics Most Useful for Identification

When in hand, the gray-brown pelage, pinkish nose, toe hairs that don't extend beyond the tips of the toes, and keeled calcar are used in combination to distinguish Indiana bats from little brown bats. Hibernating Indiana bats are distinguished from other bats by their tight clusters, grayish-brown pelage and pinkish noses.

Behavior

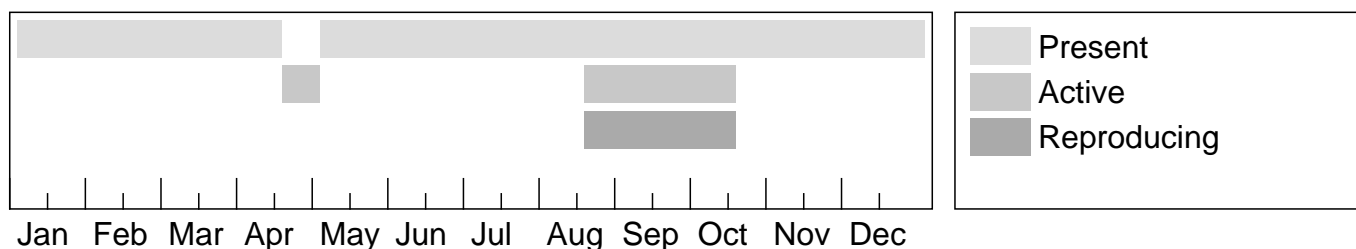
Most Indiana bats migrate seasonally between traditional winter and summer roost sites. Hibernation sites include both natural caves and mines. Caves and mines chosen for hibernation have been reported to have stable temperatures below 10 degrees Celsius (50 degrees Fahrenheit) and preferably from 4-8 degrees Celsius (39 - 46 degrees Fahrenheit). Relative humidities are fairly high at hibernation sites, usually above 74 % (Hall 1962; Humphrey 1978). Depending on local weather conditions, Indiana bats hibernate from October through April (Hall 1962). Summer foraging habitat consists of wooded or semi-wooded areas and may be along streams. Indiana bats have strong fidelity to summer colony areas, roosts, and foraging habitat (USFWS 1999), and radio-telemetry studies in New York have shown this to be true for maternity roost locations. Maternity colonies are generally in hollow trees or under loose bark of living or dead trees that are often exposed to direct sunlight. Although the majority of maternity sites reported have been in riparian areas, recent studies in New York and elsewhere indicate that upland habitats are used more than previously thought (Humphrey et al. 1977; Garner and Gardner 1992).

Diet

Indiana bats feed entirely on flying insects and the food items reflects the environments in which they forage. Prey items may include moths (Lepidoptera), caddisflies and flies (Diptera), mosquitos and midges, bees, wasps, and flying ants (Hymenoptera), beetles (Coleoptera), leafhoppers and treehoppers (Homoptera), stoneflies (Plecoptera), and lacewings (Neuroptera) (NatureServe 2006).

The Best Time to See

Females begin hibernation soon after mating, whereas males often remain active through mid-October to November (Cope and Humphrey 1977). Most individuals are in hibernation by late November although some are still active until December (Barbour and Davis 1969). Activity is resumed generally in April, with few bats still in the hibernation caves by mid-May. In Michigan, bats were present at tree roosts as late as 10 September (Kurta et al. 1993). Primarily nocturnal.



The time of year you would expect to find Indiana Bat in New York.

Similar Species

Little Brown Bat(*Myotis lucifugus*): The little brown bat differs from the Indiana bat in that it has brown pelage and its ears and nose are slightly darker than the fur (NYSDEC 2006). Little brown bat feet are also larger and with more hairs that extend beyond the tips of the toes (NYSDEC 2006). Indiana bats have a keeled calcar, which is absent in Little brown bats.

Taxonomy

Kingdom Animalia

└─ **Phylum** Craniata

└─ **Class** Mammals (Mammalia)

└─ **Order** Bats (Chiroptera)

└─ **Family** Vespertilionidae (Evening Bats and Vesper Bats)

Additional Resources

Links

Bat Conservation International

<http://www.batcon.org/home/default.asp>

NatureServe Explorer

<http://naturereserve.org/explorer/servlet/NatureServe?searchName=MYOTIS+SODALIS>

Google Images

<http://images.google.com/images?q=MYOTIS+SODALIS>

New York State Department of Environmental Conservation

<http://www.dec.ny.gov/animals/6972.html>

References

Baker, R. H. 1983. Michigan mammals. Michigan State University Press. 642 pp.

Barbour, R. W., and W. H. Davis. 1969. Bats of America. The University of Kentucky Press, Lexington, Kentucky.

Brack, V., Jr., and R. K. LaVal. 1985. Food habits of the Indiana bat in Missouri. J. Mammalogy 66:308-315.

Brady, J., R. L. Clawson, R. K. LaVal, T. Kunz, M. D. Tuttle, and D. Wilson. 1983. Recovery plan for the Indiana bat. U. S. Fish Wildlife Service, Rockville, Maryland. 94 pp.

Caire, W., J. D. Tyler, B. P. Glass, and M. A. Mares. 1989. Mammals of Oklahoma. University of Oklahoma Press, Norman. Oklahoma. 567 pp.

Callahan, E. V., R. D. Drobney, and R. L. Clawson. 1997. Selection of summer roosting sites by Indiana bats (*MYOTIS SODALIS*) in Missouri. Journal of Mammalogy 78:818-825.

Dalton, Virginia M. 1987. Distribution, Abundance, and Status of Bats Hibernating in Caves in Virginia. Virginia Journal of Science 38(4): 369-379.

Evers, D. C. 1992. A guide to Michigan's endangered wildlife. Univ. Michigan Press, Ann Arbor. viii + 103 pp.

- Figg, D. E. 1993. Missouri Department of Conservation wildlife diversity report, July 1992-June 1993. 75 pp.
- Garner, J. D., and J. E. Gardner. 1992. Determination of summer distribution and habitat utilization of the Indiana bat (*Myotis sodalis*) in Illinois. Illinois Department of Conservation. Final Report, Project E-3. Springfield, IL, 23 pp.
- Hall, E. Raymond. 1981. The Mammals of North America, Vols. I & II. John Wiley & Sons, New York, New York. 1181 pp.
- Hall, J. S. 1962. A life history and taxonomic study of the Indiana bat, *Myotis sodalis*. Reading Publication Museum Art Gallery, Science Publication 12. 68 pp.
- Hamilton, W. J., Jr., and J. O. Whitaker, Jr. 1979. Mammals of the eastern United States. Cornell Univ. Press, Ithaca, New York. 346 pp.
- Handley, C. O., Jr. 1991. Mammals. Pages 539-616 in K. Terwilliger, coordinator. Virginia's endangered species: proceedings of a symposium. McDonald and Woodward Publishing Company, Blacksburg, Virginia.
- Harvey, M.J., J.S. Altenbach, and T.L. Best. 1999. Bats of the United States. Arkansas Game and Fish Commission and United States Fish and Wildlife Service, Little Rock, Arkansas, 64 pp.
- Herkert, J. R., editor. 1992. Endangered and threatened species of Illinois: status and distribution. Vol. 2: Animals. Illinois Endangered Species Protection Board. iv + 142 pp.
- Humphrey, S. R. 1978. Status, winter habitat, and management of the endangered Indiana bat, *Myotis sodalis*. Florida Scientist 41(2):65-76.
- Humphrey, S. R., A. R. Richter, and J. B. Cope. 1977. Summer habitat and ecology of the endangered Indiana bat, *MYOTIS SODALIS*. J. Mammalogy 58:334-346.
- Jones, J. K., Jr., R. S. Hoffman, D. W. Rice, C. Jones, R. J. Baker, and M. D. Engstrom. 1992a. Revised checklist of North American mammals north of Mexico, 1991. Occasional Papers, The Museum, Texas Tech University, 146:1-23.
- Keys, Jr., J.; Carpenter, C.; Hooks, S.; Koenig, F.; McNab, W.H.; Russell, W.; Smith, M.L. 1995. Ecological units of the eastern United States - first approximation (cd-rom), Atlanta, GA: U.S. Department of Agriculture, Forest Service. GIS coverage in ARC/INFO format, selected imagery, and map unit tables.
- Kurta, A., and J. A. Teramino. 1994. A novel hibernaculum and noteworthy records of the Indiana bat and eastern pipistrelle (Chiroptera: Vespertilionidae). American Midland Naturalist 132:410-413.
- Kurta, A., et al. 1993. A maternity roost of the endangered Indiana bat (*Myotis sodalis*) in an unshaded, hollow, sycamore tree (*Platanus occidentalis*). American Midland Naturalist 130:405-407.
- Kurta, A., et al. 1993. Summer roosts of the endangered Indiana bat (*Myotis sodalis*) on the northern edge of its range. American Midland Naturalist 129:132-138.
- Matthews, J.R. and C.J. Moseley (eds.). 1990. The Official World Wildlife Fund Guide to Endangered Species of North America. Volume 1. Plants, Mammals. xxiii + pp 1-560 + 33 pp. appendix + 6 pp. glossary + 16 pp. index. Volume 2. Birds, Reptiles, Amphibia
- NatureServe. 2005. NatureServe Central Databases. Arlington, Virginia. USA
- NatureServe. 2006. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.7. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>. (Accessed:

March 28, 2006).

New York State Department of Environmental Conservation, Division of Fish, Wildlife, and Marine Resources. 2006. New York State Comprehensive Wildlife Conservation Strategy. Albany, NY: New York State Department of Environmental Conservation.

New York State Department of Environmental Conservation. Checklist of the amphibians, reptiles, birds, and mammals of New York State, including their protective status. Nongame Unit, Wildlife Resources Center, Delmar, NY.

Ransome, R. 1990. The natural history of hibernating bats. Christopher Helm, London. xxi + 235 pp.

Schwartz, C. W., and E. R. Schwartz. 1981. The wild mammals of Missouri. University of Missouri Press, Columbia. 356 pp.

Thompson, C. E. 1982. MYOTIS SODALIS. Mammalain Species No. 163:1-5.

U.S. Fish and Wildlife Service. 1983. Recovery plan for the Indiana bat.

U.S. Fish and Wildlife Service. 1999. Agency draft Indiana Bat (*Myotis sodalis*) revised recovery plan. U.S. Fish and Wildlife Service, Fort Snelling, Minnesota. 53 pp.

Whitaker, J. O. Jr. 1972. Food habits of bats from Indiana. Can. J. Zoology. 50:877-83.

Wilson, D. E., and D. M. Reeder (editors). 1993. Mammal Species of the World: a Taxonomic and Geographic Reference. Second Edition. Smithsonian Institution Press, Washington, DC. xviii + 1206 pp. Available online at: <http://www.nmnh.si.edu/msw/>.

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