

Species Status Assessment

Class: Mammalia
Family: Vespertilionidae
Scientific Name: *Myotis sodalis*
Common Name: Indiana myotis

Species synopsis:

Indiana myotis was first described by Miller and Allen (1928). Prior to that, it was confused with other *Myotis* species, especially *M. lucifugus*. Taxonomy for the species has since been stable, although the common name was formerly Indiana bat. No subspecies are recognized.

Indiana myotis overwinter primarily in multi-species hibernacula in caves or abandoned mines and generally comprise a small proportion of the total number of individuals. Individuals may travel more than 575 km (Winhold and Kurta 2006) from hibernacula to seasonal habitat, although studies in NY suggest that the large majority migrate less than 65 km.

Early accounts (e.g., Humphrey *et al.* 1977) described the species as a riparian habitat specialist in summer, a misconception that persists. Capture and radio-tracking data from NY and elsewhere suggest that summer habitat is closely tied to a wide range of deciduous forest types (Hobson and Holland 1995; Menzel *et al.* 2001; Butchkoski and Hassinger 2002; Cheng 2003; Sparks 2003; Murray and Kurta 2004; Sparks *et al.* 2005a, 2005b), with occasional use of nearby open habitats (Humphrey *et al.* 1977; Brack 1983; Clark *et al.* 1987; Hobson and Holland 1995; Gumbert 2001; Sparks *et al.* 2005a, 2005b).

Maternity colonies are most often established in trees beneath peeling bark, often in large diameter snags but notably also large, healthy shagbark hickories, or within crevices formed in the trunk of snags after bark has fallen off. Human structures are rarely used. Frequent roost-switching has been reported and females may preferentially select roost sites with high solar exposure.

Despite the fact that most chosen roost trees are ephemeral, fidelity to the colony home range between years is high (Humphrey *et al.* 1977; Gardner *et al.* 1991a, 1991b; Gardner *et al.* 1996; Callahan *et al.* 1997; Whitaker and Sparks 2003; Whitaker *et al.* 2004), as is fidelity to hibernacula (LaVal and LaVal 1980).

Although bachelor colonies have been reported (Hall 1962, Carter *et al.* 2001) most males and non-reproductive females are thought to roost individually, often near hibernacula (Hall 1962, Gardner and Cook 2002, USFWS 2007).

Indiana myotis range widely across much of the eastern U.S., but over 90% of the population in 2005 was thought to be found in 5 states. NY is one of these states, with around 9% of the known population at that time being found within the State. Winter habitat in NY is limited to 11 caves and mines in the eastern half of the state, with over 75% in the single largest site. Summer distribution is mainly limited to patchy areas within 65 km of hibernation sites. Some of these areas are in Vermont.

Recent trends suggest this species is in severe decline in NY and elsewhere in the Northeast (Turner *et al.* 2011).

I. Status

a. Current and Legal Protected Status

- i. **Federal** Endangered **Candidate?**
- ii. **New York** Endangered

b. Natural Heritage Program Rank

- i. **Global** G2
- ii. **New York** S1 **Tracked by NYNHP?** Yes

Other Rank:

Status Discussion:

Indiana myotis was listed as Endangered prior to the arrival of white-nose syndrome. Population declines since 2008 have strengthened the argument that such protection is warranted.

II. Abundance and Distribution Trends

a. North America

i. Abundance

 X declining increasing stable unknown

ii. Distribution:

 declining increasing X stable unknown

Time frame considered: 2007-2017

b. Regional

i. Abundance

 X declining increasing stable unknown

ii. Distribution:

 declining increasing X stable unknown

Regional Unit Considered: Northeast

Time Frame Considered: 2007-2017

c. Adjacent States and Provinces

NEW JERSEY Not Present No data

i. Abundance

 X declining increasing stable unknown

ii. Distribution:

 declining increasing X stable unknown

Time frame considered: 2007-2017

Listing Status: Endangered SGCN? Yes

PENNSYLVANIA Not Present _____ No data _____

i. Abundance

 X declining ___increasing ___stable ___unknown

ii. Distribution:

 X declining ___increasing ___stable ___unknown

Time frame considered: 2007-2011

Listing Status: Endangered SGCN? Yes

VERMONT Not Present _____ No data _____

i. Abundance

___ declining ___increasing ___stable X unknown

ii. Distribution:

___ declining ___increasing X stable ___unknown

Time frame considered: 2007-2011

Listing Status: Endangered SGCN? Yes

QUEBEC Not Present X No data _____

ONTARIO Not Present X No data _____

CONNECTICUT Not Present X No data _____

MASSACHUSETTS Not Present X No data _____

d. NEW YORK

No data _____

i. Abundance

 X declining increasing stable unknown

ii. Distribution:

 X declining increasing stable unknown

Time frame considered: 2007-2017

Specify any monitoring activities or regular surveys that are conducted in New York.

Winter hibernacula surveys

Summer acoustic survey

Mist netting

Trends Discussion:

Indiana myotis was thought to be in decline until 2001, but records suggest increases in abundance from then until 2007 (USFWS 2012). Since the arrival of white-nose syndrome, observations of the species have declined significantly both in NY and throughout the Northeast, suggesting a severely declining population trend. Over the past 10 years, the range-wide population of Indiana myotis has declined by about 10% (USFWS 2017). This trend is more severe in the Northeast, where white-nose syndrome has been present for longer.

Since 2007, the population in New York has declined by over 40,000 bats, or around 75%. From 2015 to 2017, the population of Indiana myotis in New York declined by just over 18% (USFWS 2017).

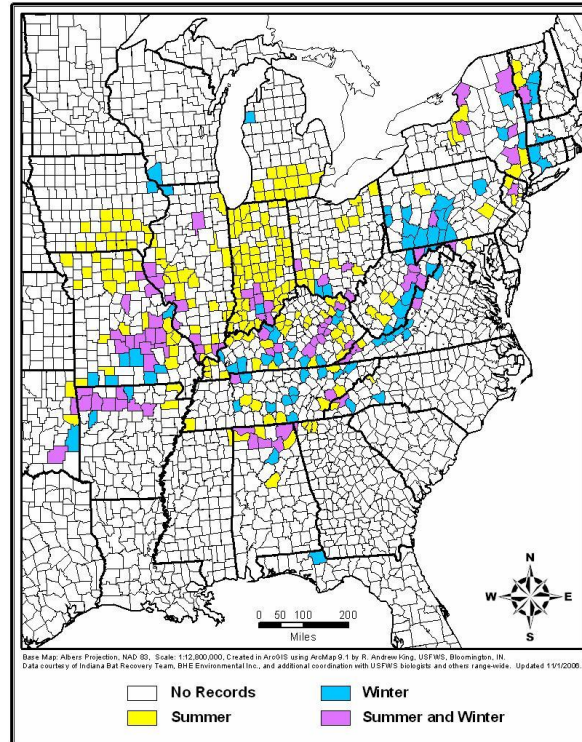


Figure 1. Distribution of Indiana bat records (USFWS 2007).

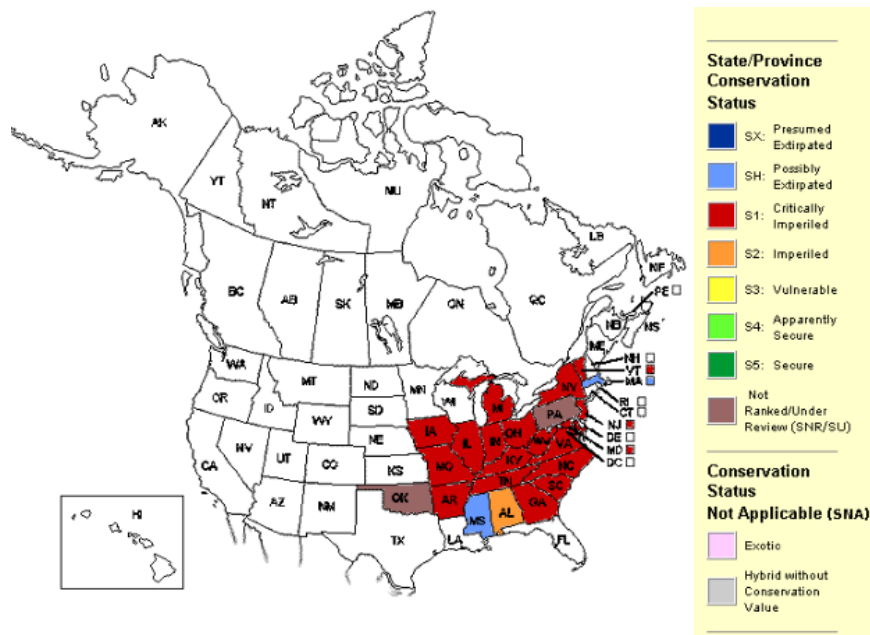


Figure 2. Conservation status of the Indiana bat in North America (NatureServe 2012).

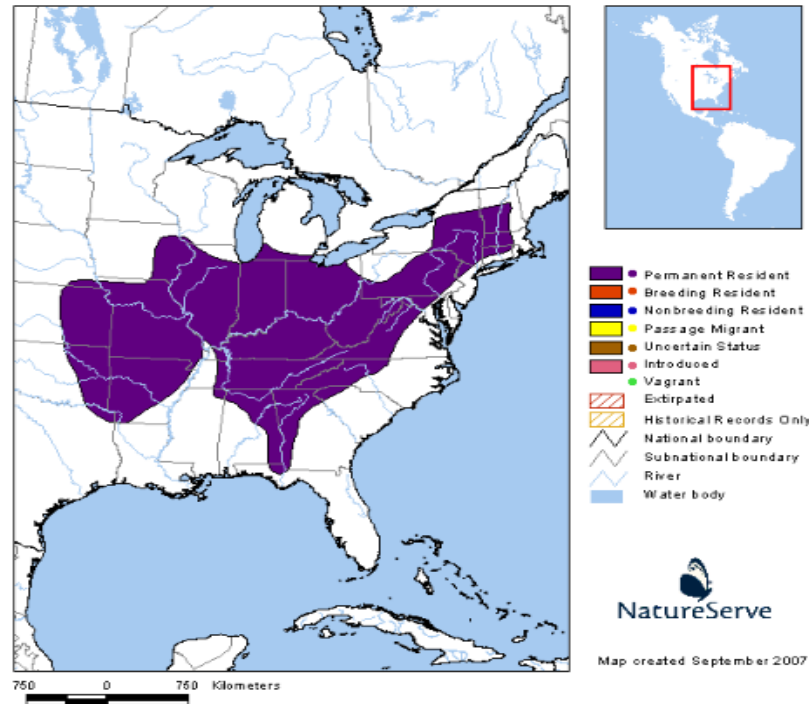


Figure 3. Indiana bat range map (NatureServe 2012).

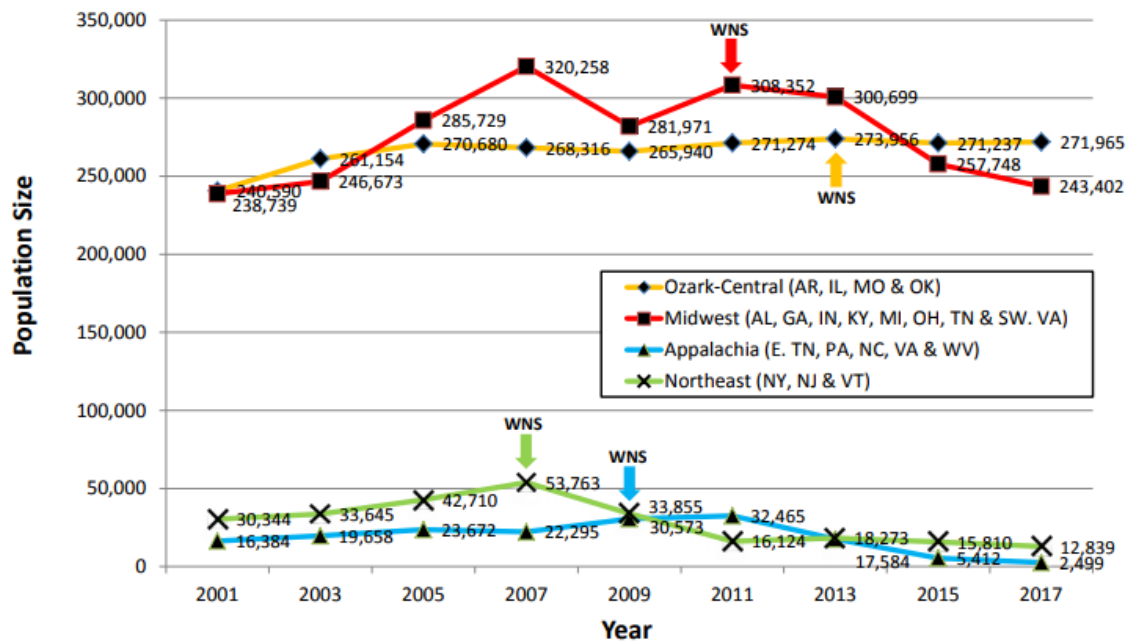


Figure 4. Indiana bat population estimates by recovery unit from 2001 to 2017 (USFWS 2017).

III. New York Rarity, if known:

Historic	<u># of Animals</u>	<u># of Locations</u>	<u>% of State</u>
prior to 1970	_____	_____	_____
prior to 1980	_____	_____	_____
prior to 1990	_____	_____	_____

Details of historic occurrence:

Little data are available prior to 1980. Apparent increases prior to 2000 are likely the result of increased survey effort. Population maximum of 52,700 in NY was seen in 2007 (NYSDEC winter survey records).

Current	<u># of Animals</u>	<u># of Locations</u>	<u>% of State</u>
	<u>12,693</u>	_____	_____

Details of current occurrence:

As of 2017, the population estimate is 12,693 individuals (NYSDEC winter survey records). This accounts for approximately 2.4% of the range-wide population of Indiana myotis (USFWS 2017). 87% of the hibernating population in NY is found in one mine (NYSDEC winter survey records).

New York's Contribution to Species North American Range:

% of NA Range in New York	Classification of New York Range
<input type="checkbox"/> 100 (endemic)	<input type="checkbox"/> Core
<input type="checkbox"/> 76-99	<input checked="" type="checkbox"/> Peripheral
<input type="checkbox"/> 51-75	<input type="checkbox"/> Disjunct
<input type="checkbox"/> 26-50	Distance to core population:
<input checked="" type="checkbox"/> 1-25	<u>1000 km</u>

IV. Primary Habitat or Community Type :

1. Caves and Tunnels
2. Mine/Artificial Cave Community
3. Northeastern Upland Forest
4. Northeastern Wetland Forest

Habitat or Community Type Trend in New York:

☐ Declining ☒ Stable ☐ Increasing ☐ Unknown

Time frame of decline/increase: _____

Habitat Specialist? ☒ Yes ☐ No

Indicator Species? ☐ Yes ☒ No

Habitat Discussion:

Winter habitat is limited to a small number of caves and mines with stable and atypically cool temperatures (USFWS 2007). Nearly 90% of the known current population in NY is found in a single site (NYSDEC winter bat survey records).

Summer habitat is closely tied to a wide range of deciduous forest types below 300 m elevation with occasional use of nearby open habitats (USFWS 2007, USFWS 2012). Female Indiana myotis are often found roosting in trees ≥ 5 inches dbh that have exfoliating bark, cracks, crevices, and/or hollows (USFWS 2016). Even at the peak of abundance for the species, summer habitat availability did not appear to be limiting in most parts of its range in NY. Since the arrival of white-nose syndrome, population declines suggest habitat availability is now even less of an issue.

V. New York Species Demographics and Life History

☒ **Breeder in New York**

☒ **Summer Resident**

☒ **Winter Resident**

☐ **Anadromous**

☐ **Non-breeder in New York**

☐ **Summer Resident**

☐ **Winter Resident**

☐ **Catadromous**

☐ **Migratory only**

☐ **Unknown**

Species Demographics and Life History Discussion:

Current demographic information for this species is mostly unknown (USFWS 2007). Females may give birth to a single young each year (Mumford and Calvert 1960, Humphrey *et al.* 1977, Thomson 1982) but the portion of females that produce young is not well documented. Few estimates of age structure have been made. Life span information is lacking. The oldest known individual was captured 20 years after banding (LaVal and LaVal 1980).

Ability to disperse and colonize is not well studied but presumed to be high, although site fidelity to both summer and winter habitat is also thought to be high (Humphrey *et al.* 1977; LaVal and LaVal 1980; Gardner *et al.* 1991a, 1991b; Gardner *et al.* 1996; Callahan *et al.* 1997; Whitaker and Sparks 2003; Whitaker *et al.* 2004).

Sources of mortality are not well studied. White-nose syndrome is likely responsible for more recent deaths in NY than any other source (NYSDEC bat winter survey records). Other possible sources include disturbance by human activity during hibernation, natural and human-induced modification to hibernation sites, direct and indirect effects of modification to summer habitat, predation, and environmental contaminants (USFWS 2007).

VI. Threats:

White-nose syndrome (WNS), discovered in New York in 2006, has caused severe mortality in several species of bats, including the Indiana myotis (Langwig *et al.* 2012), and clearly the threat posed by WNS far exceeds all other threats. Prior to the arrival of the disease, populations of Indiana myotis were increasing. After the first year of arrival of WNS, populations decreased significantly, and did not show evidence of smaller declines at smaller population sizes (i.e. density-dependence), which suggests there is not a threshold population size of this species in which declines will stabilize. Initial declines of this species were highly variable, and on average, lower than for the closely related *Myotis lucifugus*. This variability has been explained in part by relative humidity: populations roosting at more humid sites experienced more severe declines than populations roosting at drier sites (Langwig *et al.* 2012). Other studies have also predicted extirpation of this species across a wide area of its range (Thogmartin *et al.* 2012). Even prior to the arrival of the disease, hibernating populations were known to be susceptible to depletion of stored energy reserves and subsequent death due to excessive arousal during hibernation, as might take place during human intrusion in hibernacula. The presence of the disease greatly exacerbates this threat (Carl Herzog, pers. comm.).

Hibernating bats are susceptible to direct harm from vandalism, although this is thought to be a relatively minor threat.

Wind turbines pose a localized and relatively minor threat (Carl Herzog, pers. comm.). However; disruption of metapopulation dynamics from wind-related mortality coupled with population-level effects of WNS have the potential to drive the species towards extirpation and/or extinction (Erickson *et al.* 2016).

Hibernacula flooding and collapse threaten bats in some hibernation sites, but the threat is not significant at the population level (Carl Herzog, pers. comm.).

The Indiana myotis was classified as “moderately vulnerable” to predicted climate change in an assessment of vulnerability conducted by the New York Natural Heritage Program (Schlesinger *et al.* 2011).

Are there regulatory mechanisms that protect the species or its habitat in New York?

_____ No _____ Unknown

 X Yes

The Indiana myotis is listed as an endangered species in New York and is protected by Environmental Conservation Law (ECL) section 11-0535 and the New York Code of Rules and Regulations (6 NYCRR Part 182). A permit is required for any proposed project that may result in a take of a species listed as Threatened or Endangered, including, but not limited to, actions that may kill or harm individual animals or result in the adverse modification, degradation or destruction of habitat occupied by the listed species. It is also protected as a federally-listed endangered species.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Prevention of intrusions into hibernacula is the only currently known management action able to reduce the impact of WNS (Carl Herzog, pers. comm.).

Conservation Actions Discussed at Expert Meeting:

- Work with landowners to erect gates to regulate access to the selected hibernacula. [Partially completed]
- Continue to survey new potential hibernacula as they are discovered. [Ongoing]
- Survey winter populations as indicated in the objectives, develop alternative population monitoring techniques. [Ongoing]
- Operational measures for wind projects
- Locate maternity colonies and minimize threats
- Protect hibernacula and wintering populations
- Coordinate with cavers
- Include LBB conservation actions re WNS National Plan, page 18

VII. References

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