Species Status Assessment

Class: Mammalia
Family: Vespertilionidae
Scientific Name: *Myotis leibii*
Common Name: Small-footed myotis

Species synopsis:

The small-footed myotis (*Myotis leibii*) is believed to have a patchy distribution throughout its range (Erdle and Hobson 2001), which stretches across eastern North America. The species can be found from Ontario and Quebec through New England and south to Alabama and Georgia. The range extends west to Oklahoma, Arkansas and Missouri (Jennings 1997, Amelon and Burhans 2006).

The abundance of small-footed myotis is extremely hard to measure. It is considered to be rare or imperiled throughout its range. As of 2006, this bat has been documented in 125 hibernacula (Amelon and Burhans 2006), most of which occur in New York, Pennsylvania, West Virginia and Virginia. A rough count of 3,000 individuals has been derived from surveys in known hibernacula; 60% of this number can be found in two hibernacula in New York (Amelon and Burhans 2006). New York State has one of the highest documented hibernating populations of small-footed myotis in the country. Two hibernacula were estimated to contain about 60% of the total population of hibernating small-footed bats (Amelon and Burhans 2006). Small-footed myotis have been found on at least one survey in just over 150 hibernacula throughout their range, and 54 of those hibernacula are in New York.

I. Status

a. Current and Legal Protected Status

i. Federal ____Not listed_____ **Candidate?** __Yes____

ii. New York ____Special Concern; SGCN_____

b. Natural Heritage Program Rank

i. Global ____G3_____

ii. New York ____S2_____ **Tracked by NYNHP?** __Yes_____

Other Rank:

Species of Northeast Regional Conservation Concern (Therres 1999)
IUCN Red List— Least concern

Status Discussion:

The small-footed myotis is listed as rare or imperiled throughout its range. Currently, it does not have any federal protection, although it was listed as a C2 candidate species before the category was abolished (Erdle and Hobson 2001). The rounded Global and National Heritage Status of small-footed myotis is a "2," meaning that the species is imperiled throughout its range (NatureServe 2012).

II. Abundance and Distribution Trends

a. North America

i. Abundance

_____ declining ____increasing __X__stable ____unknown

ii. Distribution:

_____ declining ____increasing __X__stable ____unknown

Time frame considered: _____

b. Regional

i. Abundance

____ declining ____increasing __X__stable _____unknown

ii. Distribution:

____ declining ____increasing __X__stable _____unknown

Regional Unit Considered: ___Northeast_____
Time Frame Considered: _____

c. Adjacent States and Provinces

CONNECTICUT **Not Present** __X____ **No data** _____

MASSACHUSETTS **Not Present** _____ **No data** _____

i. Abundance

____ declining ____ increasing ____ stable __X__unknown

ii. Distribution:

____ declining ____ increasing ____ stable __X__unknown

Time frame considered: _____
Listing Status: _____Special Concern (S1)_____ SGCN? __Yes__

NEW JERSEY **Not Present** _____ **No data** _____

i. Abundance

____ declining ____ increasing ____ stable __X__unknown

ii. Distribution:

____ declining ____ increasing __X__ stable ____unknown

Time frame considered: _____
Listing Status: _____Conservation Concern (S3)_____SGCN? __Yes__

ONTARIO **Not Present _____** **No data _____**

i. **Abundance**

____ declining ____increasing _____stable __X__unknown

ii. **Distribution:**

____ declining ____increasing __X__stable ____unknown

Time frame considered: _____
Listing Status: _____Not listed (S2)_____

PENNSYLVANIA **Not Present _____** **No data _____**

i. **Abundance**

____ declining ____increasing __X__stable ____unknown

ii. **Distribution:**

____ declining ____increasing __X__stable ____unknown

Time frame considered: _____
Listing Status: _____Threatened (S1)_____ SGCN? ___Yes___

QUEBEC **Not Present _____** **No data _____**

i. **Abundance**

____ declining ____increasing _____stable __X__unknown

ii. **Distribution:**

____ declining ____increasing __X___stable ____unknown

Time frame considered: _____
Listing Status: _____Not listed (S1)_____

VERMONT **Not Present _____** **No data _____**

i. **Abundance**

____ declining ____increasing __X__stable ____unknown

ii. **Distribution:**

____ declining ____increasing __X__stable ____unknown

Time frame considered: _____
Listing Status: _____Threatened (S1)_____ SGCN? _____Yes_____

d. NEW YORK **No data _____**

i. **Abundance**

____ declining ____ increasing __X__ stable _____ unknown

ii. **Distribution:**

____ declining ____ increasing __X__ stable _____ unknown

Time frame considered: _____

Monitoring in New York.

Winter hibernacula surveys

Summer acoustic survey

Mist netting (non-target species for surveys mostly aimed at detecting presence/absence of Indiana bats)

Trends Discussion:

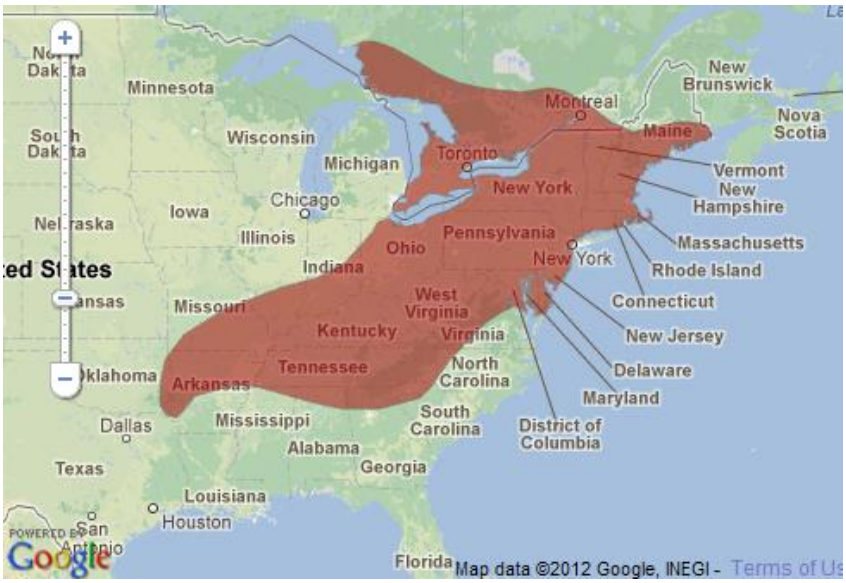

Figure 1. Distribution of the small-footed myotis (Bat Conservation International 2012).

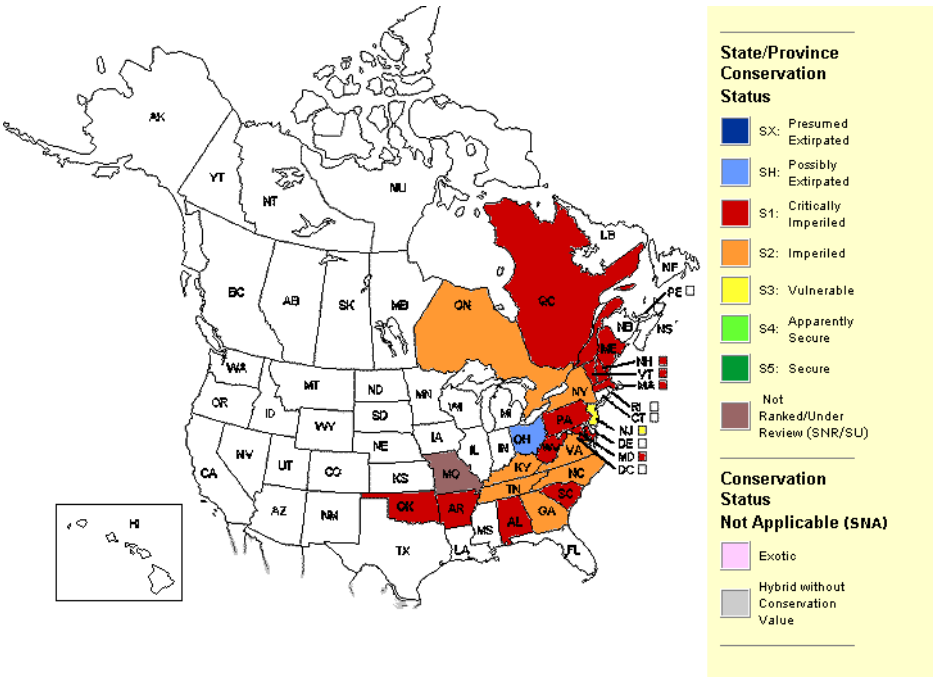

Figure 2. Conservation status of the small-footed bat in North America (NatureServe 2012).

III. New York Rarity, if known:

Historic	# of Animals	# of Locations	% of State
prior to 1970	_____	_____	_____
prior to 1980	_____	_____	_____
prior to 1990	_____	_____	_____

Details of historic occurrence:

There are no historical records of the small-footed myotis in New York.

Current	# of Animals	# of Locations	% of State
	_____	21-80 Element Occurrences	_____

Details of current occurrence:

The abundance of *M. leibii* is difficult to measure and most records come from hibernacula counts. As of 2006, the species had been documented in 125 hibernacula (Amelon and Burhans 2006). Most of these occur in New York, Pennsylvania, West Virginia and Virginia. A rough count of 3,000 individuals has been derived from surveys in known hibernacula; 60% of this number can be found in two hibernacula in New York (Amelon and Burhans 2006).

Although the species has been recorded from 40 hibernacula, there are just 9 overwintering locations with approximately 50 or more individuals (including one site with a high count of 46). Many of the hibernacula contain few individuals. The small number of total individuals statewide and the small number of high-quality occurrences are the primary ranking considerations (NYNHP 2013).

Table 1. Total *M. leibii* (MYLE) detected by acoustic monitoring (NYSDEC Files).

Year	Number of MYLE detections	Locations
2009	0	N/A
2010	3	2 in Canisteo route, 1 in Monticello route
2011	1	1 in Oneonta route
2012	3	1 in Benson route, 1 in Lawrenceville Route, 1 in Sundown route

Table 2. Total *M. leibii* (MYLE) detected by mist-netting (NYSDEC Files).

Year	County	MYLE
2003	Onondaga	1
2003	Essex	1
2003	Ulster	1
2005	Rockland/Orange	6
2005	Orange	3
2006	Ulster	2
2007	Westchester	1
2008	Dutchess	1
2008	Orange	1
2010	Jefferson	2
2011	Putnam	1

New York's Contribution to Species North American Range:

% of NA Range in New York	Classification of New York Range
____ 100 (endemic)	__X__ Core
____ 76-99	____ Peripheral
____ 51-75	____ Disjunct
____ 26-50	Distance to core population:
__X__ 1-25	_____

IV. Primary Habitat or Community Type:

1. Cliff and Talus

2. Caves and Tunnels

3. Mine/Artificial Cave Community

4. Northeastern Upland Forest

5. Northeastern Wetland Forest

Habitat or Community Type Trend in New York:

__X__ **Declining** _____**Stable** ____ **Increasing** ____**Unknown**

Time frame of decline/increase: _____

Habitat Specialist? __X__ **Yes** _____ **No**

Indicator Species? _____ **Yes** __X__ **No**

Habitat Discussion:

Small-footed myotis use rock features as day-roosts during the summer season (Johnson and Gates 2008, Divoll 2010, Divoll 2012, Johnson *et al.* 2011). Hibernacula include natural caves, mines and, in at least one instance, an old railroad tunnel (Johnson and Gates 2008).

There is the distinct possibility that small-footed myotis exhibit differences in habitat selection behavior throughout their range. Two published radio-tracking studies that looked at day-roosting behavior emphasized the importance of rock features with high solar exposure for day-roosts

(Johnson and Gates 2008, Johnson *et al.* 2011). Typical patterns of selection are large, open talus fields and rock areas with high solar exposure, but many other day-roosts were in smaller, more overgrown rock features (Chenger, unpublished). Whether these differences are true geographic variation or a product of the lack of studies on this species is unknown.

The bats have been observed in a variety of locations, including abandoned buildings, bridge expansion joints, along cliff faces, and in rock crevices at ground level (Chenger unpublished, Hitchcock 1955, Johnson *et al.* 2011, Johnson and Gates 2008, MacGregor and Kiser 1998, O'Keefe and LaVoie 2010, Roble 2004).

Johnson *et al.* (2011) found that small-footed myotis day-roosts were within five meters of vegetation. In addition, Stihler (unpublished) found that small-footed myotis were not tracked more than 2.7 meters from their day-roosts and Johnson *et al.* (2009) did not track small-footed myotis farther than 1.8 meters from their roosts, implying that day-roosts must be near foraging areas.

There is strong evidence that upland and ephemeral water sources are important, as 80% of the captures occurred over ridge top ponds and flooded road ruts. In contrast, only 44% of the capture effort included these features (Johnson *et al.* 2011). However, female roosts were found significantly closer to upland ephemeral water sources than the roosts of males (Johnson *et al.* 2011). Stihler (unpublished) found that radio-tagged small-footed myotis foraged mostly in oak dominated forests with scattered pines.

V. New York Species Demographics and Life History

___X___ Breeder in New York

__X___ Summer Resident

__X___ Winter Resident

_____ Anadromous

_____ Non-breeder in New York

_____ Summer Resident

_____ Winter Resident

_____ Catadromous

_____ Migratory only

_____Unknown

Species Demographics and Life History Discussion:

The small-footed myotis has a distinctive slow flight pattern, and often is observed very close to the ground (Harvey *et al.* 1999). They begin foraging shortly after dusk, and are capable of filling their stomachs within the first hour (Barbour and Davis 1969, Harvey *et al.* 1999). Studies have shown that small-footed myotis consume prey from at least 8 orders of insects and other invertebrates (Johnson and Gates 2007, Moosman *et al.* 2007). Soft bodied prey appears to make up most of the diet, although small hard-bodied beetles were frequent during the summer (Moosman *et al.* 2007). Lepidoptera compromise about half of the diet (Johnson and Gates 2007, Moosman *et al.* 2007). While no significant differences have been found in seasonal prey composition, there is evidence that some prey, such as spiders and caddis flies, are consumed only at certain times of the year (Moosman *et al.* 2007). The small-footed myotis may become less selective in spring and fall when insect prey becomes less abundant.

Few studies on the summer ecology of the small-footed myotis exist. Most reports come from isolated observations; until recently, transmitters were too heavy. Males and females changed roosts nearly every day. While there was not a significant difference in number of bats found using a given roost, males in this study were always solitary and females roosted either solitarily or in small groups (Johnson *et al.* 2011). The distance traveled between subsequent roosts was relatively short, a maximum of about two hundred meters (Johnson *et al.* 2011, and generally less than 50 (Johnson and Gates 2008). Overall fidelity to specific rock features has been documented (Thomson and O'Keefe, unpublished), which could explain the short distances typically traveled between roosts. In addition, Johnson *et al.* (2011) found that all located roosts were within 900 m from the original capture site. This implies that small-footed myotis have small home ranges.

These observations have been backed up by other studies. Johnson *et al.* (2011) attached radio transmitters to individuals to analyze summer roost selection and found that both sexes roosted exclusively in rock structures, the majority of which were in ground level crevices in talus slopes or rock fields (Johnson *et al.* 2011). Many (93%) of these rock fields were within transmission line clearings (Johnson *et al.* 2011). Four of the roosts were on vertical cliff faces. All of the roosts were either crevices in rocks or narrow gaps between rocks (Johnson *et al.* 2011). Roosts were always located on steep slopes close to vegetation. Solar exposure was important, as all of the roosts have <50% canopy closure, and no roosts were found in forested areas with abundant rock habitat (Johnson *et al.* 2011). Johnson *et al.* (2011) found that male and lactating female roosting behavior differed significantly in only two aspects. The first was that females were found roosting closer to the edge of the cracks or crevices than males. This could mean that, although sexes do not differ in roost location, they may be using different microclimates within roosts (Johnson *et al.* 2011).

It is unknown how far small-footed myotis travel on their spring migration. Johnson and Gates (2008) tracked female bats from their hibernacula for an average of about eight days. Within this time period, bats did not travel more than 1.1 km from their hibernacula. Fenton (1972) proposed that pregnant females may not be able to travel far from their hibernacula to explain the distribution that he observed.

Most observations of small-footed myotis come from winter hibernacula. The species is known to be very tolerant of colder temperatures and are usually the last to enter hibernacula in the fall, and

also the first to leave. Often, these bats have moved out of hibernacula in March, whereas many other species remain into April (Erdle and Hobson 2001). They are frequently observed near the entrance or in the coldest sections of hibernacula. They are believed to arise from torpor fairly often during the winter, perhaps because of the relatively large temperature shifts that generally occur near the entrance of hibernacula (Fenton 1972, Best and Jennings 1997, Erdle and Hobson 2001). Fenton (1972) found that individuals lose approximately 16% of their body weight over the winter period. Small-footed myotis are most often seen hibernating singly or in small groups, although they have been seen occasionally in groups of over 30 individuals (Best and Jennings 1997). Small-footed myotis often hibernate in the same area as *Eptesicus fuscus* (big brown bat) and are sometimes seen in physical contact.

Not much is known about the reproduction of the small-footed myotis. Breeding occurs in the fall, Erdle and Hobson 2001) with females giving birth to a single young between May and July. The small-footed myotis is not known to form large maternity colonies as some other species of bats do. Instead, small-footed myotis colonies usually consist of small groups of bats (Amelon and Burhans 2006, Best and Jennings 1997, Erdle and Hobson 2001). The two published telemetry projects on small-footed myotis found that lactating females switched roosts nearly every day (Johnson *et al.* 2011, Johnson and Gates 2008).

There is one record of an individual living for twelve years (Hitchcock 1965).

Predators of small-footed myotis include raccoons, skunks, weasels, foxes, opossums, chipmunks and domestic cats. These bats may be especially prone to predators such as snakes that utilize the same rocky habitats that small-footed bats select for day-roosts.

VI. Threats:

Disturbance to summer roost areas could lead to abandonment of roosts by bats. There is the potential that recreational rock climbing could disturb bats roosting in steep rock faces where they have been observed (Chenger, unpublished; Johnson *et al.* 2011; Stihler, unpublished). There have been reports of climbers flushing "small, black-faced bats" that were most likely small-footed myotis (Erdle and Hobson 2001). In addition, climbers in some areas scrub rocks to make better holds, removing lichen and other vegetation on rocks (Erdle and Hobson 2001) and small-footed myotis prefer to roost in areas immediately adjacent to vegetation (Johnson *et al.* 2011); such practices may decrease the value of certain areas as roost sites (NYSDEC 2013).

Females are often located significantly closer to the entrance of cracks where they are often visible and potentially more prone to disturbance than males, which selected deeper areas within cracks (Johnson *et al.* 2011). Female small-footed myotis exhibit decreased survival (Hitchcock *et al.* 1984), and the increased stress of repeated disturbance could further contribute. It is believed that small-footed myotis are polygamous, like other species of Myotis in the Northeast, so the loss of females represents a loss in reproductive potential in a slow-to-reproduce species (NYSDEC 2013).

Small-footed myotis have been documented using manmade structures such as bridges and buildings during the summer (MacGregor and Kiser 1998, O'Keefe and LaVoie 2010, Thomson and O'Keefe, unpublished). Alteration and removal of these structures could affect roosting small-footed myotis (NYSDEC 2013).

Disturbance of winter hibernacula areas affects all species of bats within them. Many people who enter caves and mines do not venture far; however, they could still pose a threat to hibernating small-footed myotis, which typically roost near the entrance. Human disturbance in hibernacula can cause bats to awaken and burn through energy reserves. Small-footed myotis have one of the lowest known over-wintering survival rates of any insectivorous bat (Hitchcock *et al.* 1984), and frequent disturbance has the potential to depress survival even further (NYSDEC 2013).

Natural processes such as collapses and floods can also alter the suitability of certain hibernacula for occupancy by small-footed myotis, as can the closure or reopening of mines. Gating of hibernacula can benefit bats by reducing human disturbance, but, when done improperly, can alter airflow (Erdle and Hobson 2001).

White-nose syndrome (WNS) is an infectious disease that was first documented in a cave in Schoharie County, NY in 2006. It has since spread and affected at least seven different species of hibernating bats in 19 different states and 4 Canadian provinces (USFWS 2012). Some sites have documented a 100% decline in the hibernating population. Caused by the fungus *Pseudogymnoascus* (formerly Geomyces) *destructans* (Minnis and Lindner 2013), WNS has killed over five million bats across the Northeast (USFWS 2012). Bats infected with WNS often display lesions on their wings that may disrupt physiological processes and/or cause alterations in typical hibernation patterns, leading the bats to dehydrate or starve (Cryan *et al.* 2010, Meteyer *et al.* 2009).

The effect of WNS on the small-footed myotis remains unknown. The species was first confirmed infected in 2009 (Langwig 2010). Initial analyses found a 78% decline in small-footed myotis in hibernacula in New York; however, these figures did not include data from the two largest mines (Langwig 2010). More recent models indicate that small-footed myotis are not as affected as several other species but that populations are no longer growing (Langwig 2012).

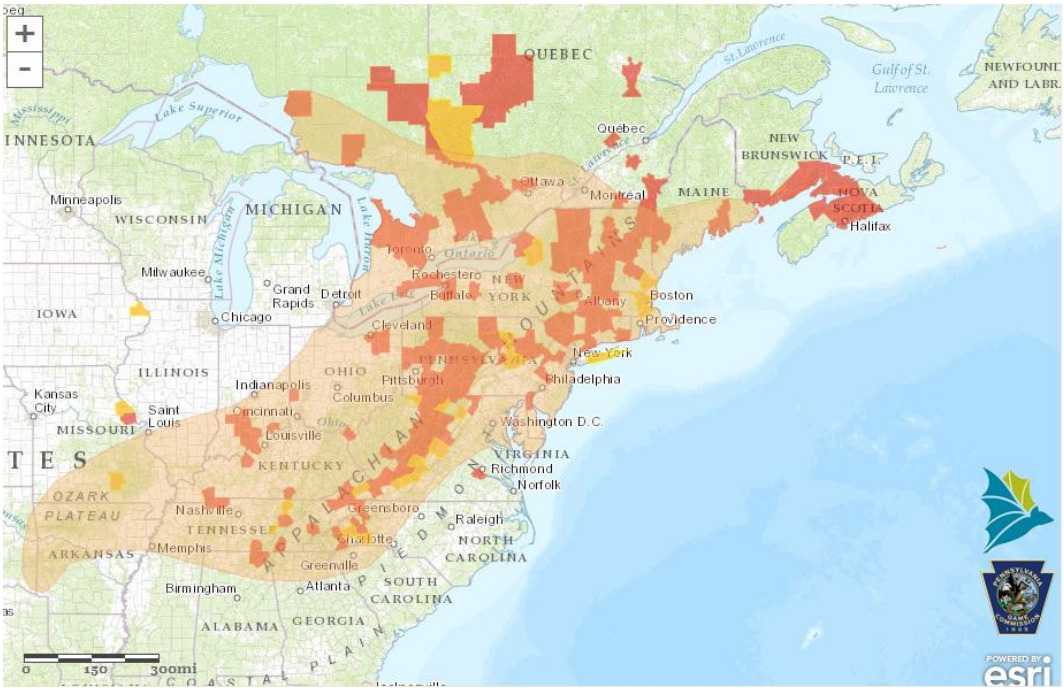

Figure 3. Counties infected by WNS overlaid with the range of *M. leibii*. Red counties are confirmed WNS infected and yellow counties are those with probably infection by WNS (PGC 2012).

Habitat degradation and loss is another significant threat. Small-footed myotis appear to be heavily reliant on the use rock features as day-roosts. This habitat type is already rather scarce across the landscape, and further alteration of such features could alter suitability of habitat. Activities such as timber harvesting in the immediate area could alter the microclimate of roost sites, potentially making the area unsuitable for occupancy. Because the species it not suspected to travel far from the roost site to forage, the suitability of day-roosts may be affected by the harvesting of nearby potential foraging areas (NYSDEC 2013).

It is currently thought that small-footed myotis may not migrate long distances to or from hibernacula or between summer roosting sites. Fenton (1972) hypothesized that pregnant females may not physically be able to make such migrations. If this is the case, small-footed myotis may be more threatened by habitat loss and fragmentation than other species of bats with greater dispersal capabilities. Bats that lose foraging and /or roosting sites may not be able to find other suitable areas within their dispersal capacity. In addition, degradation of habitat could leave bats to become isolated in remaining suitable areas, leading to a loss of genetic diversity and eventually, local population declines (NYSDEC 2013).

Many of the threats of alternative energy development to small-footed myotis are similar in nature to the threats of habitat degradation and loss. Much of the oil and natural gas development in the country occurs within their range. While the effects are localized, they may cover a large enough portion of the range that a significant effect may be felt. Small-footed myotis utilize the rock features that are often found in oil and natural gas-rich lands (Amelon and Berhans 2006). The actual process of extracting natural gas and oil could cause direct disturbance, and could also destroy or degrade existing habitat by such practices such as the clearing of areas for a drill pad in natural gas extraction, or fragmentation of habitat by the construction of roads leading to an extraction site (NYSDEC 2013).

Wind energy may also constitute a threat to small-footed myotis. Small-footed myotis typically use habitat along ridge tops; these areas have historically coincided with wind energy development (USFWS 2011). Large numbers of bats are killed by wind turbines each year, and the majority of those deaths are along forested ridge tops in the eastern United States (Kunz *et al.* 2007). Although no small-footed myotis deaths have been recorded at wind farms, Capouillez and Mumma (2008) found the species in the area around a wind farm in Pennsylvania. Even if the bats are not suffering direct mortality from wind turbines, there is the potential for habitat loss associated with these wind farms (NYSDEC 2013).

Mercury poisoning is another threat to the small-footed bat. Bat hair samples of four bat species were analyzed for mercury (Hg) from bats captured at Acadia National Park, Maine, in 2008, 2010, 2011, and 2012. Little brown myotis and Northern long-eared bats were compared to samples collected from specimens deposited at the Museum of Comparative Zoology at Harvard University in 1900 and 1901. Present day mercury in bat hair does not differ significantly than Hg levels at the turn of the 20th century for either species. Historical sample sizes were low and present day levels average higher with more robust sample sizes. Overall, small-footed myotis and Northern long-eared bat show consistently higher Hg levels than little brown myotis or Eastern red bats (*Lasiurus boreali*). Small-footed bats exhibit the highest mercury levels of all species. Higher mercury levels in Northern long-eared bats and small-footed myotis may correlate with gleaning behavior and the consumption of spiders, biomagnifying this toxic element at an accelerated rate. Three individual bats were recaptured during the study one or two years after their original capture and maintain a similar amount of mercury in hair year-to-year. These finding suggest that individual bats accumulate body burdens of mercury that cannot be reduced once elevated to a certain threshold (Divoll, unpublished).

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

___X___ No **____ Unknown**

____ Yes

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

Information on many of the threats listed below is currently inadequate for making recommendations. For threats that are more easily addressed and better understood, recommendations have been made in the draft Management Plan for *Myotis leibii* (Eastern small-footed myotis) in New York State (NYSDEC, unpublished):

Human activity in caves and mines supporting populations of small-footed myotis should be discouraged during the hibernation period, from November through March, as recommended by Erdle and Hobson (2001). Signs and other means should be used to increase awareness and education of the caving community. In sites where human disturbance continues to be a problem even after other measures are taken, the use of properly constructed bat gates may be

recommended. Such instances should be evaluated on a case-by-case basis to ensure that gates will not have a detrimental effect on any species, and do not alter the airflow and microclimate of a site, especially near the entrance where small-footed myotis tend to be found.

It is highly recommended that WNS research continues. Researchers should be sure to include small-footed myotis in their projects to garner information on the population-level impacts of this disease on the species. Managers should continue to monitor WNS in the species at known hibernacula. Additionally, potentially undiscovered hibernacula should be investigated to further our knowledge of small-footed myotis hibernation ecology.

In general, it is recommended that research projects on small-footed myotis are developed and implemented. Some top research goals that would lead to better management recommendations include:

- What are the best techniques to survey this population? Are hibernacula counts representative, or can they be corrected to be representative? What are the best techniques to survey small-footed myotis in the summer to get ideas of summer distribution and abundance?
- What is limiting population growth in New York?
- Summer roosting behavior of the species, and the effects of disturbance on roosting behavior.

Conservation Actions Discussed at Expert Meeting:

- Radio tag, release and track 20 reproductive female M. leibii as the exit the hibernacula and track them to their summer range. [partially completed]
- Radio tag and release 20 leibii as they enter the largest hibernacula for the winter. Relocate them within the mine to determine their roost selection. [partially completed, terminated]
- Continue to survey hibernating leibii in conjunction with sodalis hibernacula surveys [ongoing]

VII. References

Amelon, S. and D. Burhans. 2006. Conservation assessment: *Myotis leibii* (Eastern small-footed myotis) in the eastern United States. *In* USDA Forest Service General Technical Report NC-260: Conservation Assessments for Five Forest Bat Species in the Eastern United States.

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

Best, T. L. and J. B. Jennings. 1997. *Myotis leibii*. Mammalian Species 547: 1-6.

Chenger, J. 2012. Very quick Myolei roosts. Unpublished presentation at the Northeast Bat Working Group 2012 annual meeting, 11-13 Jan. 2012, Carlisle, PA.

Divoll, T. Multi-year monitoring of mercury in hair of Vespertillionid bats from Acadia NationalPark, Maine. Unpublished. Biodiversity Research Institute, Gorham, Maine, USA.

Erdle, S. Y. and C. S. Hobson. 2001. Current status and conservation strategy for the eastern small-footed Myotis (*Myotis leibii*). Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA. Natural Heritage Technical Report #00-19.

Fenton, M. B. 1972. Distribution and over-wintering of *Myotis leibii* and *Eptesicus fuscus* (Chiroptera: Vespertilionidae) in Ontario. Life Sciences Occasional Paper, Royal Ontario Museum 21:1-8.

Harvey, M. J., J. S. Altenbach and T. L. Best. 1999. Bats of the United States. Arkansas Game & Fish Commission.

Hitchcock, H. B., R. Keen, and A. Kurta. 1984. Survival rates of *Myotis leibii* and *Eptesicus fuscus* in southeastern Ontario. Journal of Mammalogy 65(1): 126-130.

IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Accessed 25 April 2013.

Johnson, J. B. and J. E. Gates. 2007. Food habits of *Myotis leibii* during fall swarming in West Virginia. Northeastern Naturalist 14(3): 317-322.

Johnson, J. B. and J. E. Gates. 2008. Spring migration and roost selection of female *Myotis leibii* in Maryland. Northeastern Naturalist 15(3): 453-460.

Johnson, J. S., J. D. Kiser, K. S. Watrous, and T. S. Peterson. 2011. Day-roosts of *Myotis leibii* in the Appalachian Ridge and valley of West Virginia. Northeastern Naturalist 18(1): 95-106.

MacGregor, J. and J. Kiser. 1998. Recent reproductive records of eastern small-footed bat, *Myotis leibii* in Kentucky with notes on a maternity colony located in a concrete bridge. Bat Research News, Abstract.

Minnis, A. M. and D. L. Lindner. 2013. Phylogenetic evaluation of Geomyces and allies reveals no close relatives of *Pseudogymnoascus destructans*, comb. nov., in bat hibernacula of eastern North America. Fungal Biology 117:638-649.

Moosman, P. R. Jr., H. H. Thomas, and J. P. Veilleux. 2007. Food habits of eastern small-footed bats (*Myotis leibii*) in New Hampshire. American Midland Naturalist 158: 354 – 360.

NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. <http://www.natureserve.org/explorer>. Accessed 25 April 2013.

New York Natural Heritage Program (NYNHP). 2013. Element Occurrence Database. Albany, NY.

New York State Department of Environmental Conservation (NYSDEC). 2013. Management Plan for *Myotis leibii* (Eastern small-footed myotis) in New York State. Unpublished draft.

O'Keefe, J. M. and M. LaVoie. 2010. Maternity colony of eastern small-footed Myotis (*Myotis leibii*) in a historic building. Southeastern Naturalist 10(2): 381-383.

Pennsylvania Game Commission (PGC). 2012. Millions of bats are dying from white-nose syndrome. ESRI story maps. <http://storymaps.esri.com/stories/2012/whitenose/>. Accessed 25 April 2013.

Roble, S. M. 2004. Notes on an autumn roost of an eastern small-footed bat (*Myotis leibii*). Banisteria 23: 42-44.

Therres, G.D. 1999. Wildlife species of regional conservation concern in the northeastern United States. Northeast Wildlife 54:93-100.

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