

Appendix A: Mammals

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Moose

Alces americanus

Federal Listing	N/A
State Listing	SGCN
Global Rank	G5
State Rank	S5
Regional Status	



Photo by Daniel Bergeron

Justification (Reason for Concern in NH)

In New Hampshire, moose populations are split into management regions based on established Wildlife Management Units (http://www.wildlife.state.nh.us/Hunting/WMU_maps/wmu_moose_8x11.pdf). Different goals are set by NHFG in conjunction with the public for target moose numbers in each of the six regions. In the four southern regions, moose numbers have declined below goal and have stayed below this number for multiple years, despite continued reduction in moose hunting permits. Moose weights and reproduction are also down statewide. Current information suggests that New Hampshire's moose population may continue to decline in some regions. In New Hampshire the most important limiting factors for moose include cultural carrying capacity, weather, winter tick, and brainworm. Recent study results suggest that warmer temperatures are responsible for increased parasite loads on moose which in turn may be the true limiting factor for southern distribution (Musante 2006, Bergeron 2011). For much of the primary moose range, winter tick impacts will control the moose population, causing declines by either reducing productivity and/or increasing mortality. In some years, mortality events will be severe depending on length of snow cover in the winter. The southern moose population may be more severely limited by brainworm. Infection by this parasite is dependent on deer density which in turn is tied to winter length. As our winters have shortened, our deer density has increased. Brainworm has the capability of eradicating moose or dropping the population to very low levels.

Distribution

Moose are found statewide with the highest densities in the Connecticut Lakes region and declining as you go from the Connecticut Lakes region south, with the lowest densities in the South East region. This mimics historic NH moose distribution. In the northeastern US, robust moose populations also occur in Maine and Vermont with small populations found in Massachusetts, Connecticut and New York. Southern distribution of moose is thought to be limited by heat (Kelsall and Telfer 1974). Recent research by Musante (2006) suggests parasites are the primary mortality factor.

Habitat

Moose habitat preferences shift depending on both the time of year and age and sex of the animal. In general, good moose habitat provides hardwood browse, aquatic vegetation or mineral licks, plentiful water and cover that provide relief from the sun, excessive heat, insects, deep snow, crust and extreme cold.

Moose in northern N.H. spend a majority of their time in hardwood or mixed wood stands (Miller 1989, Scarpitti 2006). Mature stands of timber with a vigorous under-story component are also good

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sources of browse.

In the winter, moose use softwood cover if snow depths exceed 27 inches or if snow becomes dense or develops a crust thus impeding travel (Kelsall and Prescott 1971). They will also utilize softwood cover to escape the sun on warm winter days. During this time moose may browse heavily on young fir.

In spring, both bulls and cows begin to visit road side salt licks and increase their home range as they increase their foraging range.

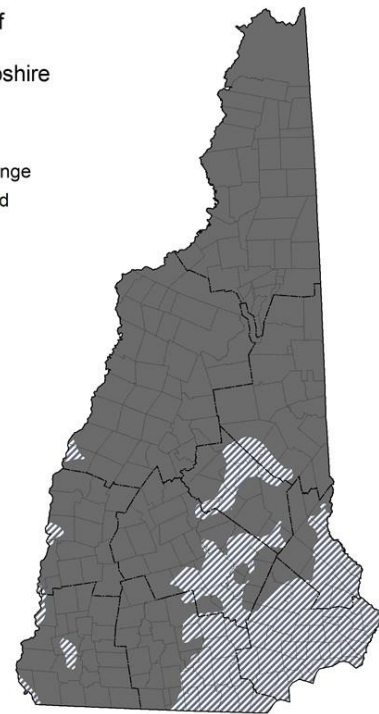
In summer, bulls (male moose) and cows (female moose) use slightly different habitats. Some studies suggest that cows with calves seem to prefer areas of denser cover that are near water (Frannzmann and Schwartz 1985). Scarpitti (2006) was unable to document this in NH but often found birthing cows in mature softwood with little cover. Bulls seek out more mature upland hardwood habitats that provide forage as well as cover from the sun (Leptich 1986, Miller 1989). In fall, moose expand their range as they search for mates, and may use many habitat types.

NH Wildlife Action Plan Habitats

- Lowland Spruce-Fir Forest
- Northern Hardwood-Conifer Forest
- Appalachian Oak Pine Forest
- Floodplain Habitats
- Hemlock Hardwood Pine Forest
- High Elevation Spruce-Fir Forest
- Lakes and Ponds with Coldwater Habitat
- Marsh and Shrub Wetlands
- Northern Swamps
- Shrublands
- Temperate Swamps
- Warmwater Lakes and Ponds

Distribution of
MOOSE
in New Hampshire

■ Core Range
▨ Localized



Distribution Map

Current Species and Habitat Condition in New Hampshire

New Hampshire's moose population has made a remarkable recovery since its almost total extirpation in the mid-1800s. The peak population for moose in New Hampshire was around 1996, when there were 7,600 moose in the state. Currently, most regions are below the goal number set by NHFG in conjunction with the public. The North region has been below goal for three years but recently

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showed some growth back towards goal. The same is true for the White Mountain population. Winter tick is keeping the northern populations at current densities or causing them to stagnate or decline by causing irruptive declines in certain years and/or reducing productivity. Currently the only population at goal is that in the Connecticut Lakes region. The three southern populations have been declining somewhat steadily since 2008 and are all below goal. It is believed this decline is being influenced more by brainworm than winter tick.

Population Management Status

Moose numbers are managed in part by the number of hunting permits issued each year. The hunting season is statewide and requires a permit issuance, which had been as high as 675 in 2006/07, but in response to declines have been dropped to 105 permits issued for 2015. Data collected through both research and annual monitoring will be used to further reduce permit numbers if warranted. In the most recent 10 year management plan (2016- 2026) the department also instituted cut off points for regional moose populations which will result in suspension of permit issuance if reached.

The physical evaluation of moose taken during the hunting season is a very important part of the monitoring system. All animals taken are required to be brought to a registration station, where the animal is weighed and aged. Cows are checked for evidence of pregnancy and antler measurements are recorded for bulls. In addition, animals are checked for tick infestation levels. This gives biologists a measure of herd health. The most recent addition to the monitoring system is the spring hair loss survey conducted in early May. This survey is in its infancy but should, over time, allow NH to determine the winter tick mortality impacts for the past year. A full assessment of the population is conducted every ten years, which takes into account all of this information.

Regulatory Protection (for explanations, see Appendix I)

- Harvest permit - season/take regulations

Quality of Habitat

All regions have more than or are at 15% of the land base in softwood cover with the exception of the Southeast which (at 11%) is still above the recommended minimum. All regions also have a large percentage of mature hardwood, birch/aspen and mixed wood stands ranging from a high of 62% in the Connecticut Lakes to 43% in the Southwest and Southeast. While the three northern regions maintain sufficient hardwood/deciduous forests and aquatic environments (35% - 55%), the remaining southern regions fall well below the recommended amount of these habitats for moose (22 % in Central, 16% in Southwest and 27% in the Southeast) (Peek et al. 1976).

While all regions provide high quantities of the components of moose habitat not all of this habitat is equally available. Human development patterns often preclude use of available habitats. One way to examine the influence of “light” development (homes and light industry) is to define habitat that is within 300 feet of a road. Habitat found within this boundary is most likely to contain residences and light development. It is here that we plainly see the impact the human population is having on wildlife. The Connecticut Lakes region loses 4.4% of its moose habitat; the North Region loses 6.1% of its moose habitat, the White Mountains 7.0%, the Central 15%, the Southwest 17.2% and the Southeast 24.1%.

Habitat Protection Status

In the White Mountain region, the White Mountain National Forest makes up the bulk of the land area. Land ownership in the Connecticut Lakes and North regions has been primarily by paper companies. Today there are no longer any lands in NH owned by industrial forest companies. They

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have all been sold to timberland investment management organizations (or TIMOs).

Habitat Management Status

There is not any active moose habitat management currently occurring in the state. However, any time a clear cut or large patch cut is created, this benefits moose. Many large landowners in New Hampshire are timberland investment management organizations (or TIMOs). These companies generally do not manage land for long term forest products. Instead the land is managed to get the most return on the investment. This return is made through timber management, sale of high value parcels, and appreciation of land values coupled with re-sale of the property. Length of ownership by a TIMO is usually 10 years or less. This high rate of turn over often results in a large contiguous forest being sold off as smaller parcels with increased development. This reduces acreage for all wildlife.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a "medium" or "high" score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Mortality from increased winter tick infestation due to shorter winters and increased moose density (Threat Rank: High)

During years when the winter season is unusually short, tick populations are not regulated by snow and therefore continue to reproduce to problematic numbers for moose. Winter ticks congregate and attach to moose in the thousands, causing discomfort that result in the loss of hair in adult moose and can lead to anemia and death in young moose.

A mortality study conducted in NH in 2001-2005 found that winter tick accounted for 41% of moose mortality and compelling evidence was documented implicating winter tick induced anemia as the primary cause. Winter tick is keeping the northern three populations at current densities or causing them to stagnate or decline by causing increased mortality and decreased productivity (Rines 2015). While higher tick levels are related to both moose density and weather, early springs and late winters seem to be increasing tick abundance and infection levels for moose. These weather patterns cannot be predicted but in the past 30 years, winter has shortened for much of the northern end of the state by up to 3 weeks (Wake et al. 2014).

Species impacts due to reduced productivity from increase in winter tick infestation due to shorter winters and increased moose density (Threat Rank: High)

Twinning rate (the proportion of births that are twins or triplets) is influenced by the age and weight of the cow (Schwartz and Hundertmark 1993, Adams 1995). Stress from winter tick is predicted to cause declines in moose weight, which may in turn impact reproductive ability.

Winter tick can cause increased energy expenditure resulting in depletion of fat reserves, secondary infections and hypothermia in moose. In addition, chronic heavy tick loads were implicated in declining moose weights resulting in reduced productivity (Scarpitti 2006; Musante 2006).

An average tick load is about 35,000 ticks per moose with some animals carrying up to 150,000 ticks (Samuel and Welch 1991). Based on animals taken during the fall hunts in Maine, Vermont and NH Adams (1995) found that cows with a dressed weight of 440 lbs. or less are unlikely to ovulate, those

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weighing between 440 and 550 tend to ovulate one egg and those over 550 are most likely to produce two.

Mortality from brainworm due to increased deer densities (Threat Rank: High)

Brainworm is a parasitic roundworm that is passed on to moose from deer via the secondary host which is land snails. The snails are consumed by a moose as it feeds on vegetation. Once ingested the roundworm is released into the animal's blood supply where it travels to the central nervous system. It affects the central nervous system and is almost always fatal to the moose.

The primary host of brainworm is white-tailed deer which is able to carry the parasite with few ill effects, so areas with high densities of deer are hot spots for brainworm. Recent work done in Minnesota on a declining moose population indicated that brainworm was responsible for as much as 54% of the mortality of collared animals (Arno et al. 2014). It is the North American experience that at deer densities above 10-13/mi² moose densities decline. Deer densities in New Hampshire have been increasing in the past 15 years and generally exceed this level south of the White Mountain region.

Habitat conversion due to development (Threat Rank: Medium)

Moose need large spaces of various habitats throughout the year, and have large home ranges (in fall, average home range size is 29.55 mi² for both sexes combined). Development directly removes habitat, and can fragment existing habitat. Because moose move large distances across the landscape, moose are also exposed to development-related threats, such as road mortality. Moose feed primarily on hardwood browse found between 1 – 10 feet in height. As moose consume 40 lbs of herbaceous material per day, regenerating clearcuts or burns provide the most abundant source of food for moose.

The Society for the Protection of New Hampshire's Forests predicts that by 2030 forest cover will decline to 78.5% (225,000 acres removed) while the human population is predicted to increase by 180,000 people. While most population growth is taking place in the seven southern counties and particularly Carroll County (projected growth rate of 24%), housing increases are taking place statewide. By the year 2030 less than 1/3 of the state is expected to be rural and the bulk of that will be from the White Mountains north. Clearcuts are becoming much smaller and less common due to public concern for aesthetics. This has led to less forage for moose.

List of Lower Ranking Threats:

Habitat impacts and degradation from development and associated fragmentation

Mortality due to predation on calves by black bears

Mortality of individuals from vehicles on roadways

Species impacts from heat stress that causes a decrease in foraging

Actions to benefit this Species or Habitat in NH

Continue to implement education and outreach programs about moose and associated threats

Primary Threat Addressed: Mortality of individuals from vehicles on roadways

Specific Threat (IUCN Threat Levels): Transportation & service corridors

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Objective:

Increase statewide outreach to promote public understanding of the impacts that human development, climate change and increasing deer densities have on moose density.

General Strategy:

Continue outreach programs (like “Brake for Moose”) and implement other strategic outreach programs to increase public understanding of the impacts that human development, climate change and increasing deer densities have on moose density. This needs to occur statewide.

Political Location:

Statewide

Watershed Location:

Statewide

Adjust cutting practices in targeted areas to increase browse opportunity or places of refuge for moose

Primary Threat Addressed: Species impacts from heat stress that causes a decrease in foraging

Specific Threat (IUCN Threat Levels): Climate change & severe weather

Objective:

Provide technical assistance to foresters and landowners, particularly in the White Mountains, and provide education and outreach to the public to increase support for cutting practices that benefit moose.

General Strategy:

This is important for all lands but is most needed on federal lands in the White Mountain National Forest where cutting targets are not being met. In all cases the biggest factor in preventing clear cuts is public opinion. This needs to be changed using

Political Location:

Statewide

Watershed Location:

Statewide

Continue research on winter tick impacts and explore mitigation actions to benefit moose populations

Primary Threat Addressed: Mortality from increased winter tick infestation due to shorter winters and increased moose density

Specific Threat (IUCN Threat Levels): Climate change & severe weather

Objective:

Continue ongoing research projects that are addressing the impacts of winter tick and other associated problems.

General Strategy:

Monitor the moose population and its interactions with winter tick. Winter tick seems to be most problematic from the Central region north, however the influence on winter tick (climate change) would need to be influenced by the global human population.

Political Location:

Watershed Location:

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Carroll County, Coos County, Grafton County

Androscoggin-Saco Watershed, Upper CT Watershed

Address brainworm issues in the moose population through long-term planning

Primary Threat Addressed: Mortality from brainworm due to increased deer densities

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases

Objective:

Reduce the occurrence of brainworm in moose by reducing deer densities in certain areas.

General Strategy:

Brainworm can be reduced by reducing deer densities. During a recent 10 year planning process, the public was in support of keeping deer density at current levels.

Political Location:

Statewide

Watershed Location:

Statewide

References, Data Sources and Authors

Data Sources

Sources of information came from literature review, expert review and consultation, and hunter observation data provided to NHFG.

Current New Hampshire habitat was assessed using information from the USGS National Land Cover Database (NLCD). According to this GIS data, all regions have a large percentage of the land base that could be defined as moose habitat. The NHFG New Hampshire Moose Assessment provided updated condition information (Rines 2015).

Data Quality

Hunting seasons are set annually, so every year NHFG must know the status of the moose population in all management regions. NHFG can estimate moose population numbers by using information based on the number of moose seen per 100 hunter hours reported from a deer hunter mail survey. This observation rate provides distribution patterns, an index to population size, rate of change and provides good information on adult sex ratios and fall recruitment rates. It takes place statewide each fall.

Accidental kill data is also recorded annually. This includes cause, date, WMU, town and location of death, as well as sex and age (calf or adult) of the animal involved. The bulk of these reports are vehicle kills.

All animals taken during the moose season are brought to a biological check station where information on sex, age, weight, reproductive status, tick infestation and kill site are recorded. Three NHFG Department-sponsored research projects have taken place over the past ten years with a fourth and fifth currently underway. These studies have focused on seasonal home range characteristics and habitat relationships, determining the productivity of cows, determining the cause and rates of mortality of adult cows and calves, monitoring annual tick loads on moose, determining relationships between weather and tick abundance, and determining the relationship between moose population density and forest regeneration. The current two studies were implemented due to

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concerns that mortality may now be higher than that documented in the most recent study (2006) and the need for better data on the relationship between weather and tick abundance. Field work will be conducted through the winter of 2018, and aims to determine mortality rates and causes and productivity of moose in the North region as well as the relationship between weather, moose density and tick abundance.

2015 Authors:

Kristine Rines, NHFG, Loren Valliere, NHFG

2005 Authors:

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Gray Wolf

Canis lupus

Federal Listing	E
State Listing	E
Global Rank	G4G5
State Rank	SX
Regional Status	



Photo by unknown/web

Justification (Reason for Concern in NH)

Wolves play an important role as a top predator in the places they inhabit feeding primarily on large mammals such as deer and moose, removing sick and injured animals from those populations. They are highly social and live in packs hunting and raising their young (USFWS 1992). Wolves prefer large contiguous blocks of mixed deciduous-conifer forest and conifer forested wetlands (Mladenoff and Sickley 1998). These habitats are threatened by subdivision and development in the Northeast. The eastern wolf, found in southeastern Canada, is likely most closely related to red wolves (*Canis rufus*) and coyotes (*Canis latrans*) than to gray wolves (Wilson et al. 2000). Much of the literature over the past 15 years suggests that *Canis lycaon* should be considered an individual species, yet there is still much debate over the influence and overlap with closely related species such as red wolves (*Canis rufus*) and coyotes (*Canis latrans*). As a result the conservation and listing of this species is still controversial yet important in the due to the potential impacts as a rare species. Recent evidence of eastern wolves in Maine, NH, VT, and NY, is listed in Thiel and Wydeven, 2011.

Distribution

Wolves were extirpated from New Hampshire in the early 1800's.

Currently, the closest population of eastern wolves exists in Quebec, north of the St. Lawrence River. In general these populations in Quebec appear to be relatively stable (Thiel and Wydeven 2011). Quebec does not recognize eastern wolves as a separate species (Thiel and Wydeven 2011). Consequently there are no large areas closed to public harvest and the level of wolf exploitation in this area may reduce the likelihood if eastern wolves expanding south of the Saint Lawrence River and increase the likelihood of hybridization with northeastern coyotes (Wydeven et al. 1998, Carroll 2003).

Recent GIS habitat assessments have suggested that New Hampshire has 4,591 km² (1773 mi²) of core habitat and 1,222 km² (472 mi²) of dispersal habitat. This habitat was connected to a much larger area in Maine which collectively contained 48,787 km² (18,837 mi²) of habitat which would support at least 488 wolves (Harrison and Chapin 1997). This is more than the minimum viable population size of 200 animals set by the original recovery plan for wolves (Thiel and Wydeven 2011).

Primary obstacles to recolonization include the Saint Lawrence Seaway (75km from Maine border), extensive areas of unforested agricultural land, current population status and management of wolves in Canada, and areas with high human and road densities in southern Quebec (Harrison and Chapin 1998).

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Wolves can disperse long distances, often crossing obstacles such as 4 lane highways (Merril 2000). The recent expansion of wolf populations in Europe and the midwestern states suggests that the potential for a natural recolonization of wolves in New Hampshire, although difficult, may be possible.

Habitat

Historically, wolves lived in a wide variety of habitats throughout the northern hemisphere, from mountain forests to open prairie (Mech 1970). The primary requirement for a wolf population is a source of large prey, such as deer, moose, or bison.

Mladenoff and Sickley (1998) and Harrison and Chapin (1998) propose that eastern wolf habitat includes:

Mixed deciduous conifer forest

Conifer forested wetlands

Public and industrial (e.g. timber investment) ownerships

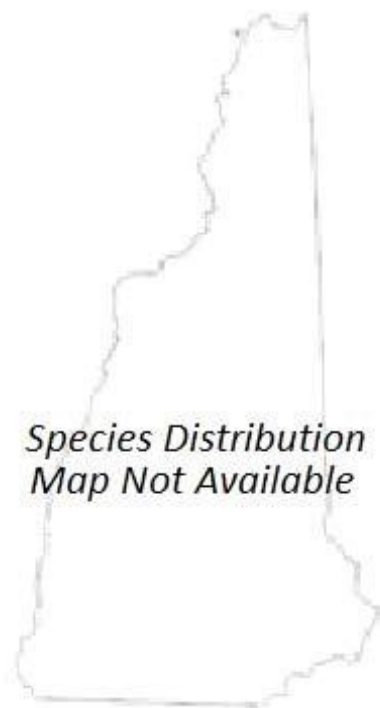
Landscapes with road densities less than 0.70 km/km² and

Landscapes with human densities less than 4 individuals/km²

Small ownerships and private lands seem to be avoided as well as land cover classes including agriculture and deciduous forests.

NH Wildlife Action Plan Habitats

- Northern Hardwood-Conifer Forest
- High Elevation Spruce-Fir Forest



Distribution Map

Current Species and Habitat Condition in New Hampshire

Wolf populations are currently considered stable in Quebec (Lariviere et al. 2000). An increase in protection or a decrease in hunting/trapping pressure on wolves in Quebec would likely lead to an increase in wolf numbers, and ultimately to an increase in dispersal rates (Wydeven et al. 1998). Any increase in wolf dispersal would increase the likelihood of a natural wolf recolonization of the northeastern U.S. A wolf population that establishes in Maine would be likely to expand into northern New Hampshire.

Population Management Status

New Hampshire Fish and Game biologists investigate credible wolf sightings, but have yet to confirm the presence of wolves in the state.

New Hampshire would constitute only a small portion of potential wolf range in the northeast, which would be expected to include areas of Maine, New Hampshire, Vermont, and New York. New Hampshire currently has no management plan that addresses the potential return of wolves to the state. Minnesota, Wisconsin, and Michigan are examples of states that have recently dealt with the issue of a naturally recovering wolf population. New Hampshire should look to these states for guidance in the preparation of a strategy for dealing with the potential return of wolves. A key component of this strategy would be to support public education that dispels myths about wolves and focuses on the actual benefits and problems of living with a wolf population. The strategy should also differentiate between short term and long-term management goals. In general, recovering wolf populations require protection in the short term, but expanding populations will need a more flexible management policy to address the inevitable increase in wolf/human conflicts, such as the killing of livestock or pets (Mech 1995). Minnesota has been successful with a strategy that allows for increased harvest in agricultural and suburban areas while maintaining protection in areas of core wolf habitat (Mech 1995).

Regulatory Protection (for explanations, see Appendix I)

- Federal Endangered Species Act

Quality of Habitat

Harrison and Chapin (1998) identify most of northern New Hampshire as suitable wolf habitat based on habitat parameters defined in 1.1.

Habitat Protection Status

Conserving and maintaining large, unfragmented blocks of forest habitat in northern NH should be priority.

Over the past 20 years several large blocks have been conserved in northern NH, but there are many larger ownerships with no protection and high potential for subdivision.

Habitat Management Status

The majority of land in northern New Hampshire is managed for forestry products. Forestry operations actually benefit wolves by creating more browse for deer and moose. Future development could fragment the landscape, which would restrict the movements of a potential wolf population (Carrol 2003).

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

There were no threats ranked high or medium.

List of Lower Ranking Threats:

Mortality related to incidental take from shooting and trapping

Habitat impacts from road fragmentation

Mortality from indirect human impacts

Climate change impacting important prey abundance (e.g. declining moose population due to winter ticks)

Actions to benefit this Species or Habitat in NH

Minimize road infrastructure in potential core habitat

Primary Threat Addressed: Habitat impacts from road fragmentation

Specific Threat (IUCN Threat Levels): Transportation & service corridors

Objective:

General Strategy:

Political Location:

Watershed Location:

Provide education and outreach on proper identification and ways to minimize incidental capture, consider a more defined coyote season

Primary Threat Addressed: Mortality related to incidental take from shooting and trapping

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

General Strategy:

Political Location:

Watershed Location:

Educate the public on ways to prevent impacts to live stock and/or implement an active compensation plan/program

Primary Threat Addressed: Mortality from indirect human impacts

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

General Strategy:

Political Location:

Watershed Location:

Review and adjust deer and moose population goals to support wolf populations upon recolonization

Primary Threat Addressed: Climate change impacting important prey abundance (e.g. declining moose population due to winter ticks)

Specific Threat (IUCN Threat Levels): Climate change & severe weather

Objective:

NHFG should consider the impacts of predation on moose and deer in the big game planning efforts if/when wolves recolonize NH

General Strategy:

Political Location:

Watershed Location:

References, Data Sources and Authors

Data Sources

Literature review and communications with New Hampshire Fish and Game biologists and US Fish and Wildlife Service.

Literature review and communication with New Hampshire Fish and Game biologists.

Data Quality

Still need clarity on species genetics and morphology determining eastern wolves as a distinct species. Abundance of information on potential habitat found in the Northeast.

More information is needed on the impacts of hunting and trapping along dispersal and movement corridors connecting core habitats.

The status of wolves in Quebec is based on hunter survey reports (Lariviere et al. 2000). The potential for natural recolonization of the northeast has been addressed by a number of authors (Harrison and Chapin 1998, Wydeven et al. 1998, Carrol 2003).

2015 Authors:

Jillian Kilborn, NHFG

2005 Authors:

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Big Brown Bat

Eptesicus fuscus

Federal Listing	N/A
State Listing	SGCN
Global Rank	G5
State Rank	S3
Regional Status	High



Photo by NHFG

Justification (Reason for Concern in NH)

Big brown bats, like all hibernating bats in NH, are affected by White-Nose Syndrome. Data from the northeast region shows a decline of 41% overall in cave and mine hibernacula (Turner et al 2011). Because of their larger body size and ability to hibernate in buildings, big brown bats have not been as affected as other species, but summer population data are lacking so that the actual effect of White-Nose Syndrome is unknown. Big brown bats often use buildings for maternity colonies, which results in conflicts with humans. In NH, Wildlife Control Operators may only conduct exclusions to remove bat colonies, and may not exterminate them. This is less damaging to bats except when the exclusion is done during the time females are caring for young, generally late May through early August. Timing of exclusions to prevent this is only regulated in uninhabited buildings.

Distribution

Big brown bats can be found statewide in all forest types. They are unlikely to be found in high elevation forests. They are unlikely to roost in young forests, but will use them for foraging. They also forage over wetlands, streams and open areas including in suburban and urban landscapes.

Habitat

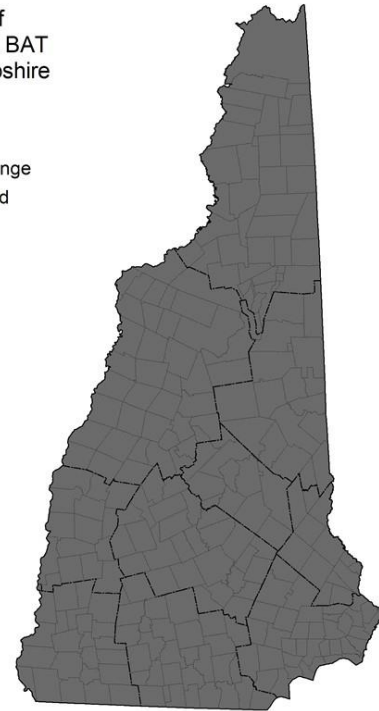
Big brown bats use three types of habitat, forests, buildings and caves or mines. Forests with associated openings, streams and wetlands are used for foraging from the time they emerge from hibernation in the spring to the time they enter hibernation in late fall. Bats will use trees for day and night roosts during this active season. They will use many kinds of buildings for night and maternity roosts and heated or unheated but insulated buildings for hibernating. They also use caves or mines or similar artificial subterranean structures such as bunkers for hibernating.

NH Wildlife Action Plan Habitats

- Caves and Mines
- Hemlock Hardwood Pine Forest
- Appalachian Oak Pine Forest
- Floodplain Habitats
- Lowland Spruce-Fir Forest
- Northern Hardwood-Conifer Forest
- Northern Swamps
- Temperate Swamps

Distribution of
BIG BROWN BAT
in New Hampshire

■ Core Range
▨ Localized



Distribution Map

Current Species and Habitat Condition in New Hampshire

Big brown bats have been affected by white-nose syndrome but it is unknown how negatively. They still are found in buildings, but wildlife control operators say they are doing many fewer evictions overall. As it is unknown how many of the colonies they used to evict were little brown bats versus big brown bats, this data does not provide an indication of big brown bat population health.

Population Management Status

Big brown bat populations are not managed except that evictions from buildings during pupping season are forbidden in buildings not occupied by humans.

Regulatory Protection (for explanations, see Appendix I)

- NHFG FIS 308 Wildlife Control Operators

Quality of Habitat

There are adequate forest and hibernation locations, including those out of state, for big brown bats. Hibernacula are not as high quality due to the presence of *Pseudogymnoascus destructans*, the fungus that causes white-nose syndrome. This fungus persists in hibernacula in the absence of bats (Lorch et al 2012).

Habitat Protection Status

Most bat hibernacula in NH are not protected. Three are on state land but only two are gated. One hibernacula on private land has a conservation easement with a special management unit defined around the mine entrance but is not gated. The other hibernacula are located on private land.

Habitat Management Status

There is no habitat management for this species other than educating landowners on managing individual colonies.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Habitat conversion due to negative perceptions of bats by homeowners that results in loss of roosting habitat in buildings (Threat Rank: High)

Big brown bats often use human structures for roosting, usually in the attic or walls. Humans often do not like having bats roosting in their buildings, particularly in houses and businesses and so remove them, mostly through exclusion. Exclusions done when pups are in residence can lead to the death of the pups. Bats entering the parts of buildings that humans use may be killed due to fears about the bats. Big brown bats will also hibernate in buildings.

Habitat conversion from changes in mine configuration due to landowner and natural causes including reopening or closing mines (Threat Rank: Medium)

Changes in the mine entrances can block access or change the temperature and humidity within the mine. Bats have specific ranges of temperatures and humidity they require for hibernating. Reopening of mines for active use can disturb or kill hibernating bats, or make the mine unsuitable for hibernating.

Disturbance from humans exploring bat hibernacula (Threat Rank: Medium)

Active cavers and casual cave explorers disturb bats when they enter occupied caves and mines. Noise, light, changes in temperature and airflow, and physical contact can all disturb bats (Thomas 1995). In winter during hibernation, these disturbances can cause bats to arouse from hibernation and thus use up precious stored energy. Bats susceptible to White-Nose Syndrome are especially vulnerable to disturbance, as the disease already causes increased numbers of arousals and depletion of stored fat.

Big brown bats occur at hibernacula that may experience high levels of human disturbance. They also hibernate in the attics and walls of houses, which may mean they are less sensitive to noise.

Mortality and species impacts (loss of fitness) due to White-Nose Syndrome (Threat Rank: Medium)

Big brown bats have been affected by White-Nose Syndrome (WNS), a fungal disease that affects bats during hibernation. The fungus, *Pseudogymnoascus destructans*, grows into the wings, muzzles and ears of the bats (Lorch et al. 2011), disrupting metabolic functions (Meteyer et al. 2009, Cryan et al. 2013, Verant et al. 2014) and causing bats to arouse from hibernation more frequently and stay awake longer than uninfected bats (Lorch et al. 2011, Reeder et al. 2012). This causes them to use up stored energy (fat) at a much higher rate (Reeder et al. 2012). Bats cannot replenish their fat stores in winter as their food source is unavailable. They perish from starvation, some first flying out the hibernacula in mid-winter in a desperate search for food. Since bats are in hibernation they do not mount an immune response to this disease.

WNS was first found in NH in 2009. Winter surveys have not found a significant decline as the number of big brown bats found hibernating in NH has always been variable. The population in other affected states has dropped overall by 41% population (Turner et al. 2011). Big brown bats may be less susceptible due their larger body size and habit of hibernating in buildings, which are not cold or humid enough for the fungus causing WNS to grow.

List of Lower Ranking Threats:

Species impacts from agricultural pesticide use causing prey declines

Habitat degradation from succession that causes loss of drinking and foraging habitats

Habitat degradation from timber harvest that removes summer roosting and foraging areas

Habitat degradation from roads and powerline development that removes roosting habitat

Mortality and conversion of migratory habitat due to wind turbine development

Habitat conversion and degradation due to removal of summer roosting and foraging areas

Actions to benefit this Species or Habitat in NH

Monitor bat populations

Objective:

Continue to monitor hibernating and summer bat populations.

General Strategy:

Monitor hibernacula at least every three years for the presence and abundance of bats. Resurvey summer mist netting sites that have been historically monitored such as Surry Mountains Dam and New Boston Air Force Station.

Political Location:

Statewide

Watershed Location:

Statewide

Protect occupied roosting trees

Primary Threat Addressed: Habitat degradation from timber harvest that removes summer roosting and foraging areas

Appendix A: Mammals

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

Prevent occupied roosting trees from being cut down.

General Strategy:

Develop voluntary BMPs for forestry that help landowners and foresters identify and protect known and potential roosting trees during harvesting operations. Provide these guidelines to organization building trails or otherwise potentially cutting trees. BMPs could include time of year restrictions for cutting, tree size limitation and other techniques. Coordinate with other states for consistency.

Political Location:

Watershed Location:

Statewide

Protect summer colonies in buildings

Primary Threat Addressed: Habitat conversion due to negative perceptions of bats by homeowners that results in loss of roosting habitat in buildings

Specific Threat (IUCN Threat Levels): Human intrusions & disturbance

Objective:

Protect summer colonies in buildings without compromising public health

General Strategy:

Protect summer colonies by prohibiting exclusion of bats from buildings during the time they have non-volant young (May 15-August 15). Exceptions should be available in the case of a documented rabid bat in the building or other public health issue. Develop materials for wildlife control operators and homeowners about bats in houses and their reproductive cycle to build support for the rule change and compliance afterwards.

Political Location:

Watershed Location:

Statewide

Statewide

Protect hibernacula from structural damage

Primary Threat Addressed: Habitat conversion from changes in mine configuration due to landowner and natural causes including reopening or closing mines

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

Protect hibernacula from structural damage such as changes to mine opening or configuration.

General Strategy:

Work with owners of hibernacula to encourage them to voluntarily refrain from changing the opening

Appendix A: Mammals

or the configuration of the interior of mines, unless it is to erect a bat-friendly gate over the opening. Encourage the installations of bat-friendly gates.

Political Location:

Coos County, Grafton County, Merrimack County, Rockingham County

Watershed Location:

Androscoggin-Saco Watershed, Upper CT Watershed, Middle CT Watershed, Pemi-Winni Watershed, Merrimack Watershed, Coastal Watershed

Promote organic practices and integrated pest management (IPM)

Primary Threat Addressed: Species impacts from agricultural pesticide use causing prey declines

Specific Threat (IUCN Threat Levels): Pollution / Agricultural & forestry effluents / Herbicides & pesticides

Objective:

Provide technical assistance to organizations that provide education, technical assistance and funding to farmers and homeowners on organic growing practices and IPM.

General Strategy:

Work with the Northeast Organic Farmers Association, UNH Cooperative Extension, NRCS, nursery stock growers, garden centers, garden clubs, landscapers and others to educate farmers, homeowners and commercial landscapers on using IPM and organic practices

Political Location:

Statewide

Watershed Location:

Statewide

Develop standard processes to reduce the effect of wind energy production on bats

Primary Threat Addressed: Mortality and conversion of migratory habitat due to wind turbine development

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

Develop and implement rules on siting and operation of wind turbines to reduce mortality of bats during construction and operation

General Strategy:

Develop and implement siting rules that protect occupied habitat from wind turbine development. Develop required operational mitigation measures such as curtailment to reduce bat mortality post-construction. Develop these in conjunction with nearby states to provide consistency to energy developers across the northeast.

Political Location:

Northeast, Statewide

Watershed Location:

Statewide

Participate in efforts regarding White-Nose Syndrome

Primary Threat Addressed: Mortality and species impacts (loss of fitness) due to White-Nose Syndrome

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases / Invasive non-native/alien species/diseases / Named species

Objective:

Assist in the research, management and planning efforts to control the spread of, find a treatment for, and recover bat species affected by White-Nose Syndrome

General Strategy:

Participate in regional, national and international research, management and planning efforts to control the spread of, find a treatment for, and recover bat species affected by White-Nose Syndrome. Continue to participate in national research projects such as acoustic transects and emergence counts. Continue to participate in research efforts as requested. Participate in regional and national workshops, plans and projects for conservation, recovery and communications about White-Nose Syndrome.

Political Location:

National, Northeast, Statewide

Watershed Location:

Statewide

References, Data Sources and Authors

Data Sources

Information on big brown bats comes from NHFG unpublished data, hibernation survey reports from Dr. Jacques Veilleux and Dr. Scott Reynolds, and published scientific literature.

Data Quality

Cave and mine hibernacula data is fairly comprehensive. Data is missing from what may have been the largest hibernacula, still not specifically located but known to be on the slopes of Mount Washington due to the presence of hundreds of sick bats flying in February of 2010. Hibernation data from houses is lacking as is summer population data. Data on most threats is well documented in the scientific literature.

2015 Authors:

Emily Preston, NHFG

2005 Authors:

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Silver-haired Bat

Lasionycteris noctivagans

Federal Listing	N/A
State Listing	SC
Global Rank	G4
State Rank	S3
Regional Status	Very High

Justification (Reason for Concern in NH)

Silver-haired bats have a life history different from the life history of other small mammals. Individuals are relatively long-lived and have a low reproductive rate, typically giving birth to two young per year (Kunz 1982). Only 8 individuals have been captured in New Hampshire from 3 counties (Sasse 1995, NHFG unpublished data). Acoustic data has been recorded from 3 additional counties (Reynolds 1999, Krusic 1996). Existing data indicate that silver-haired bats may have a wide summer distribution in New Hampshire. Habitat loss and degradation may lead to population decline, which would be aggravated by slow reproductive rates. Silver-haired bats are also of conservation concern in New Hampshire because little is known about their population status. The lack of detailed data on the distribution, habitat use, and life history of silver-haired bats in New Hampshire may be largely due to a lack of research. The biggest threats to silver-haired bats are wind turbines and habitat loss.

Distribution

Data on the current and historic range of silver-haired bats in New Hampshire are too few to allow a regional comparison.

Habitat

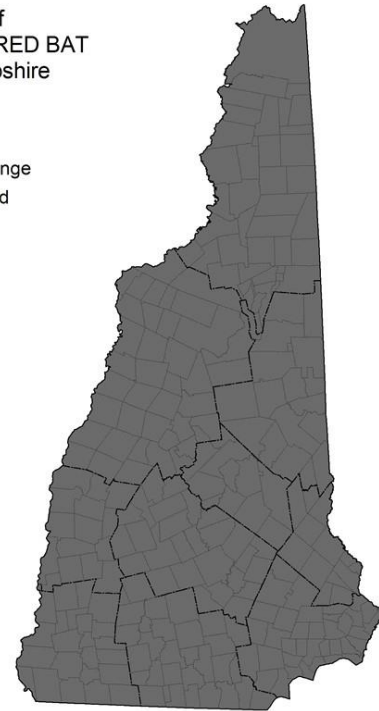
Silver-haired bats do not remain in New Hampshire during the winter. Individuals that inhabit New Hampshire during the summer migrate to southern states in autumn. During spring, individuals return to their summer habitat in New Hampshire (or, more generally, to northern states; Cryan and Veilleux 2007). The silver-haired bat is a tree-roosting species that roosts in tree hollows (e.g. Vonhof 1996, Betts 1998, Crampton and Barclay 1998). No data describe the summer roosting ecology of silver-haired bats in New Hampshire, but several studies have examined summer roosting in the northwestern United States and southwestern Canada (Campbell et al. 1996, Vonhof and Barclay 1996, Betts 1998, Crampton and Barclay 1998). Though results of habitat studies varied, in general, silver-haired bats preferred to roost in large tall trees, often in early to moderate stages of decay, in deep cavities relatively high off the ground. Betts (1998) found most roosts used by silver-haired bats were in mature rather than young stands. Campbell et al. (1996) found roost sites located > 100 m from riparian areas, on slopes averaging 38%, and the slope aspect for 11 of 15 roosts within 70° of north. The maternity roost described by Parsons et al. (1986) was located within a mixed-wood stand dominated by sugar maple (*Acer saccharum*), eastern white cedar (*Thuja occidentalis*), and white birch (*Betula papyrifera*).

NH Wildlife Action Plan Habitats

- Hemlock Hardwood Pine Forest
- Northern Hardwood-Conifer Forest
- Appalachian Oak Pine Forest
- Floodplain Habitats
- Lowland Spruce-Fir Forest
- Northern Swamps
- Temperate Swamps

Distribution of SILVER-HAIRED BAT in New Hampshire

■ Core Range
▨ Localized



Distribution Map

Current Species and Habitat Condition in New Hampshire

Population trends and viability cannot be inferred from the limited data on summer occurrences in New Hampshire.

Population Management Status

Silver-haired bats are not currently managed in New Hampshire. The risk to bats from mortality due to wind turbines is considered during the environmental review process for wind power facilities.

Regulatory Protection (for explanations, see Appendix I)

- NHFG Permit for collection or possession

Quality of Habitat

Unknown.

Habitat Protection Status

Unknown

Habitat Management Status

None.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

There are no threats ranked high or medium for this species.

List of Lower Ranking Threats:

- Mortality and species impacts from agricultural pesticide use causing prey declines
- Mortality due to prescribed fire during winter
- Habitat degradation from timber harvest that removes summer roosting and foraging areas
- Habitat degradation from roads and powerline development
- Mortality and conversion of migratory habitat due to wind turbine development
- Habitat conversion and degradation due to removal of summer roosting and foraging areas

Actions to benefit this Species or Habitat in NH

Promote organic practices and integrated pest management (IPM)

Primary Threat Addressed: Mortality and species impacts from agricultural pesticide use causing prey declines

Specific Threat (IUCN Threat Levels): Pollution / Agricultural & forestry effluents / Herbicides & pesticides

Objective:

Provide technical assistance to organizations that provide education, technical assistance and funding to farmers and homeowners on organic growing practices and IPM.

General Strategy:

Work with the Northeast Organic Farmers Association, UNH Cooperative Extension, NRCS, nursery stock growers, garden centers, garden clubs, landscapers and others to educate farmers, homeowners and commercial landscapers on using IPM and organic practices

Political Location:

Statewide

Watershed Location:

Statewide

Develop standard processes to reduce the effect of wind energy production on bats

Appendix A: Mammals

Primary Threat Addressed: Mortality and conversion of migratory habitat due to wind turbine development

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

Develop and implement rules on siting and operation of wind turbines to reduce mortality of bats during construction and operation

General Strategy:

Develop and implement siting rules that protect migration routes and occupied habitat from wind turbine development. Develop required operational mitigation measures such as curtailment to reduce bat mortality post-construction. Develop these in conjunction with nearby states to provide consistency to energy developers across the northeast.

Political Location:

Northeast, Statewide

Watershed Location:

Statewide

Monitor bat populations

Objective:

Continue to monitor summer bat populations.

General Strategy:

Resurvey summer mist netting sites that have been historically monitored such as Surry Mountain Dam and New Boston Air Force Station.

Political Location:

Statewide

Watershed Location:

Statewide

Protect occupied roosting trees

Primary Threat Addressed: Habitat degradation from timber harvest that removes summer roosting and foraging areas

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

Prevent occupied roosting trees from being cut down.

General Strategy:

Develop voluntary BMPs for forestry that help landowners and foresters identify and protect known and potential roosting trees during harvesting operations. Provide these guidelines to organization building trails or otherwise potentially cutting trees. BMPs could include time of year restrictions for cutting, tree size limitation and other techniques. Coordinate with other states for consistency.

Political Location:

Statewide

Watershed Location:

Statewide

References, Data Sources and Authors

Data Sources

Data on species distribution were compiled by searching for specimens deposited in museums and college/university teaching collections and by examining published and gray literature of research on bat populations in New Hampshire. NHFG unpublished data includes capture records provided by researchers as part of their reporting requirements for obtaining scientific collecting permits in NH.

Data Quality

Data on the distribution of silver-haired bats in New Hampshire are extremely limited, though existing data are believed to be good. Hoary bats are morphologically unique and identifications should be accurate. Echolocation sequences of silver-haired bats are difficult to distinguish from big brown bats and therefore such data should be treated with caution.

2015 Authors:

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2005 Authors:

Jacques Veilleux, Franklin Pierce University; D. Scott Reynolds, St. Paul's School

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Appendix A: Mammals

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Eastern Red Bat

Lasiurus borealis

Federal Listing	N/A
State Listing	SC
Global Rank	G4
State Rank	S3
Regional Status	Very High

Justification (Reason for Concern in NH)

Like other bat species, the eastern red bat's life history is different from the typical life history of small mammals. Individuals are relatively long-lived and have a low reproductive rate with a mean litter size of three young per year (Shump and Shump 1982). Habitat loss and degradation may lead to population declines, which, when coupled with their slow reproductive rate, could lead to a slow population recovery time. Eastern red bats are of conservation concern in New Hampshire for the above reasons and because of the lack of knowledge about the species' population status in New Hampshire. Only 54 individuals have been captured in New Hampshire (NHFG unpublished data) from 7 counties. Ecolocation calls have been recorded in one additional county (Reynolds 1999). The above data indicate that eastern red bats may have a wide summer distribution in New Hampshire. The current lack of detailed data on the distribution, habitat use, and life history of eastern red bats in New Hampshire is largely due to a lack of research. The biggest threats to eastern red bats are wind turbines and habitat loss.

Distribution

Data on the current and historical ranges of eastern red bats in New Hampshire are too few to allow a regional population comparison. Available data indicate that eastern red bats may have a wide summer distribution in New Hampshire.

Habitat

Eastern red bats inhabit New Hampshire during the summer. Individuals migrate to southern states in the fall and return to New Hampshire and other northern states in the spring (Cryan and Veilleux 2007). No available data describe the summer habitat requirements of eastern red bats in specifically in New Hampshire. During the summer, eastern red bats roost in tree foliage (Shump and Shump 1982, Whitaker and Hamilton 1998). Adult males and non-reproductive females roost singly; reproductive females are colonial and roost with their young (Mumford 1973, Shump and Shump 1982, Hutchinson and Lacki 2000). Females give birth and wean their young within foliage roosts. Studies have found that red bats roost in a variety of deciduous tree species, in the largest trees, often high off the ground near the outer canopy edge. Hutchinson and Lacki (2001) suggest that eastern red bats roosting at such locations are sheltered from high temperatures caused by direct solar insolation and benefit from the cooling effects of wind caused by evaporative/convective heat loss. Eastern red bats roosting in fragmented habitats, such as urban areas and farmland, may roost nearer the ground. This behavior may reflect the lower height of tree canopies in such areas, as well as benefits from the cooling effects of wind.

Roost trees are typically located close to permanent water sources (Hutchinson and Lacki 2000).

Appendix A: Mammals

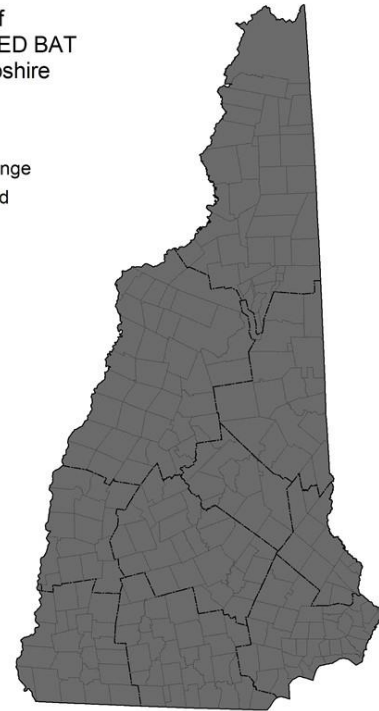
Menzel et al. (1998) reported the mean roost area (the area containing all roost trees) at 2.6 ha, while Mager and Nelson (2001) reported a mean roost area of 90 ha.

NH Wildlife Action Plan Habitats

- Hemlock Hardwood Pine Forest
- Northern Hardwood-Conifer Forest
- Appalachian Oak Pine Forest
- Floodplain Habitats
- Lowland Spruce-Fir Forest
- Northern Swamps
- Temperate Swamps

Distribution of
EASTERN RED BAT
in New Hampshire

■ Core Range
▨ Localized



Distribution Map

Current Species and Habitat Condition in New Hampshire

The paucity of data on summer occurrences in New Hampshire prevents an analysis of the population trends and viability of eastern red bats.

Population Management Status

Eastern red bats are not currently managed in New Hampshire. The risk to bats from mortality due to wind turbines is considered during the environmental review process for wind power facilities.

Regulatory Protection (for explanations, see Appendix I)

- NHFG Permit for collection or possession

Quality of Habitat

Unknown.

Habitat Protection Status

Unknown.

Habitat Management Status

None.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

There are no threats ranked high or medium for this species.

List of Lower Ranking Threats:

Mortality and species impacts from agricultural pesticide use causing prey declines
Habitat degradation from succession that causes loss of drinking and foraging habitats
Mortality due to prescribed fire during winter
Habitat degradation from timber harvest that removes summer roosting and foraging areas
Habitat degradation from roads and powerline development
Mortality and conversion of migratory habitat due to wind turbine development
Habitat conversion and degradation due to removal of summer roosting and foraging areas

Actions to benefit this Species or Habitat in NH

Protect occupied roosting trees

Primary Threat Addressed: Habitat degradation from timber harvest that removes summer roosting and foraging areas

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

Prevent occupied roosting trees from being cut down.

General Strategy:

Develop voluntary BMPs for forestry that help landowners and foresters identify and protect known and potential roosting trees during harvesting operations. Provide these guidelines to organization building trails or otherwise potentially cutting trees. BMPs could include time of year restrictions for cutting, tree size limitation and other techniques. Coordinate with other states for consistency.

Political Location:

Statewide

Watershed Location:

Statewide

Develop standard processes to reduce the effect of wind energy production on bats

Appendix A: Mammals

Primary Threat Addressed: Mortality and conversion of migratory habitat due to wind turbine development

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

Develop and implement rules on siting and operation of wind turbines to reduce mortality of bats during construction and operation

General Strategy:

Develop and implement siting rules that protect migration routes and occupied habitat from wind turbine development. Develop required operational mitigation measures such as curtailment to reduce bat mortality post-construction. Develop these in conjunction with nearby states to provide consistency to energy developers across the northeast.

Political Location:

Northeast, Statewide

Watershed Location:

Statewide

Monitor bat populations

Objective:

Continue to monitor summer bat populations.

General Strategy:

Resurvey summer mist netting sites that have been historically monitored such as Surry Mountain Dam and New Boston Air Force Station.

Political Location:

Statewide

Watershed Location:

Statewide

Promote organic practices and integrated pest management (IPM)

Primary Threat Addressed: Mortality and species impacts from agricultural pesticide use causing prey declines

Specific Threat (IUCN Threat Levels): Pollution / Agricultural & forestry effluents / Herbicides & pesticides

Objective:

Provide technical assistance to organizations that provide education, technical assistance and funding to farmers and homeowners on organic growing practices and IPM.

General Strategy:

Work with the Northeast Organic Farmers Association, UNH Cooperative Extension, NRCS, nursery stock growers, garden centers, garden clubs, landscapers and others to educate farmers, homeowners and commercial landscapers on using IPM and organic practices

Political Location:

Statewide

Watershed Location:

Statewide

References, Data Sources and Authors

Data Sources

Town data on the eastern red bat's summer distribution were compiled from museum specimens, college and university teaching collections, and the published and gray literature of bat research in New Hampshire. NHFG unpublished data includes capture records provided by researchers as part of their reporting requirements for obtaining scientific collecting permits in NH.

Data Quality

Data on the distribution of eastern red bats in New Hampshire are extremely limited, but the quality of existing data is believed to be good because eastern red bats are morphologically unique and easy to identify. The major knowledge gap is the paucity of occurrence records and research into distribution patterns.

2015 Authors:

Emily Preston, NHFG

2005 Authors:

Jacques Veilleux, Franklin Pierce University; D. Scott Reynolds, St. Paul's School

Literature

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Appendix A: Mammals

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Hoary Bat

Lasiurus cinereus

Federal Listing	N/A
State Listing	SC
Global Rank	G4
State Rank	S3
Regional Status	Very High

Justification (Reason for Concern in NH)

Hoary bats are relatively long lived and have a low reproductive rate, typically giving birth to 2 young per year (Koehler and Barclay 2000; Shump and Shump 1982). Habitat loss and degradation may lead to population declines, which are compounded by slow reproductive rates. Only 16 individuals have been captured in New Hampshire (NHFG unpublished data) from 5 counties. Based on echolocation calls, Reynolds (1999) reported the presence of hoary bats at Gile State Park, Springfield, Sullivan County and Pawtuckaway State Park, Nottingham, Rockingham County. Chenger (2005) reported echolocation calls from Gorham (Coos County) and Albany (Carroll County). These data indicate that hoary bats may have a wide summer distribution in New Hampshire. The current lack of detailed data on the distribution, habitat use, and life history of hoary bats in New Hampshire is largely due to a lack of research. The biggest threats to hoary bats are wind turbines and habitat loss.

Distribution

Data that describe the range of hoary bats in New Hampshire are too few to allow a regional comparison of hoary bat populations.

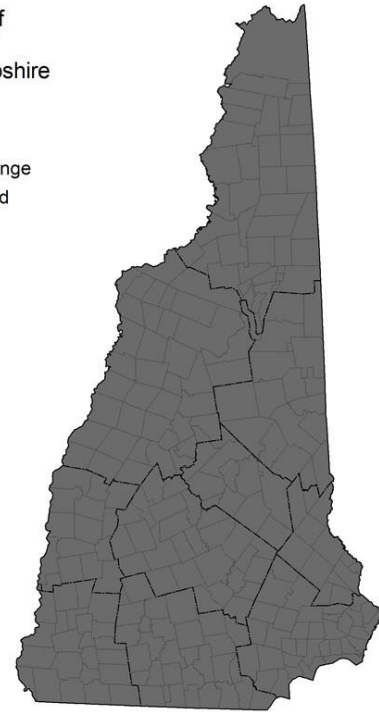
Habitat

Hoary bats leave New Hampshire in the autumn to spend winter months in the South. During spring, they return north to their summer habitat (Cryan and Veilleux 2007). Veilleux et al 2009 describe the summer roosting habitat as eastern hemlock (*Tsuga canadensis*) with individual bats using multiple roosts within a 0.5ha area. Elsewhere they roost in tree foliage or even in woodpecker holes and squirrel nests (Shump and Shump 1982, Whitaker and Hamilton 1998). They use both deciduous and coniferous trees for roosting (Willis and Brigham 2005, Perry and Thill 2007). Hoary bats are not colonial, but roost singly during all times of the year (except for reproductive females, who birth and wean their young within the roost) (Shump and Shump 1982). A study by Willis and Brigham (2005) demonstrated that, on average, hoary bats roosted 2 m from the tree trunk and in branches located 12.7 m from the ground. Roosts were oriented to the southeast (mean angle = 158.6). Roosts are typically sheltered by dense, overhanging foliage that forms an umbrella shape above the bats. The southeast exposure, lower canopy closure, and relative roost height may increase exposure of bats to sunlight, thereby providing warmer roost temperatures (Willis and Brigham 2005). Koehler and Barclay (2000) reported hoary bats from Manitoba, Canada, roosting at heights of 8-18 m in the foliage, and occasionally on the bark of trees. Trees bordered clearings or rose above nearby trees in the forest. Willis and Brigham (2005) observed reduced forest density on the roosting side of roost trees, possibly providing an open 'flyway' for bats returning to and leaving the roost. Hoary bats also roost at lower elevations, possibly due to lower wind levels and the abundance white spruce.

NH Wildlife Action Plan Habitats

- Hemlock Hardwood Pine Forest
- Northern Hardwood-Conifer Forest
- Appalachian Oak Pine Forest
- Floodplain Habitats
- Lowland Spruce-Fir Forest
- Northern Swamps
- Temperate Swamps

Distribution of
HOARY BAT
in New Hampshire



Distribution Map

Current Species and Habitat Condition in New Hampshire

Population trends and viability cannot be assessed due to the paucity of data on hoary bats in NH.

Population Management Status

Hoary bats are not currently managed in New Hampshire. The risk to bats from mortality due to wind turbines is considered during the environmental review process for wind power facilities.

Regulatory Protection (for explanations, see Appendix I)

- NHFG Permit for collection or possession

Quality of Habitat

Unknown

Habitat Protection Status

Unknown

Habitat Management Status

None.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

There are no threats ranked high or medium for this species.

List of Lower Ranking Threats:

Mortality and species impacts from agricultural pesticide use causing prey declines
Habitat degradation from succession that causes loss of drinking and foraging habitats
Mortality due to prescribed fire during winter
Habitat degradation from timber harvest that removes summer roosting and foraging areas
Habitat degradation from roads and powerline development
Mortality and conversion of migratory habitat due to wind turbine development
Habitat conversion and degradation due to removal of summer roosting and foraging areas

Actions to benefit this Species or Habitat in NH

Monitor bat populations

Objective:

Continue to monitor summer bat populations.

General Strategy:

Resurvey summer mist netting sites that have been historically monitored such as Surry Mountain Dam and New Boston Air Force Station.

Political Location:

Statewide

Watershed Location:

Statewide

Promote organic practices and integrated pest management (IPM)

Primary Threat Addressed: Mortality and species impacts from agricultural pesticide use causing prey declines

Specific Threat (IUCN Threat Levels): Pollution / Agricultural & forestry effluents / Herbicides & pesticides

Appendix A: Mammals

Objective:

Provide technical assistance to organizations that provide education, technical assistance and funding to farmers and homeowners on organic growing practices and IPM.

General Strategy:

Work with the Northeast Organic Farmers Association, UNH Cooperative Extension, NRCS, nursery stock growers, garden centers, garden clubs, landscapers and others to educate farmers, homeowners and commercial landscapers on using IPM and organic practices

Political Location:

Statewide

Watershed Location:

Statewide

Protect occupied roosting trees

Primary Threat Addressed: Habitat degradation from timber harvest that removes summer roosting and foraging areas

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

Prevent occupied roosting trees from being cut down.

General Strategy:

Develop voluntary BMPs for forestry that help landowners and foresters identify and protect known and potential roosting trees during harvesting operations. Provide these guidelines to organization building trails or otherwise potentially cutting trees. BMPs could include time of year restrictions for cutting, tree size limitation and other techniques. Coordinate with other states for consistency

Political Location:

Statewide

Watershed Location:

Statewide

Develop standard processes to reduce the effect of wind energy production on bats

Primary Threat Addressed: Mortality and conversion of migratory habitat due to wind turbine development

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

Develop and implement rules on siting and operation of wind turbines to reduce mortality of bats during construction and operation

General Strategy:

Develop and implement siting rules that protect migration routes and occupied habitat from wind turbine development. Develop required operational mitigation measures such as curtailment to reduce bat mortality post-construction. Develop these in conjunction with nearby states to provide consistency to energy developers across the northeast.

Political Location:
Northeast, Statewide

Watershed Location:
Statewide

References, Data Sources and Authors

Data Sources

Data on species distribution were compiled by searching for specimens deposited in museums and college/university teaching collections and by examining published and gray literature of research on bat populations in New Hampshire. NHFG unpublished data includes capture records provided by researchers as part of their reporting requirements for obtaining scientific collecting permits in NH. See 2.4.

Data Quality

There are limited data on the distribution of hoary bats in New Hampshire but data quality is believed to be good. Hoary bats are morphologically unique and identifications should be accurate. See 2.4.

2015 Authors:

Emily Preston, NHFG

2005 Authors:

Jacques Veilleux, Franklin Pierce University; D. Scott Reynolds, St. Paul's School

Literature

Arnett, E. B., technical editor. 2005. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. A final

Baerwald, E. F., D'Amours, G. H., Klug, B. J., & Barclay, R. M. (2008). Barotrauma is a significant cause of bat fatalities at wind turbines. *Current biology*, 18(16), R695-R696.

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Appendix A: Mammals

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Canada Lynx

Lynx canadensis

Federal Listing	T
State Listing	E
Global Rank	G5
State Rank	S1
Regional Status	Very High



Photo by unknown

Justification (Reason for Concern in NH)

The recovery outline for lynx (USFWS) lists the degradation of lynx habitat through forest management which specifically limits the extent of boreal forest and the associated structure needed to support adequate densities of snowshoe hare as the original reason for listing lynx in the contiguous United States. This was specific to National Forest and BLM lands planning and forest management practices such as pre-commercial thinning. In the contiguous US, lynx are on the southern edge of their distribution in the boreal forest. As a result habitat is more patchily distributed and therefore snowshoe hare densities are likely lower (USFWS recovery outline). Forest management to maintain forest cover and snowshoe hare densities to support lynx is more critical to maintain populations specifically in the Northeast. Large-scale timber harvests for agriculture and suburban developments north of the St. Lawrence Seaway combined with intensive lynx harvests and land clearing south of the Seaway may have resulted in isolation of lynx in northern New England (Litvaitis et al. 1991). Lynx are morphologically adapted to deep snow a condition (long legs and large feet, Parker et al. 1983) which assists them in outcompeting bobcats and coyotes within their distribution. Lynx observations are increasing in New Hampshire. Possible habitat changes and corresponding changes in snowshoe hare densities in Maine may explain the expansion into New Hampshire. New Hampshire still has several large landowners throughout Coos County who have the ability, and continue to manage softwood habitat that is conducive to producing higher snowshoe hare densities. Maintaining this habitat at the landscape scale, which would support a viable population of lynx in New Hampshire, is the ultimate limiting factor.

Distribution

Historic distribution in New Hampshire included Coos and northern Carroll and Grafton counties (i.e. White Mountain National Forest; Siegler 1971, Silver 1974, Hoving et al. 2003).

Approximately 11,162 square miles (mi²) or 6.5 million acres of mostly private lands in northern Maine were designated as critical habitat under the Endangered Species Act. This is the only habitat designated in the contiguous United States in the Northeast. Northern NH, portions of Vermont and NY are considered supporting landscapes.

Lynx tracks or sign have been sporadically observed throughout Coos County and portions of the White Mountain National Forest since the 1980's (NHFG historic records). Occurrence appears to be more stable over the last 10 years. Few lynx have been captured or killed in New Hampshire in recent years. In 1966 and 1992, adult lynx were killed after collisions with vehicles in Lee and west of Concord on Interstate 89, respectively (Litvaitis 1994).

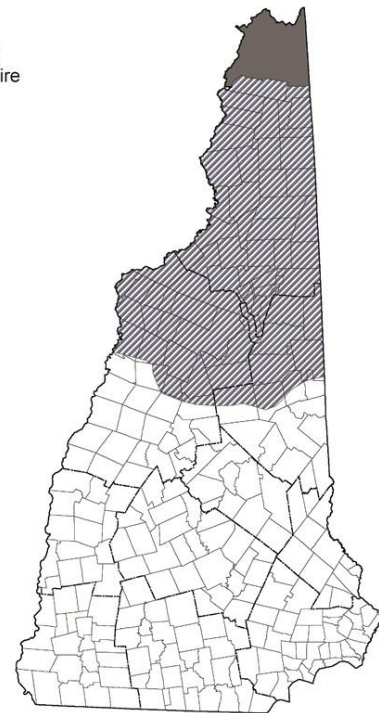
Habitat

Lynx occupy various habitats in the boreal forests and their southern extensions (Anderson and Lovallo 2003). In eastern forests, dominant vegetation includes spruce (*Picea spp.*) and balsam fir (*Abies balsamea*). Snowshoe hare (*Lepus americanus*) are important prey for lynx, and young or subalpine stands may be preferred because they contain more hare than do mature stands (Anderson and Lovallo 2003). Though data on competition and predation are equivocal, lynx may avoid bobcat (*Lynx rufus*) and coyote (*Canis latrans*) by seeking deep snow, to which lynx are morphologically adapted (long legs and large feet, Parker et al. 1983).

NH Wildlife Action Plan Habitats

- Lowland Spruce-Fir Forest
- High Elevation Spruce-Fir Forest

Distribution of
CANADA LYNX
in New Hampshire



Distribution Map

Current Species and Habitat Condition in New Hampshire

It would appear that the only consistent population or occupation of New Hampshire by lynx would be in the northern portions of Pittsburg along the Maine and Canadian border. In 2011, 4 lynx kittens were observed in Pittsburg and considered evidence of breeding in New Hampshire.

Historically lynx were found throughout the White Mountain National Forest and Coos County, yet today occurrence in these areas today is less predictable and more sporadic in nature. Areas with the highest probability of occurrence based on today's knowledge includes northern Pittsburg, portions of central Coos County and portions of the White Mountain National Forest (Siren 2014).

Population Management Status

Annual remote camera surveys and track transects within habitat with the highest probability of

Appendix A: Mammals

occurrence appears to be predicting lynx occurrence distribution in NH and can be used into the future to monitor lynx distribution.

In 2012 NHFG implemented a lynx exclusion zone for the fisher trapping season in an effort to minimize incidental capture as a result of the observed expansion in occurrence. The recommendations provided in this zone will likely need to be reviewed and changed due to 2 incidentally taken lynx in Maine in the fall of 2014.

Regulatory Protection (for explanations, see Appendix I)

- Federal Endangered Species Act

Quality of Habitat

Habitats with the highest probability of occurrence in New Hampshire are located in northern Pittsburg (Siren 2014). The majority of this habitat is located on the Connecticut Lakes Natural Area WMA which is owned and managed by NHFG. Surrounding habitat is owned and managed by the Connecticut Lakes Timber Company under a conservation easement held by the State of NH. Occurrence records from the past 10 years have been centered on these two ownerships.

Habitat on the Connecticut Lakes Natural Area has a conservation easement with 15,000 acres of the core lynx habitat also being part of a no management area of the 25,000 acre property. As a result these core 15,000 acres will be allowed to mature to a climax forest type potentially allowing for good denning habitat but restricting the amount of snowshoe hare habitat in the foreseeable future. Current conditions are in a transition state and portions of the 15,000 acres are supporting higher densities of snowshoe hare due to historic management.

Portions of the White Mountain National Forest were also identified as having high probability of occurrence. High elevation habitat is more patchy in distribution and it is unknown if the natural forest dynamics of these habitats will produce adequate densities of snowshoe hare to support a viable population of lynx.

Habitat Protection Status

Conserved land properties contributing to lynx habitat include: The Connecticut Lakes Natural Area, Connecticut Lakes Timber Company, the Vicki Bunnell Preserve, Nash Stream State Forest, Kilkenny National Forest, the White Mountain National Forest, and the Randolph Town Forest and the Errol Town Forest, all of which have specific goals for promoting boreal forest and wildlife species within their boundaries.

Portions of Coos County remain virtually unprotected through easement or conservation ownership. These properties are critical north/south as well as east/west movement corridors between populations and states.

Potentially important ownerships:

Town of Success, no protection

Second College Grant no protection

Bayroot LLC no protection

Balsams Resort in Dixville, partial easement protection

Perry Stream Land and Timber no formal protection

Habitat Management Status

Management options within the State are restricted to providing quality habitat for snowshoe hare. In northern New Hampshire even aged management is predominant on the larger private ownerships. The creation of large quantities of snowshoe hare habitat on the landscape may be most limited by the distribution of spruce fir and the conversion of those habitats due to management practices. Large areas of spruce fir regeneration may also be limited by some of the ownership and easement restrictions on protected parcels due to the scale at which lynx require habitat management to occur.

In 2000, the USFWS and USFS developed a lynx conservation agreement that requires the USFS to promote the conservation of lynx habitat on national forests within the historic range of lynx (USFS Agreement 00-MU-11015600-013). Application of even-aged timber management on the White Mountain National Forest could enhance prey abundance for lynx. However, all management alternatives considered in the revised White Mountain National Forest Plan do not include an increase in the amount of forest that will be under even-aged management. In fact, the most liberal application of even-aged management that is being considered would not replace the hare habitat that is being lost to succession.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a "medium" or "high" score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Species and habitat impacts due to roads (Threat Rank: High)

Increased roads and people increasing exposure to variety of threats (road kill, trapping and habitat loss)

Mortality from incidental capture in body gripping trap (Threat Rank: High)

Death in body gripping trap

Habitat impacts from native and non native insect pests (Threat Rank: High)

Loss of spruce fir habitat from mortality and salvage harvesting associated with balsam wooly adelgid and spruce bud worm

Species and habitat impacts from the loss of softwood habitat and reduced snow depths associated with climate change (Threat Rank: Medium)

Reduced amounts of low land spruce fir and more isolated fragments of spruce fir habitat resulting in reduced snowshoe hare densities and distribution and decreased suitability of habitat for lynx

Species impacts from incidental capture in leghold traps (Threat Rank: Medium)

Injury or death in restraint trap

Species impacts and habitat conversion resulting from forestry moving away from even-aged management which reduces snowshoe hare densities (Threat Rank: Medium)

Lack of timber management that would create snowshoe hare habitat

List of Lower Ranking Threats:

Species impacts from hybridization (with bobcat)

Actions to benefit this Species or Habitat in NH

Monitor for the movement and infestation of balsam wooly adelgid and spruce budworm

Primary Threat Addressed: Habitat impacts from native and non-native insect pests

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases

Objective:

General Strategy:

Political Location:

Watershed Location:

Genetic sampling of bobcats and lynx (if possible) to identify potential hybridization in likely areas

Primary Threat Addressed: Species impacts from hybridization (with bobcat)

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases

Objective:

General Strategy:

Political Location:

Watershed Location:

Minimize road development and fragmentation in spruce fir habitats

Primary Threat Addressed: Species and habitat impacts due to roads

Specific Threat (IUCN Threat Levels): Transportation & service corridors

Objective:

Prevent the loss and fragmentation of spruce fir habitats

General Strategy:

Appendix A: Mammals

Political Location:

Carroll County, Coos County, Grafton County

Watershed Location:

Identify protect areas likely to maintain adequate snow and softwood cover for snowshoe hare and lynx

Primary Threat Addressed: Species and habitat impacts from the loss of softwood habitat and reduced snow depths associated with climate change

Specific Threat (IUCN Threat Levels): Climate change & severe weather

Objective:

General Strategy:

Political Location:

Watershed Location:

Work with Maine and USFWS to implement methods that minimize lynx capture in body gripping traps

Primary Threat Addressed: Mortality from incidental capture in body gripping trap

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

General Strategy:

Political Location:

Watershed Location:

Work with Maine and USFWS on ways to minimize incidental capture in restraint traps

Primary Threat Addressed: Species impacts from incidental capture in leghold traps

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

General Strategy:

Political Location:

Watershed Location:

Provide technical assistance and outreach in areas likely to support early successional habitat for snowshoe hare and lynx

Primary Threat Addressed: Species impacts and habitat conversion resulting from forestry moving away from even-aged management which reduces snowshoe hare densities

Appendix A: Mammals

Specific Threat (IUCN Threat Levels): Natural system modifications

Objective:

General Strategy:

Political Location:

Watershed Location:

References, Data Sources and Authors

Data Sources

Literature review and content review by USFWS and NHFG biologists.

Literature review and review by NH Fish and Game and US Fish and Wildlife biologists.

Data Quality

Species distribution data is good due to a concerted effort by NH Fish and Game to quantify distribution. In 2012 and 2013 snowmobiles were used to search for tracks as the town scale using protocols adapted from Maine's lynx monitoring protocol. In 2014 and 2015 NHFG partnered with the USFS to survey high elevation habitats as well as low elevation areas utilizing a combination of cameras and track transects to help better understand the use of different habitats by a variety of carnivores.

Habitat distribution data is less clearly defined. More information is needed on snowshoe hare densities in different habitats (i.e. high elevation habitats and different types of managed stands). More information is also needed on the connectivity of critical habitats in New Hampshire as well as with source populations in Maine.

Species Condition

Knowledge of species distribution is increasing due to recent survey efforts. Not well understood is the impact of competing carnivores overlapping with lynx occurrence (i.e. coyote, fisher and bobcats).

Potential impacts and susceptibility of lynx to foothold and body gripping traps is not well understood.

Habitat Condition

More information is needed on the status of spruce fir habitat throughout northern New Hampshire, the amount being converted due to management practices and the amount being adequately regenerated. Historical accounts seem to indicate that spruce fir was more abundant throughout Coos County.

Spruce budworm and balsam woolly adelgid both have high potential to impact the amount of spruce fir in northern NH over the next ten years. Experts are predicting the recent budworm outbreak to move south into the contiguous US, yet the severity and extent of the outbreak is predicted to be less severe than the outbreak in the late 70ies and early 80ies.

2015 Authors:

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2005 Authors:

John Litvaitis, UNH; Jeff Tash, UNH

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American Marten

Martes americana

Federal Listing	N/A
State Listing	T
Global Rank	G5
State Rank	S2
Regional Status	High



Photo by Ravenel Bennett

Justification (Reason for Concern in NH)

In New Hampshire, marten were once common and economically important. By 1935, habitat loss and trapping had resulted in a drastic population decline. Marten remained scarce despite 2 reintroduction attempts (Kelly et al. 2009) and were one of the first species classified as threatened on the states list of threatened and endangered species. Since the early 1980s, evidence of marten has been observed in towns throughout northern New Hampshire. Based on tracks, sightings and an examination of marten distribution, it appears that northern New Hampshire has an expanding population of marten. However, marten demographics are still poorly understood. In addition to being threatened in New Hampshire, marten are of particular concern because of their status as an “umbrella species”; their large range and sensitivity to disturbance make them broad indicators of ecosystem health.

Distribution

Marten were once found throughout the state except along the coast (Silver 1957). Marten have been documented as far south as the northern shore of Lake Winnepesaukee, yet core habitat and populations are found in the White Mountains and to the north. Populations found in the White Mountain National Forest and central Coos County may be isolated by habitat fragmentation resulting from development (e.g., roads) and habitat differences (e.g., less snow, less coniferous and mixed coniferous/deciduous cover). High elevation habitat appears to be extremely important along the southern edge of their current distribution in New Hampshire. Occupancy modeling has predicted that marten could expand into Sullivan and Cheshire Counties but current distribution in these areas is unknown (Kelly 2005).

Habitat

In the Northeast, American marten are found in forests dominated by mid- to late-successional, coniferous, and deciduous stands, as well as in partially harvested stands (Chapin et al. 1997, Fuller and Harrison 2005, Payer 1999). Stands with complex horizontal and vertical structure are especially important to marten, due to prey access and abundance (Sherburne and Bissonette 1994), denning and nesting sites (Buskirk et al. 1989, Ruggerio et al. 1998), refuge from predators (Buskirk and Ruggerio 1994, Hodgman et al. 1997), and thermoregulation (Buskirk and Harlow 1989).

During winter, martens prefer stands with greater horizontal structure (e.g., coarse woody debris) to access subnivean resting and hunting sites (Payer and Harrison 2003). These conditions are often found in mature mixed-wood and softwood forests. To compensate for scarce prey and higher metabolism during winter, marten have been known to shift to larger prey, such as snowshoe hare

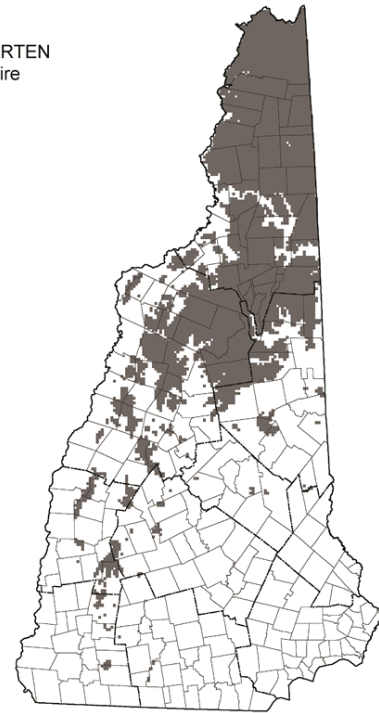
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(Lachowski 1997), which provide more energy per volume than mice and voles (Zielinski 1986). At higher elevations, deep snow, unique soil composition, inclement weather, and infrequent logging all contribute to the conifer cover and coarse woody debris that marten seek. Thus, ridgelines and areas of high elevation may be particularly important for marten in New Hampshire (Kelly 2005, Siren 2013). Marten distribution is likely limited by fisher distribution which is considered to be dependent on snow dependent factors (Krohn et al. 1995).

NH Wildlife Action Plan Habitats

- Northern Hardwood-Conifer Forest
- High Elevation Spruce-Fir Forest

Distribution of
AMERICAN MARTEN
in New Hampshire



Distribution Map

Current Species and Habitat Condition in New Hampshire

Marten populations in the White Mountains and north seem to be increasing or stable. Historically marten were likely found throughout southwestern NH, yet evidence of marten recolonization in this area is lacking.

Currently marten populations and habitats are not being scientifically monitored. Estimates of abundance and health are based on historic research (Kelly 2005, Siren 2013) and general observations and incidental captures from the public and staff regarding distribution and habitats.

Portions of northern New Hampshire have a disproportionate amount of younger spruce fir and mixed forest that may be limiting marten movement and occupation of the landscape (Siren 2015, Guild 2013).

Population Management Status

Incidental capture tracking

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Biologists currently track the number and location of incidentally captured marten during the fisher trapping season. Age and sex of each individual is mapped in ArcGIS to help identify trends and potential impacts of the incidental take.

Occurrence monitoring

Biologists also currently track the number and location of observed marten from the public and staff. Locations are mapped in ArcGIS to identify trends and changes in the distribution of observations.

Incidental capture mitigation

NHFG is exploring opportunities to work with Vermont Fish and Wildlife and local NH trappers to test the efficacy of an exclusion device to minimize the number of incidental marten captures during fisher trapping. Population impacts of incidental take is thought to be minimal due to the high percentage of juvenile animals captured indicating trapping is likely occurring in suboptimal habitats.

Use of Special Management Areas (SMA) and conservation easements

Biologists have used the identification and further technical assistance of SMA areas identified through conservation easements to help provide habitat recommendations for marten habitat use and movement across the landscape. Especially in overlapping habitats with lynx, a landscape analysis of marten and lynx habitat would be beneficial in providing recommendations to the single landowner that currently has both species on the landscape.

Public outreach

Biologists are currently working with foresters and land managers to consider marten habitat and landscape/stand requirements when planning harvests. Creating public awareness about the species distribution and habitat needs.

Population isolation due to management on larger ownerships

In northern NH there is extensive pressure on larger ownerships due to ownership changes and turnover over the last 20 years. Landowners are currently seeking alternative methods of increasing investment return on these ownerships due to financial pressures including energy development and parcelization.

Regulatory Protection (for explanations, see Appendix I)

- Endangered Species Conservation Act (RSA 212-A)

Quality of Habitat

Northern Coos County has good to improving habitat quality for marten. The Connecticut Lakes Natural Area (CLNA) (owned and managed by NHFG) is specifically managed for wildlife and marten are a focal species in that management. Additionally the conservation easement on the CLTC property and continued technical assistance in managing the SMA's established for marten is also improving the quantity and quality of marten habitat in this landscape.

Central Coos County likely has medium to good habitat for marten. Ownership patterns have resulted in extensive areas of younger forest and less optimal marten habitat. High elevation areas are likely serving as sources for population expansion and dispersal. Research conducted on Kelsey Mountain (Siren 2013) provides a good summary of this relationship.

The White Mountain National Forest is good to excellent habitat, especially in high elevation remote sections of the Forest. Stands are more mature and mixed in nature. Populations may be isolated

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due to loss of connectivity between the Forest and surrounding landscape during leaf off season. Additionally the Forest is at the southern edge of marten distribution in New Hampshire making the importance of deeper snow and more mixed or softwood cover types are more pronounced.

Habitat Protection Status

Conserved land contributing to marten habitat include: The Connecticut Lakes Natural Area, Connecticut Lakes Timber Company, the Vicki Bunnell Preserve, Nash Stream State Forest, Kilkenny National Forest, the White Mountain National Forest, and the Randolph Town Forest and the Errol Town Forest, all of which have specific goals for promoting boreal forest and wildlife species within their boundaries.

Portions of Coos County remain unprotected through easement or conservation ownership. High elevation habitats in these areas have limited protection under the unincorporated town zoning. These high elevation areas and connecting habitats are critical north/south as well as east/west movement corridors between populations and states. Within the PD6 zone (Zoning Ordinances Coos County Unincorporated Places 1991) for the unincorporated town ownerships NHFG biologists work with managers to plan high elevation harvests.

Habitat Management Status

Connecticut Lakes Natural Area is owned by NHFG with a conservation easement held by the Nature Conservancy. Within this property there is a 15,000 acre Nature Preserve where no active management will occur. The remaining 10,000 acres will be managed specifically for wildlife. Several other state ownerships such as Nash Stream State forest are benefitting marten as well.

Connecticut Lakes Timber Company owned by Forests Land Group with conservation easement held by the state of NH. This property has several Special Management Areas (SMA) specifically established for marten as well as goals and objectives in the Stewardship Plan that will benefit marten. Town forests such as the Randolph Community Forest and the Errol Town Forest both have stipulations in their easements regarding wildlife and associated habitats. .

White Mountain National Forest owned by the federal government has structure goals and objectives conducive to excellent marten habitat.

The majority of habitat in central Coos County remains in large ownerships with few easements and little protection, and is thus at risk of logging and development. Unincorporated places within New Hampshire have specific zoning for critical wildlife habitat (PD3), wetlands (PD7), high elevation (PD6), and unusual areas (PD8).

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a "medium" or "high" score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Habitat loss from forest insect outbreaks (native and non-native) (Threat Rank: High)

Spruce bud worm is predicted to spread south over the next 10 years and has potentially to significantly impact the amount of balsam fir and therefore softwood cover throughout core marten

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habitat in NH. Northern NH has also seen an increase in the number of softwood stands impacted by balsam wooly adelgid, which could also significantly impact balsam fir distribution and abundance in NH.

Habitat impacts from development (Threat Rank: Medium)

Development causes a direct loss of habitat as well as increased access for other less specialize carnivores such as coyotes, fisher and fox which can compete with marten.

Habitat impacts from climate change reducing the amount of core habitat and connectivity (Threat Rank: Medium)

Climate change will likely cause a retraction and conversion of spruce fir habitat as well as reduce annual snow depth, distribution and duration allowing species less adapted to these conditions to outcompete marten on the southern edge of their distribution.

Excessive timber harvesting resulting in landscapes that lack sufficient habitat to support marten populations (Threat Rank: Medium)

Mortality from incidental capture in body gripping trap (Threat Rank: Medium)

Direct mortality from body gripping traps used primarily for fisher trapping.

Increasing competition from generalist species (Threat Rank: Medium)

Increasing abundance and distribution of species (i.e. fisher, coyote and fox) that compete and predate on marten could impact marten distribution.

List of Lower Ranking Threats:

Human and wildlife community impacts from roads (including forest roads)
Habitat impacts from communication tower and wind turbine development

Actions to benefit this Species or Habitat in NH

Development of best management practices to maintain marten habitat

Primary Threat Addressed: Excessive timber harvesting resulting in landscapes that lack sufficient habitat to support marten populations

Specific Threat (IUCN Threat Levels): Biological resource use

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Objective:

Development of best management practices for habitat management to maintain marten habitat

General Strategy:

NHFG will develop best management practices that can be used when engaging private and public landowners in technical assistance for managing wildlife habitats

Political Location:

Watershed Location:

Primary Threat Addressed: Habitat loss from forest insect outbreaks (native and non native)

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases

Objective:

General Strategy:

Political Location:

Watershed Location:

Primary Threat Addressed: Habitat impacts from climate change reducing the amount of core habitat and connectivity

Specific Threat (IUCN Threat Levels): Climate change & severe weather

Objective:

General Strategy:

Political Location:

Watershed Location:

Monitor the distribution and abundance of forest insect pests to help identify places most susceptible to invasion and potential impacts

Primary Threat Addressed: Habitat loss from forest insect outbreaks (native and non native)

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases

Objective:

Early identification of areas likely to be most susceptible to insect outbreaks

General Strategy:

Monitoring

Political Location:

Watershed Location:

Identify areas that will be most resilient to climate change to help identify core marten areas and connecting habitats

Primary Threat Addressed: Habitat impacts from climate change reducing the amount of core habitat and connectivity

Specific Threat (IUCN Threat Levels): Climate change & severe weather

Objective:

Protect and enhance areas that would be most resilient to climate change and associated habitat changes that would be detrimental to marten

General Strategy:

Identify important parcels and their protection status to maintain marten habitat on the landscape

Political Location:

Watershed Location:

Develop methods to minimize incidental capture

Primary Threat Addressed: Mortality from incidental capture in body gripping trap

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

Work with Vermont to test the efficacy of a marten exclusion device for use by fisher trappers utilizing body gripping traps

General Strategy:

Working collaboratively with neighboring state to help minimize the number of marten incidentally captured in fisher body gripping sets. VT Fish and Wildlife has designed a device to help do this and NHFG will work with them to test the efficacy of the device.

Political Location:

Watershed Location:

Minimize road construction in core marten habitat

Primary Threat Addressed: Human and wildlife community impacts from roads (including forest roads)

Specific Threat (IUCN Threat Levels): Transportation & service corridors

Objective:

Minimizing road development in core marten habitat will help to mitigate habitat loss as well as increased access by competing predators; increases are of compacted snow surfaces in winter and humans (trapping).

General Strategy:

Work with landowners and towns to minimize the development of new permanent roads. Promote

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the use of seasonal roads when needed.

Political Location:

Watershed Location:

Minimize high elevation and core marten habitat loss due to development

Primary Threat Addressed: Habitat impacts from communication tower and wind turbine development

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

To minimize or prevent the development of high elevation and core marten habitat

General Strategy:

Work with conservation commissions, the unincorporated towns planning board and local landowners to minimize or prevent the development of high elevation and core marten habitat

Political Location:

Watershed Location:

Provide technical assistance and outreach to unincorporated towns planning board, conservation commissions, towns and managers on the importance of high elevation habitats and potential impacts of development in core marten habitat

Primary Threat Addressed: Habitat impacts from development

Specific Threat (IUCN Threat Levels): Residential & commercial development

Objective:

Minimize or prevent development in high elevation habitats

General Strategy:

Recent research (Siren 2013) has shown the potential impacts of development in high elevation habitats for marten. NHFG should work with the local conservation commissions as well as the unincorporated towns planning board to minimize or prevent development in these habitats.

Political Location:

Watershed Location:

References, Data Sources and Authors

Data Sources

Information on marten habitat, population distribution, and status was collected from Kelly (2005), Siren (2013), trappers, technical field reports, agency data (United States Forest Service (USFS), United States Fish and Wildlife Service (USFWS) and scientific journals.

Information on habitat protection and management was obtained from literature review, expert review and consultation.

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Data Quality

Species Distribution

Currently marten distribution is tracked using public sighting records and incidental captures during the fisher trapping season. Both methods are biased toward areas with increased human densities and areas with more roads. Little is known about the distribution of marten in less accessible areas such as high elevation habitats and remote roadless areas such as the White Mountain National Forest and portions of Coos County. Additionally marten distribution in southern Vermont is expanding and could impact the recolonization of southwestern New Hampshire by marten.

Habitat Distribution

Marten habitat distribution is largely based on Kelly (2005). Data collected since 2005 could be used to update this model and thus estimates of potential marten occurrence state wide. Additional insight into marten habitat in New Hampshire is summarized in Siren (2013) which could be used to update habitat models in New Hampshire.

There is little information regarding the connectivity of populations and habitats in Coos County, especially the influence of areas that don't meet landscape habitat requirements as a result of management.

Species

Condition of species across the state based on Kelly (2005) and Siren (2013) as well as collected information on occurrence and incidental capture maintained in Access and ArcGIS.

Gap in knowledge include distribution and abundance in remote high elevation habitats impacted by development and timber harvesting, as well as distribution in historically occupied locations such as southwestern New Hampshire.

Habitat

More information is needed on the status of spruce fir and mixed wood habitat throughout northern New Hampshire, the amount being converted to hardwood due to management practices and the amount being adequately regenerated. Historical accounts seem to indicate that spruce fir was more abundant throughout Coos County. It is unknown if spruce-fir restoration is possible, due to diverse landownership, management restrictions, shifting markets, and climate change.

2015 Authors:

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2005 Authors:

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Rock vole

Microtus chrotorrhinus

Federal Listing	N/A
State Listing	
Global Rank	G4
State Rank	S4
Regional Status	

Justification (Reason for Concern in NH)

The population status of rock voles is not well understood. It is considered common in the northern range but less abundant in the southern and eastern range (Nature Serve 2015). It is believed that rock voles occur in small isolated populations across its range thus making them susceptible to local extinctions (DeGraaf and Yamasaki 2001).

Distribution

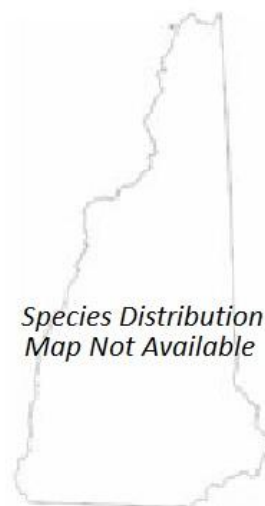
Little is known about the distribution and habitat of this species in New Hampshire. Trapping in the White Mountain National Forest of Maine and New Hampshire varied from 0.03-0.07 captures per 100 trap nights (Yamasaki 1997).

Habitat

Rock voles are found throughout the mountains of northern and western Maine, New Hampshire and Vermont in the Northeast. They inhabit coniferous and mixed forests at higher elevations or lower elevations in the Adirondacks and northern Maine. Rock voles will favor cool, damp, moss-covered rocks and talus slopes in the vicinity of streams (DeGraaf and Yamasaki 2001).

NH Wildlife Action Plan Habitats

- Northern Hardwood-Conifer Forest
- High Elevation Spruce-Fir Forest



Distribution Map

Current Species and Habitat Condition in New Hampshire

There are insufficient data to draw conclusions about the population health or distribution of rock voles.

Population Management Status

There are no management efforts for rock voles in New Hampshire.

Regulatory Protection (for explanations, see Appendix I)

None

Quality of Habitat

Rock vole habitat is throughout the mountains of New Hampshire. Significant portions are protected in the White Mountain National Forest, yet there are more habitats in northern New Hampshire where they could be more abundant.

Habitat Protection Status

Little is known about the distribution and habitat for rock voles in New Hampshire specifically.

Habitat Management Status

There are no habitat management efforts for rock voles.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a "medium" or "high" score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

There are no threats ranked high or medium for this species.

List of Lower Ranking Threats:

Habitat degradation due to forestry practices

Habitat loss and conversion from wind tower and turbine development

Habitat degradation due to the development of ski areas

Actions to benefit this Species or Habitat in NH

Provide technical assistance and outreach to foresters and landowners on ways to minimize impacts

Primary Threat Addressed: Habitat degradation due to forestry practices

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

General Strategy:

Political Location:

Watershed Location:

Minimize development in high elevation habitats

Primary Threat Addressed: Habitat degradation due to the development of ski areas

Specific Threat (IUCN Threat Levels): Residential & commercial development

Objective:

General Strategy:

Political Location:

Watershed Location:

Minimize development in high elevation habitats

Primary Threat Addressed: Habitat loss and conversion from wind tower and turbine development

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

General Strategy:

Political Location:

Watershed Location:

References, Data Sources and Authors

Data Sources

DeGraaf and Yamasaki, 2001

Nature Serve 2015

Information on habitat, population distribution, and status was collected from unpublished data, scientific literature, and limited agency data.

Appendix A: Mammals

Data Quality

With the cooperation of the WMNF, Yamasaki conducted a 3-year systematic survey of small mammals between 1995 and 1997. This survey took place in potential habitats across three levels of vegetation management in the White Mountains region. Out of the 108 study sites surveyed across managed, unmanaged, and remote locations in the forest, rock vole captures varied between 0.03-0.07 captures per 100 trap-nights and occurred on 6% of the forested plots (Yamasaki 1997).

There is very little data on the condition of the species and its habitats statewide.

2015 Authors:

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2005 Authors:

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Eastern Small-footed Bat

Myotis leibii

Federal Listing	N/A
State Listing	E
Global Rank	G3/G4
State Rank	S1
Regional Status	Very High



Photo by Brendan Clifford, NHFG

Justification (Reason for Concern in NH)

Like other bats, eastern small-footed bats are relatively long lived and have a low reproductive rate, likely giving birth to a single young per year (Best and Jennings 1997). Tuttle and Heaney (1984) found possible evidence of some twinning. Since eastern small-footed bats are found in rare habitats during summer (rocky outcrops) and winter (caves and mines), they are at risk of population declines if such habitats are lost or degraded. Their slow reproductive rate would, in turn, lead to a slow population recovery time. Eastern small-footed bats have been documented in only 1 of the 7 known hibernacula in New Hampshire (Mascot Lead Mine). Although winter surveys of eastern small-footed bats suggest a stable or even increasing population (Butchkoski 2003, Reynolds unpublished data), total numbers are still extremely low. In fact, eastern small-footed bats are rarer than Indiana bats in most northeastern states that have long-term monitoring data (Trombulak et al. 2001, Thomas, 1993). During summer, small-footed bats have been captured at 3 locations in New Hampshire, including the White Mountain National Forest (Krusic et al. 1996, Chenger 2005), New Boston (Hillsborough County; LaGory et al. 2002), and Surry (Cheshire County; Chenger 2005). Beyond these few data, the species' status in New Hampshire remains almost entirely unknown.

Distribution

Data that describe the range of eastern small-footed bats in New Hampshire are too few to allow a regional comparison of New Hampshire populations or to indicate distribution patterns. Winter distribution data of eastern small-footed bats is limited to one locality in Coos County and one in Rockingham County. Summer records are known from seven localities: the White Mountain National Forest (Krusic et al. 1996; no specific locality available), Bartlett (Coos Carroll County; Chenger 2005), New Boston (Hillsborough County; Lagory et al. 2002), Peirmont (Grafton County; Chenger 2005), Surry (Cheshire County; Chenger 2005), Hinsdale (J.Veilleux pers. com.) and Newington (D. Yates pers. com.).

Habitat

In winter, eastern small-footed bats (*Myotis leibii*) require cave or mine habitat that provides adequate characteristics for successful hibernation. Such characteristics include low levels of human disturbance and a stable microclimate (i.e. temperature stability). Although their hibernation has not been extensively researched, they appear to arrive at hibernacula later than most other species and leave earlier in the spring (Thomas 1993, Best and Jennings 1997). They also prefer colder temperatures than do other *Myotis* bats (Best and Jennings 1997, Butchkoski 2003, Tuttle 2003). For example, they are often found in the coldest sections of a cave or mine, either utilizing short (less than 150 m in length) adits (Best and Jennings 1997) or choosing roost locations near the entrance of

Appendix A: Mammals

larger hibernacula (Tuttle 2003). It is also believed that they roost in narrow crevices (Best and Jennings 1997), although all of the individuals documented in New Hampshire were found on exposed surfaces (Reynolds, unpublished data).

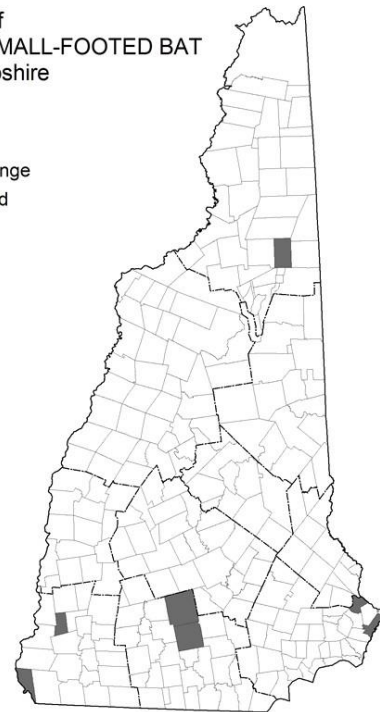
Few data describe the summer habitat of eastern small-footed bats in New Hampshire. Most suggest that they roost in rock crevices (Whitaker and Hamilton 1998, Chenger 2003). Chenger (2003) captured 11 small-footed bats in Surry, Cheshire County, and radio tagged 3 individuals (2 adult females and 1 adult male). Data from radio tagged bats revealed several roost sites, each within rock crevices in outcrops near the base of the Surry Mountain Lake dam. Although no radio tagged individuals were reproductive females, it is likely that females give birth and wean young within similar rock crevice roosts. No data describe the rock crevices (crevice dimension, temperature profile, height from ground, etc.) that provided roost habitat for these animals.

NH Wildlife Action Plan Habitats

- Caves and Mines
- Rocky Ridge, Cliff, and Talus
- Appalachian Oak Pine Forest
- Hemlock Hardwood Pine Forest
- Northern Hardwood-Conifer Forest

Distribution of
EASTERN SMALL-FOOTED BAT
in New Hampshire

■ Core Range
▨ Localized



Distribution Map

Current Species and Habitat Condition in New Hampshire

Hibernating eastern small-footed bats are known only from the Mascot Lead Mine (Coos County) and one site in Rockingham County. The New Hampshire Natural Heritage Survey ranked Mascot Lead

Appendix A: Mammals

Mine as 'B/C', indicating 'fair to good quality and prospects for long-term conservation'. However, there are concerns about long-term safety of the mine interior which may alter habitat availability due to debris and mine collapse. In 2004, 9 hibernating individuals were documented in this mine. In 2014 there were 3 hibernating individuals. Only one individual was found in the Rockingham County site. Given the small number of surveys, there is not enough data to conduct an analysis of trends and viability of winter populations. Summer surveys at Surry Mountain Lake show a decline in capture rates since the onset of White-Nose Syndrome (Moosman et al 2013).

Population Management Status

There is no management aimed at the conservation of eastern small-footed bats, although the one known winter population is incidentally protected by the bat gate at Mascot Lead Mine, and the Surry Mountain site is partially protected by the ACOE through its management plan. Lack of data on the distribution of eastern small-footed bats prohibits identification of conservation opportunities beyond the need to conduct additional habitat surveys.

Regulatory Protection (for explanations, see Appendix I)

- NHFG Permit for collection or possession

Quality of Habitat

The known winter population of eastern small-footed bats is in the abandoned Mascot Lead Mine. This is a relatively stable mine with multiple levels and two openings, both of which are gated to prevent human disturbance. There are concerns with stability within portions of the mine, with debris accumulating and a loss of structural integrity which will likely cause collapses within the mine. No microclimate data have been collected within Mascot Lead Mine.

Although several of the potential hibernacula are shallow, there are no winter microclimate data to determine whether they are cold and stable enough to maintain a hibernating population of eastern small-footed bats. Because most of the summer records of eastern small-footed bats occur in southern New Hampshire, it will be important to assess any potential hibernacula in Hillsborough, Merrimack, Cheshire, and Rockingham counties as they are discovered.

Habitat Protection Status

The Department of Resources and Economic Development (DRED) manages Mascot Lead Mine. The Nature Conservancy (TNC) maintains the gates that restrict access to the mine. The New Hampshire Natural Heritage Survey has given all known bat hibernacula a conservation rank that indicates habitat quality and prospects for long-term conservation. Mascot Lead Mine was ranked as 'B/C', indicating a 'fair to good quality and prospects for long-term conservation'. DRED also owns and manages the Rockingham County location, and has sealed the entrance from human visitation.

Some of the known summer roosts are on state or federal land which provides some level of protection, however management decisions at those sites may affect habitat quality.

Habitat Management Status

The only ongoing habitat management action occurring in Coos County is the bat gate at Mascot Lead Mine. These gates, used over the last 35 years, are steel structures installed in mine or cave entrances to restrict human access without hindering air flow or bat flight. Because many caves and mines are

Appendix A: Mammals

found in remote locations, bat gates are “the only means available for protecting these [colonies]” (Pierson et al. 1991: 31). It is reasonable to assume these bat gates have been highly effective at minimizing human disturbance due to spelunking activities, though surveys in 1993 and 2004 did not indicate significant changes from 1992 populations. The Rockingham County site has the entrance for humans also blocked in a way that does not change the traditional bat entry.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Disturbance from humans exploring bat hibernacula (Threat Rank: High)

Active cavers and casual cave explorers disturb bats when they enter occupied caves and mines. Noise, light, changes in temperature and airflow, and physical contact can all disturb bats (Thomas 1995). In winter during hibernation, these disturbances can cause bats to arouse from hibernation and thus use up precious stored energy. Bats susceptible to White-Nose Syndrome are especially vulnerable to disturbance, as the disease already causes increased numbers of arousals and depletion of stored fat.

Eastern small-footed bats are less affected by this threat as they occur at hibernacula that are gated to prevent cavers from entering. It is unknown where most eastern small-footed bats hibernate in NH.

Mortality and species impacts (loss of fitness) due to White-Nose Syndrome (Threat Rank: High)

Eastern small-footed bats have been affected by White-Nose Syndrome (WNS), a fungal disease that affects bats during hibernation. The fungus, *Pseudogymnoascus destructans*, grows into the wings, muzzles and ears of the bats (Lorch et al. 2011), disrupting metabolic functions (Meteyer et al. 2009, Cryan et al. 2013, Verant et al. 2014) and causing bats to arouse from hibernation more frequently and stay awake longer than uninfected bats (Lorch et al. 2011, Reeder et al. 2012). This causes them to use up stored energy (fat) at a much higher rate (Reeder et al. 2012). Bats cannot replenish their fat stores in winter as their food source is unavailable. They perish from starvation, some first flying out the hibernacula in mid-winter in a desperate search for food. Since bats are in hibernation they do not mount an immune response to this disease.

WNS was first found in NH in 2009. Winter surveys have not found a significant decline as the number of eastern small-footed bats found hibernating in NH has always been very small. However, drops in population have occurred in other affected states (Turner et al. 2011).

List of Lower Ranking Threats:

Habitat degradation and mortality due to pesticide application at roost sites

Species impacts from agricultural pesticide use causing prey declines

Habitat degradation from succession that causes loss of drinking and foraging habitats

Mortality and conversion of migratory habitat due to wind turbine development

Habitat degradation and conversion due to changes in mine configuration from landowner & natural causes, including reopening or closing mines

Habitat conversion and degradation due to removal of summer roosting and foraging areas

Actions to benefit this Species or Habitat in NH

Promote organic practices and integrated pest management (IPM)

Primary Threat Addressed: Species impacts from agricultural pesticide use causing prey declines

Specific Threat (IUCN Threat Levels): Pollution / Agricultural & forestry effluents / Herbicides & pesticides

Objective:

Provide technical assistance to organizations that provide education, technical assistance and funding to farmers and homeowners on organic growing practices and IPM.

General Strategy:

Work with the Northeast Organic Farmers Association, UNH Cooperative Extension, NRCS, nursery stock growers, garden centers, garden clubs, landscapers and others to educate farmers, homeowners and commercial landscapers on using IPM and organic practices

Political Location:

Statewide

Watershed Location:

Statewide

Monitor bat populations

Objective:

Continue to monitor hibernating and summer bat populations.

General Strategy:

Monitor hibernacula at least every three years for the presence and abundance of bats. Resurvey summer mist netting sites that have been historically monitored such as Surry Mountains Dam and New Boston Air Force Station. Survey potential eastern small-footed bat summer roost sites including both daytime transect surveys (Moosman 2014) and mist netting.

Political Location:

Statewide

Watershed Location:

Statewide

Prevent disturbances to hibernating bats

Primary Threat Addressed: Disturbance from humans exploring bat hibernacula

Specific Threat (IUCN Threat Levels): Human intrusions & disturbance

Objective:

Prevent recreational use of known bat hibernacula during the hibernation period

General Strategy:

Through education, bat-friendly gates and other means prevent people from entering hibernacula during the hibernation period.

Political Location:

Watershed Location:

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Coos County, Grafton County, Merrimack
County, Rockingham County

Androscoggin-Saco Watershed, Upper
CT Watershed, Middle CT Watershed,
Pemi-Winni Watershed, Merrimack
Watershed, Coastal Watershed

Protect hibernacula from structural damage

Primary Threat Addressed: Habitat degradation and conversion due to changes in mine configuration from landowner & natural causes, including reopening or closing mines

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

Protect hibernacula from structural damage such as changes to mine opening or configuration.

General Strategy:

Work with owners of hibernacula to encourage them to voluntarily refrain from changing the opening or the configuration of the interior of mines, unless it is to erect a bat-friendly gate over the opening. Encourage the installations of bat-friendly gates.

Political Location:

Coos County, Grafton County, Merrimack County

Watershed Location:

Androscoggin-Saco Watershed, Upper CT Watershed, Middle CT Watershed, Pemi-Winni Watershed, Merrimack Watershed, Coastal Watershed

Participate in efforts regarding White-Nose Syndrome

Primary Threat Addressed: Mortality and species impacts (loss of fitness) due to White-Nose Syndrome

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases / Invasive non-native/alien species/diseases / Named species

Objective:

Assist in the research, management and planning efforts to control the spread of, find a treatment for, and recover bat species affected by White-Nose Syndrome.

General Strategy:

Participate in regional, national and international research, management and planning efforts to control the spread of, find a treatment for, and recover bat species affected by White-Nose Syndrome. Continue to participate in national research projects such as acoustic transects and emergence counts. Continue to participate in research efforts as requested. Participate in regional and national workshops, plans and projects for conservation, recovery and communications about White-Nose Syndrome.

Political Location:

National, Northeast, Statewide

Watershed Location:

Statewide

Develop standard processes to reduce the effect of wind energy production on bats

Primary Threat Addressed: Mortality and conversion of migratory habitat due to wind turbine development

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

Develop and implement rules on siting and operation of wind turbines to reduce mortality of bats during construction and operation

General Strategy:

Develop and implement siting rules that protect migration routes and occupied habitat from wind turbine development. Develop required operational mitigation measures such as curtailment to reduce bat mortality post-construction. Develop these in conjunction with nearby states to provide consistency to energy developers across the northeast.

Political Location:

Northeast, Statewide

Watershed Location:

Statewide

References, Data Sources and Authors

Data Sources

Data on winter distribution were compiled by examining New Hampshire Natural Heritage Inventory – Bat Hibernaculum Record data sheets, and by examining the collection dates of specimens deposited in museum collections and college/university teaching collections. Summer distribution data were determined by examining specimen collections, published literature, and unpublished sources.

To determine the winter distribution at known hibernacula, New Hampshire Natural Heritage Survey-Hibernacula Survey Data Sheets were examined. To determine habitat patch protection status of Mascot Lead mine, the site was mapped on the Conservation Lands GIS data layer (GRANIT – 2003 data).

Data Quality

Data on the distribution of eastern small-footed bats in New Hampshire are extremely limited (see discussions in elements 1.2 and 1.4). The quality of data is believed to be good, as qualified bat biologists made identifications. Occurrence records and research efforts aimed at determining distribution patterns in New Hampshire are few.

There have been several winter surveys at Mascot Lead Mine since 1987; most of these surveys were conducted since installation of the bat gate in 1992. Although these surveys were extensive, no microclimate data were collected. Future surveys should be conducted in late winter (December through February) to ensure eastern small-footed bats have begun hibernation (Thomas 1993). Furthermore, surveys should not be done during mild weather periods when eastern small-footed bats are known to temporarily leave hibernacula (Butchkoski 2003).

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Little Brown Bat

Myotis lucifugus

Federal Listing	N/A
State Listing	SGCN
Global Rank	G3/G4
State Rank	S1
Regional Status	Very High



Photo by Maury McKinney

Justification (Reason for Concern in NH)

Little brown bats, like all hibernating bats in NH, are affected by white-nose syndrome. Data from the northeast region shows a decline of over 91% overall in cave and mine hibernacula (Turner et al 2011), with over 99% decline in NH (NHFG unpublished data). Little brown bats often use buildings for maternity colonies, which results in conflicts with humans. In NH, Wildlife Control Operators may only conduct exclusions to remove bat colonies, and may not exterminate them. This is less damaging to bats except when the exclusion is done during the time females are caring for young, generally late May through early August. Timing of exclusions to prevent this is only regulated in uninhabited buildings.

Distribution

Little brown bats can be found statewide in all forest types. They are unlikely to be found in high elevation forests. They are unlikely to roost in young forests, but will use them for foraging. They also forage over wetlands, streams and open areas including in suburban and urban landscapes.

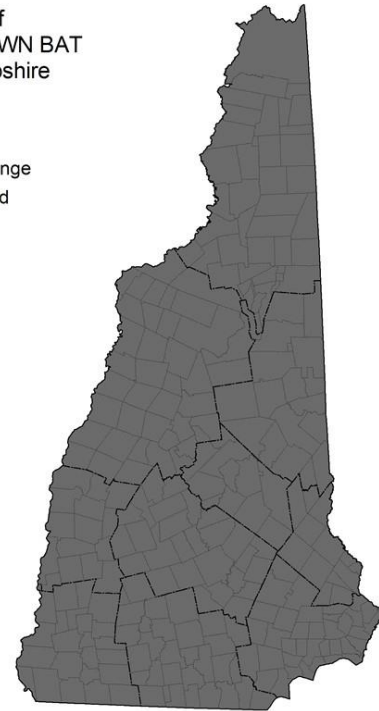
Habitat

Little brown bats use three types of habitat, forests, buildings and caves or mines. Forests with associated openings, streams and wetlands are used for foraging from the time they emerge from hibernation in the spring to the time they enter hibernation in late fall. Bats will use trees for day and night roosts during this active season. They will use many kinds of buildings for night and maternity roosts. They use caves or mines or similar artificial subterranean structures such as bunkers for hibernating.

NH Wildlife Action Plan Habitats

- Caves and Mines
- Hemlock Hardwood Pine Forest
- Appalachian Oak Pine Forest
- Developed Habitats
- Lowland Spruce-Fir Forest
- Northern Hardwood-Conifer Forest
- Northern Swamps
- Pine Barrens
- Temperate Swamps

Distribution of
LITTLE BROWN BAT
in New Hampshire



Distribution Map

Current Species and Habitat Condition in New Hampshire

Little brown bats have been affected by White-Nose Syndrome with a 99% decline in hibernating bats but it is unknown how many bats that summer in NH winter elsewhere.

Population Management Status

Little brown bat populations are not managed except that evictions from buildings during pupping season are forbidden in buildings not occupied by humans.

Regulatory Protection (for explanations, see Appendix I)

- NHFG Permit for collection or possession
- NH NHB Database - current
- NH NHB Database - historic
- NHFG Rule FIS 803.02. Importation.
- NHFG Rule FIS 804.02. Possession.
- WMNF sensitive species
- NHFG FIS 308 Wildlife Control Operators

Quality of Habitat

There are adequate forest and hibernation locations, including those out of state, for little brown bats.

Appendix A: Mammals

Hibernacula are not as high quality due to the presence of *Pseudogymnoascus destructans*, the fungus that causes White-Nose Syndrome. This fungus persists in hibernacula in the absence of bats (Lorch et al 2012).

Habitat Protection Status

Most bat hibernacula in NH are not protected. Three are on state land but only two are gated. One hibernacula on private land has a conservation easement with a special management unit defined around the mine entrance but is not gated. The other hibernacula are located on private land.

Habitat Management Status

There is no habitat management for this species other than educating landowners on managing individual colonies.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a "medium" or "high" score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Disturbance from humans exploring bat hibernacula (Threat Rank: High)

Active cavers and casual cave explorers disturb bats when they enter occupied caves and mines. Noise, light, changes in temperature and airflow, and physical contact can all disturb bats (Thomas 1995). In winter during hibernation, these disturbances can cause bats to arouse from hibernation and thus use up precious stored energy. Bats susceptible to White-Nose Syndrome are especially vulnerable to disturbance, as the disease already causes increased numbers of arousals and depletion of stored fat.

Little brown bats occur at hibernacula that may experience high levels of human disturbance. Prior to White-Nose Syndrome they occurred in all known hibernacula.

Habitat conversion due to negative perceptions of bats by homeowners that results in loss of roosting habitat in buildings (Threat Rank: High)

Little brown bats very often use human structures for roosting, usually beneath the roof or in walls. Humans often do not like having bats roosting in their buildings, particularly in houses and businesses and so remove them, mostly through exclusion. Exclusions done when pups are in residence can lead to the death of the pups. Bats entering the parts of buildings that humans use may be killed due to fears about the bats.

Mortality and species impacts (loss of fitness) due to White-Nose Syndrome (Threat Rank: High)

Little brown bats have been decimated by White-Nose Syndrome (WNS), a fungal disease that affects bats during hibernation. The fungus, *Pseudogymnoascus destructans*, grows into the wings, muzzles and ears of the bats (Lorch et al. 2011), disrupting metabolic functions (Meteyer et al. 2009, Cryan et al. 2013, Verant et al. 2014) and causing bats to arouse from hibernation more frequently and stay

Appendix A: Mammals

awake longer than uninfected bats (Lorch et al. 2011, Reeder et al 2012). This causes them to use up stored energy (fat) at a much higher rate (Reeder et al. 2012). Bats cannot replenish their fat stores in winter as their food source is unavailable. They perish from starvation, some first flying out the hibernacula in mid-winter in a desperate search for food. Since bats are in hibernation they do not mount an immune response to this disease.

WNS was first found in NH in 2009. Winter surveys in 2010 showed a 52% decline and by 2011 declines had reached 99% for little brown bats. Surveys over the winters of 2014 and 2015 echoed this with only one individual found in only one of the 8 regularly surveyed hibernacula (down from the 2009 high of 2929). This drop in population has also occurred in other affected states (Turner et al. 2011).

Habitat conversion from changes in mine configuration due to landowner and natural causes including reopening or closing mines (Threat Rank: Medium)

Changes in the mine entrances can block access or change the temperature and humidity within the mine. Bats have specific ranges of temperatures and humidity they require for hibernating. Reopening of mines for active use can disturb or kill hibernating bats, or make the mine unsuitable for hibernating.

List of Lower Ranking Threats:

Species impacts from agricultural pesticide use causing prey declines

Habitat degradation from succession that causes loss of drinking and foraging habitats

Habitat degradation from timber harvest that removes summer roosting and foraging areas

Habitat degradation from roads and powerline development that removes roosting habitat

Mortality and conversion of migratory habitat due to wind turbine development

Habitat conversion and degradation due to removal of summer roosting and foraging areas

Actions to benefit this Species or Habitat in NH

Promote organic practices and integrated pest management (IPM)

Primary Threat Addressed: Species impacts from agricultural pesticide use causing prey declines

Specific Threat (IUCN Threat Levels): Pollution / Agricultural & forestry effluents / Herbicides & pesticides

Objective:

Provide technical assistance to organizations that provide education, technical assistance and funding to farmers and homeowners on organic growing practices and IPM.

General Strategy:

Work with the Northeast Organic Farmers Association, UNH Cooperative Extension, NRCS, nursery stock growers, garden centers, garden clubs, landscapers and others to educate farmers, homeowners and commercial landscapers on using IPM and organic practices

Appendix A: Mammals

Political Location:

Statewide

Watershed Location:

Statewide

Protect occupied roosting trees

Primary Threat Addressed: Habitat degradation from timber harvest that removes summer roosting and foraging areas

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

Prevent occupied roosting trees from being cut down.

General Strategy:

Develop voluntary BMPs for forestry that help landowners and foresters identify and protect known and potential roosting trees during harvesting operations. Provide these guidelines to organization building trails or otherwise potentially cutting trees. BMPs could include time of year restrictions for cutting, tree size limitation and other techniques. Coordinate with other states for consistency.

Political Location:

Northeast, Statewide

Watershed Location:

Statewide

Prevent disturbances to hibernating bats

Primary Threat Addressed: Disturbance from humans exploring bat hibernacula

Specific Threat (IUCN Threat Levels): Human intrusions & disturbance

Objective:

Prevent recreational use of known bat hibernacula during the hibernation period

General Strategy:

Through education, bat-friendly gates and other means prevent people from entering hibernacula during the hibernation period.

Political Location:

Coos County, Grafton County, Merrimack County, Rockingham County

Watershed Location:

Androscoggin-Saco Watershed, Upper CT Watershed, Middle CT Watershed, Pemi-Winni Watershed, Merrimack Watershed, Coastal Watershed

Protect summer colonies in buildings

Primary Threat Addressed: Habitat conversion due to negative perceptions of bats by homeowners that results in loss of roosting habitat in buildings

Specific Threat (IUCN Threat Levels): Human intrusions & disturbance

Objective:

Protect summer colonies in buildings without compromising public health

General Strategy:

Protect summer colonies by prohibiting exclusion of bats from buildings during the time they have non-volant young (May 15-August 15). Exceptions should be available in the case of a documented rabid bat in the building or other public health issue. Develop materials for wildlife control operators and homeowners about bats in houses and their reproductive cycle to build support for the rule change and compliance afterwards.

Political Location:

Statewide

Watershed Location:

Statewide

Participate in efforts regarding White-Nose Syndrome

Primary Threat Addressed: Mortality and species impacts (loss of fitness) due to White-Nose Syndrome

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases / Invasive non-native/alien species/diseases / Named species

Objective:

Assist in the research, management and planning efforts to control the spread of, find a treatment for, and recover bat species affected by White-Nose Syndrome

General Strategy:

Participate in regional, national and international research, management and planning efforts to control the spread of, find a treatment for, and recover bat species affected by White-Nose Syndrome. Continue to participate in national research projects such as acoustic transects and emergence counts. Continue to participate in research efforts as requested. Participate in regional and national workshops, plans and projects for conservation, recovery and communications about White-Nose Syndrome.

Political Location:

National, Northeast, Statewide

Watershed Location:

Statewide

Monitor bat populations

Objective:

Continue to monitor hibernating and summer bat populations.

General Strategy:

Monitor hibernacula at least every three years for the presence and abundance of bats. Resurvey summer mist netting sites that have been historically monitored such as Surry Mountain Dam and New Boston Air Force Station.

Appendix A: Mammals

Political Location:

Statewide

Watershed Location:

Statewide

Develop standard processes to reduce the effect of wind energy production on bats

Primary Threat Addressed: Mortality and conversion of migratory habitat due to wind turbine development

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

Develop and implement rules on siting and operation of wind turbines to reduce mortality of bats during construction and operation

General Strategy:

Develop and implement siting rules that protect migration routes and occupied habitat from wind turbine development. Develop required operational mitigation measures such as curtailment to reduce bat mortality post-construction. Develop these in conjunction with nearby states to provide consistency to energy developers across the northeast.

Political Location:

Northeast, Statewide

Watershed Location:

Statewide

References, Data Sources and Authors

Data Sources

Information on little brown bats comes from NHFG unpublished data, hibernation survey reports from Dr. Jacques Veilleux and Dr. Scott Reynolds, and published scientific literature.

Data Quality

Cave and mine hibernacula data is fairly comprehensive. Data is missing from what may have been the largest hibernacula, still not specifically located but known to be on the slopes of Mount Washington due to the presence of hundreds of sick bats flying in February of 2010. Summer population data is lacking. Data on most threats is well documented in the scientific literature.

2015 Authors:

Emily Preston, NHFG

2005 Authors:

Literature

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Northern Long-eared Bat

Myotis septentrionalis

Federal Listing	N/A
State Listing	SC
Global Rank	G2
State Rank	
Regional Status	Very High



Photo by USFWS

Justification (Reason for Concern in NH)

Like other bats, northern long-eared bat life history is different from the typical life history of other small mammals. Individuals are relatively long lived and have a low reproductive rate, generally giving birth to a single young each year (Whitaker and Hamilton 1998). Since the northern long-eared bat is found in relatively rare, at-risk habitats during winter (caves/mines), they are at risk of population decline if such habitats are lost or degraded. Their slow reproductive rate would, in turn, lead to a slow population recovery time. This has proven to be the case since the onset of White-Nose Syndrome (WNS). Northern long-eared bats have been decimated by White-Nose Syndrome, a fungal disease that affects bats during hibernation. The fungus, *Pseudogymnoascus destructans*, grows into the wings, muzzles and ears of the bats, disrupting metabolic functions and causing bats to arouse from hibernation more frequently and stay awake longer than uninfected bats. This causes them to use up stored energy (fat) at a much higher rate. Bats cannot replenish their fat stores in winter as their food source is unavailable. They perish from starvation, some first flying out the hibernacula in mid-winter in a desperate search. Since bats are in hibernation they do not mount an immune response to this disease. First discovered in 2006-2007 by cavers near Albany, New York, the disease quickly spread, with NH seeing its first cases during the winter of 2009. By 2015, WNS had found in 24 states and 4 Canadian provinces. Winter surveys in 2010 showed a 54% decline in northern long-eared bats and by 2011 declines had reached 99%. Surveys over the winters of 2014 and 2015 echoed this with one individual found in one of the 8 regularly surveyed hibernacula (down from the 2008 high of 721).

Distribution

Winter distribution of the northern long-eared bat prior to White-Nose Syndrome included each of New Hampshire's seven mine hibernacula. In addition, a newly discovered hibernacula in a WWII bunker was discovered in 2010 also housed northern long-eared bats. The concentration of northern long-eared bats among the hibernacula ranged from fewer than 1% (Mascot Lead Mine) to 47% (Bristol Mine) of the total bat population. Northern long-eared bats in New Hampshire tended to be less common (fewer than 1% of hibernating bats) in the large hibernacula such as Mascot Lead Mine, intermediate (less than 20%) at medium-sized mines such as Paddock Copper Mine and Mt. Kearsarge Lead Mine, and relatively abundant in small hibernacula such as Bristol Mine, Beebe River Mine, and the Red Mine (table 1). This pattern is consistent with hibernaculum surveys in Vermont (Trombulak 2001).

Summer records are known from Carroll, Coos, Cheshire, Grafton, Hillsborough and Rockingham counties. Of 141 summer captures of northern long-eared bats in New Hampshire prior to WNS, 74.2% are from the White Mountain National Forest (Sasse 1995, Krusic 1996, Cheng 2005), 24.3%

Appendix A: Mammals

are from northern Cheshire County (Chenger 2002, J.P. Veilleux, unpublished data) and 3.5% are from Merrimack and Hillsborough County (LaGory et al. 2002, Reynolds, unpublished data). Any apparent geographical clustering may be an artifact of sampling effort. Data from Rockingham County comes from one site and includes just a few individuals (D. Yates pers. com.).

Habitat

During winter, the northern long-eared bats requires cave or mine habitat that provides adequate characteristics for successful hibernation. Such characteristics include proper microclimate (i.e. temperature stability) and a low level of human disturbance. During hibernation, the northern long-eared bat often retreats into small holes, cracks, and crevices in the walls and ceiling (John Whitaker, Indiana State University, personal communication, Durham 2000), though they will also cling to the wall and ceiling surface. It is unknown whether the northern myotis prefers caves and mines with large numbers of small crevices for hibernation. Northern long-eared bats are often found deep within mine shafts (Durham 2000). Northern long-eared bats are known to use caves and mines year-round and often maintain some activity throughout the winter months (Whitaker & Rissler 1992).

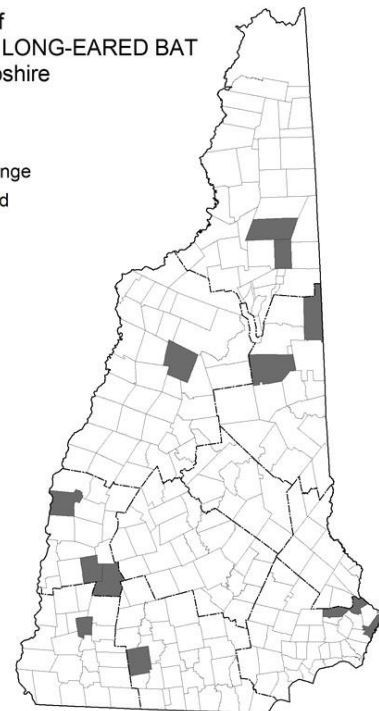
In the White Mountain National Forest (WMNF), sixty-six percent of northern long-eared bats roosted in snags (dead trees) and the remainder roosted in live trees (Sasse 1995), They will use a variety of deciduous species, and choice may be influenced by availability. Large, tall trees with intact bark and moderate levels of decay are commonly chosen, especially if they have hollows (Sasse 1995). Most roost trees used by northern long-eared bats in West Virginia were located in 70-90 year-old intact forests that had not been logged in 10 to 15 years (Owen et al. 2003). However, some females have been observed roosting in actively managed industrial forests in West Virginia (Menzel et al. 2002).

NH Wildlife Action Plan Habitats

- Hemlock Hardwood Pine Forest
- Caves and Mines
- Appalachian Oak Pine Forest
- Lowland Spruce-Fir Forest
- Northern Hardwood-Conifer Forest
- Pine Barrens

Distribution of
NORTHERN LONG-EARED BAT
in New Hampshire

■ Core Range
▨ Localized



Distribution Map

Current Species and Habitat Condition in New Hampshire

Northern long-eared bats were known from seven mine and one artificial hibernacula in New Hampshire, but the decline in the population due to WNS has reduced it to only one seen in the past two winters. However, northern long-eared bats roost in cracks and crevices and may not be detected. Summer data collected at the Great Bay National Wildlife Refuge 2013-2015 has recorded the presence of several individuals (D. Yates pers com).

Population Management Status

Northern long-eared bat are not specifically managed in New Hampshire. The bat gate at Mascot Lead Mine and sealing of the Rockingham County hibernacula are conservation tools for hibernating bats collectively. Lack of data on the summer distribution of northern long-eared bats hinders effective management.

Regulatory Protection (for explanations, see Appendix I)

- NHFG Permit for collection or possession
- Federal Endangered Species Act - under consideration
- NH NHB Database - current
- NH NHB Database - historic
- NHFG Rule FIS 804.02. Possession.
- WMNF sensitive species

Quality of Habitat

The New Hampshire Natural Heritage Survey (NHNHS) has ranked all known northern long-eared bat hibernacula according to habitat quality and prospects for long-term conservation. Carter's Mine (Grafton County), Paddock Copper Mine (Grafton County), and Bristol Mine (Grafton County) each received an 'A', indicating excellent quality and prospects for long-term conservation. Dodge Mine (Grafton County) was ranked 'B', indicating good quality and prospect for long-term conservation. Both Mt. Kearsarge Lead Mine and Mascot Lead Mine were ranked as 'B/C', indicating fair to good quality and prospects for long-term conservation. Beebe River Mine was ranked as 'C', indicating fair quality and/or prospects for long-term conservation. However, NHNHB ranking does not appear to reliably assess the value of northern long-eared bat mine habitats, because the two hibernacula in serious decline received a 'B/C' (Mascot Lead Mine) and an 'A' (Paddock Copper Mine).

Habitat Protection Status

Most bat hibernacula in NH are not protected. Three are on state land but only two are gated. One hibernacula on private land has a conservation easement with a special management unit defined around the mine entrance but is not gated. The other hibernacula are located on private land.

Habitat Management Status

The only ongoing habitat management practices in New Hampshire are the bat gate at Mascot Lead Mine and the sealing of the Rockingham County hibernacula.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Disturbance from humans exploring bat hibernacula (Threat Rank: High)

Active cavers and casual cave explorers disturb bats when they enter occupied caves and mines. Noise, light, changes in temperature and airflow, and physical contact can all disturb bats (Thomas 1995). In winter during hibernation, these disturbances can cause bats to arouse from hibernation and thus use up precious stored energy. Bats susceptible to White-Nose Syndrome are especially vulnerable to disturbance, as the disease already causes increased numbers of arousals and depletion of stored fat.

Northern long-eared bats occur at hibernacula that may experience high levels of human disturbance. Ungated mines saw the largest decline in hibernating northern long-eared bats 1986-2004, whereas bat populations within the gated hibernaculum remained stable during this same period.

Mortality and species impacts (loss of fitness) due to White-Nose Syndrome (Threat Rank: High)

Northern long-eared bats have been decimated by White-Nose Syndrome (WNS), a fungal disease that affects bats during hibernation. The fungus, *Pseudogymnoascus destructans*, grows into the wings, muzzles and ears of the bats (Lorch et al. 2011), disrupting metabolic functions (Meteyer et al. 2009, Cryan et al. 2013, Verant et al. 2014) and causing bats to arouse from hibernation more frequently and stay awake longer than uninfected bats (Lorch et al. 2011, Reeder et al. 2012). This causes them to use up stored energy (fat) at a much higher rate (Reeder et al. 2012). Bats cannot replenish their fat stores in winter as their food source is unavailable. They perish from starvation, some first flying out the hibernacula in mid-winter in a desperate search for food. Since bats are in hibernation they do not mount an immune response to this disease.

WNS was first found in NH in 2009. Winter surveys in 2010 showed a 54% decline and by 2011 declines had reached 99% for Northern long-eared bats. Surveys over the winters of 2014 and 2015 echoed this with only one individual found in only one of the 8 regularly surveyed hibernacula (down from the 2009 high of 519). This drop in population has also occurred in other affected states (Turner et al. 2011).

Habitat degradation and conversion due to changes in mine configuration from landowner & natural causes, including reopening or closing mines (Threat Rank: Medium)

Changes in the mine entrances can block access or change the temperature and humidity within the mine. Bats have specific ranges of temperatures and humidity they require for hibernating. Reopening of mines for active use can disturb or kill hibernating bats, or make the mine unsuitable for hibernating.

Habitat conversion due to negative perceptions of bats by homeowners that results in loss of roosting habitat in buildings (Threat Rank: Medium)

Northern long-eared bats sometimes use human structures for roosting, usually in the attic or walls. Humans often do not like having bats roosting in their buildings, particularly in houses and businesses and so remove them, mostly through exclusion. Exclusions done when pups are in residence can lead

Appendix A: Mammals

to the death of the pups. Bats entering the parts of buildings that humans use may be killed due to fears about the bats.

List of Lower Ranking Threats:

Species impacts from agricultural pesticide use causing prey declines

Habitat degradation from succession that causes loss of drinking and foraging habitats

Habitat degradation from timber harvest that removes summer roosting and foraging areas

Habitat degradation from roads and powerline development

Mortality and conversion of migratory habitat due to wind turbine development

Habitat conversion and degradation due to removal of summer roosting and foraging areas

Actions to benefit this Species or Habitat in NH

Participate in efforts regarding White-Nose Syndrome

Primary Threat Addressed: Mortality and species impacts (loss of fitness) due to White-Nose Syndrome

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases / Invasive non-native/alien species/diseases / Named species

Objective:

Assist in the research, management and planning efforts to control the spread of, find a treatment for, and recover bat species affected by White-Nose Syndrome

General Strategy:

Participate in regional, national and international research, management and planning efforts to control the spread of, find a treatment for, and recover bat species affected by White-Nose Syndrome. Continue to participate in national research projects such as acoustic transects and emergence counts. Continue to participate in research efforts as requested. Participate in regional and national workshops, plans and projects for conservation, recovery and communications about White-Nose Syndrome.

Political Location:

National, Northeast, Statewide

Watershed Location:

Statewide

Monitor bat populations

Objective:

Continue to monitor hibernating and summer bat populations.

General Strategy:

Monitor hibernacula at least every three years for the presence and abundance of bats. Resurvey summer mist netting sites that have been historically monitored such as Surry Mountains Dam and New Boston Air Force Station.

Appendix A: Mammals

Political Location:

Statewide

Watershed Location:

Statewide

Promote organic practices and integrated pest management (IPM)

Primary Threat Addressed: Species impacts from agricultural pesticide use causing prey declines

Specific Threat (IUCN Threat Levels): Pollution / Agricultural & forestry effluents / Herbicides & pesticides

Objective:

Provide technical assistance to organizations that provide education, technical assistance and funding to farmers and homeowners on organic growing practices and IPM.

General Strategy:

Work with the Northeast Organic Farmers Association, UNH Cooperative Extension, NRCS, nursery stock growers, garden centers, garden clubs, landscapers and others to educate farmers, homeowners and commercial landscapers on using IPM and organic practices

Political Location:

Statewide

Watershed Location:

Statewide

Protect summer colonies in buildings

Primary Threat Addressed: Habitat conversion due to negative perceptions of bats by homeowners that results in loss of roosting habitat in buildings

Specific Threat (IUCN Threat Levels): Human intrusions & disturbance

Objective:

Protect summer colonies in buildings without compromising public health

General Strategy:

Protect summer colonies by prohibiting exclusion of bats from buildings during the time they have non-volant young (May 15-August 15). Exceptions should be available in the case of a documented rabid bat in the building or other public health issue. Develop materials for wildlife control operators and homeowners about bats in houses and their reproductive cycle to build support for the rule change and compliance afterwards.

Political Location:

Statewide

Watershed Location:

Statewide

Prevent disturbances to hibernating bats

Primary Threat Addressed: Disturbance from humans exploring bat hibernacula

Specific Threat (IUCN Threat Levels): Human intrusions & disturbance

Objective:

Appendix A: Mammals

Prevent recreational use of known bat hibernacula during the hibernation period

General Strategy:

Through education, bat-friendly gates and other means prevent people from entering hibernacula during the hibernation period.

Political Location:

Coos County, Grafton County, Merrimack County, Rockingham County

Watershed Location:

Androscoggin-Saco Watershed, Upper CT Watershed, Middle CT Watershed, Merrimack Watershed, Coastal Watershed

Protect occupied roosting trees

Primary Threat Addressed: Habitat degradation from timber harvest that removes summer roosting and foraging areas

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

Prevent occupied roosting trees from being cut down.

General Strategy:

Develop voluntary BMPs for forestry that help landowners and foresters identify and protect known and potential roosting trees during harvesting operations. Provide these guidelines to organization building trails or otherwise potentially cutting trees. BMPs could include time of year restrictions for cutting, tree size limitation and other techniques. Coordinate with other states for consistency.

Political Location:

Northeast, Statewide

Watershed Location:

Statewide

Develop standard processes to reduce the effect of wind energy production on bats

Primary Threat Addressed: Mortality and conversion of migratory habitat due to wind turbine development

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

Develop and implement rules on siting and operation of wind turbines to reduce mortality of bats during construction and operation

General Strategy:

Develop and implement siting rules that protect migration routes and occupied habitat from wind turbine development. Develop required operational mitigation measures such as curtailment to reduce bat mortality post-construction. Develop these in conjunction with nearby states to provide consistency to energy developers across the northeast.

Political Location:

Northeast, Statewide

Watershed Location:

Statewide

Protect hibernacula from structural damage

Primary Threat Addressed: Habitat degradation and conversion due to changes in mine configuration from landowner & natural causes, including reopening or closing mines

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

Protect hibernacula from structural damage such as changes to mine opening or configuration.

General Strategy:

Work with owners of hibernacula to encourage them to voluntarily refrain from changing the opening or the configuration of the interior of mines, unless it is to erect a bat-friendly gate over the opening. Encourage the installations of bat-friendly gates.

Political Location:

County, Rockingham County Coos County, Grafton County,

Watershed Location: Merrimack

Androscoggin-Saco Watershed, Upper CT Watershed, Middle CT Watershed, Pemi-Winni Watershed, Merrimack Watershed, Coastal Watershed

References, Data Sources and Authors

Data Sources

Information on northern long-eared bats comes from NHFG unpublished data, hibernation survey reports from Dr. Jacques Veilleux and Dr. Scott Reynolds, and published scientific literature.

Data Quality

Cave and mine hibernacula data is fairly comprehensive. Data is missing from what may have been the largest hibernacula, still not specifically located but known to be on the slopes of Mount Washington due to the presence of hundreds of sick bats flying in February of 2010. Summer population data is lacking. Data on most threats is well documented in the scientific literature

2015 Authors:

Emily Preston, NHFG

2005 Authors:

Jacques Veilleux, Franklin Pierce University; D. Scott Reynolds, St. Paul's School

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Tricolored Bat

Perimyotis subflavus

Federal Listing	N/A
State Listing	SC
Global Rank	G3/G4
State Rank	S1
Regional Status	Very High



Photo by USFWS

Justification (Reason for Concern in NH)

Populations of tricolored bats, like many other bat species, are believed to be decreasing, however the data is lacking in NH due to the very low population numbers. The likely reasons for the possible declines are White-Nose Syndrome (WNS) along with the destruction or degradation of winter habitat (hibernacula) and summer habitat (roosting and foraging areas). Like other bat species, the tricolored bat's life history is different from the typical life history of small mammals. Individuals are relatively long-lived and have a low reproductive rate. Tricolored bats give birth to two young per year (Fujita and Kunz 1984), although only one may survive to reproductive age. The slow reproductive rate would, in turn, lead to a slow population recovery time. Since tricolored bats are found in cave/mine habitats that are relatively rare and at risk, this species is at risk of population decline if such habitats are lost or degraded. Tricolored bats are of conservation concern in New Hampshire for the above reasons and because of the lack of knowledge about the species' population status in New Hampshire.

Distribution

Data on the current and historic range of tricolored bats in New Hampshire are too few to allow a regional population comparison. The winter distribution data of tricolored bats are limited to three mine localities with historically as many as five individuals in Mascot Lead Mine, three individuals in Mt. Kearsarge Lead Mine (Merrimack County), and one individual in Red Mine (Grafton County). One individual was also collected at Ruggle's Mine in Grafton (Grafton County), which is a potential but unsurveyed hibernaculum. The latest hibernacula surveys in the winters of 2014-2015 found only one individual in one mine. Five definite summer records are known from New Hampshire. One individual is known from Canaan (Grafton County) and Chenger (2005) reported single individuals captured in the towns of Bartlett (Carroll County), Bean's Purchase (Coos County), Wentworth (Grafton County) and Warren (Grafton County). Possible echolocation call sequences have been recorded from Albany (Carroll County), Bartlett (Carroll County), New Boston (Hillsborough County), and possibly Nottingham (Rockingham County). These data indicated a potentially broad summer distribution of tricolored bats in New Hampshire.

Habitat

Tricolored bats hibernate in caves or mines, although they occasionally use other structures. For successful hibernation, tricolored bats require habitat with low levels of human disturbance and a proper microclimate (e.g., temperature stability). Although tricolored bats hibernate singly or in groups of two or three, individual hibernacula can have large populations of tricolored bats, including over 750 individuals from a single mine in New York (Hicks 2003). Therefore, the protection of

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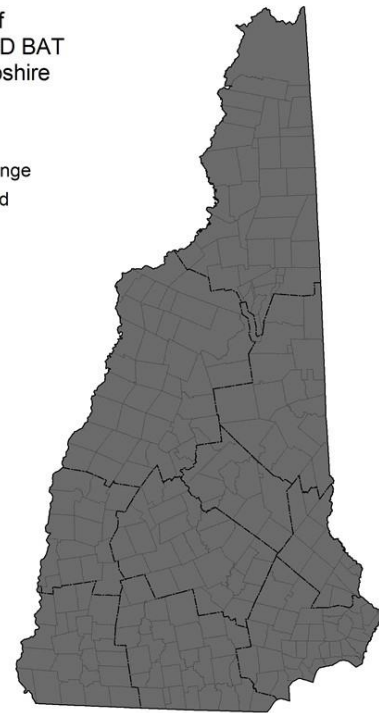
hibernacula is an important conservation concern.

No available data describe the summer habitat requirements of tricolored bats in New Hampshire. The few available data on summer habitat use and life history come from the Midwest (Veilleux et al. 2003, Veilleux et al. 2004, Veilleux and Veilleux 2004). After leaving hibernacula, female tricolored bats from maternity colonies in live or dead foliage of deciduous trees (Veilleux et al. 2003). The birth and weaning of young occur within these foliage roosts. Some data indicate that females prefer to roost in oak and maple trees (Veilleux et al. 2003). Although tricolored bats are a foliage-roosting species, individuals occasionally roost in man-made structures (Whitaker 1998).

NH Wildlife Action Plan Habitats

- Caves and Mines
- Hemlock Hardwood Pine Forest
- Appalachian Oak Pine Forest
- Floodplain Habitats
- Lowland Spruce-Fir Forest
- Northern Hardwood-Conifer Forest
- Northern Swamps
- Temperate Swamps

Distribution of
TRICOLORED BAT
in New Hampshire



Distribution Map

Current Species and Habitat Condition in New Hampshire

The sparse data on winter or summer occurrences of tricolored bats in New Hampshire prevent an analysis of the trends and viability of winter or summer populations. Priority conservation actions include winter surveys at New Hampshire mines that have not been surveyed.

Population Management Status

No population management efforts are directed at the conservation of tricolored bats.

Regulatory Protection (for explanations, see Appendix I)

- NHFG Permit for collection or possession

Quality of Habitat

NHNHB has ranked both Mt. Kearsarge and Mascot Lead Mine as “B/C”, indicating “fair to good quality and prospects for long-term conservation”. Red Mine was ranked “B”, indicating “good quality and prospects for long-term conservation”. Ruggle’s Mine has not been ranked by NHNHB. Although each mine with known wintering bats has been assessed for long-term conservation prospects, no research has determined the microclimate quality.

Habitat Protection Status

Most bat hibernacula in NH are not protected. Three are on state land but only two are gated. One hibernacula on private land has a conservation easement with a special management unit defined around the mine entrance but is not gated. The other hibernacula are located on private land.

Habitat Management Status

The only ongoing habitat management action occurring in New Hampshire is the bat gate at the Mascot Lead Mine (see Caves and Mines habitat profile). A census prior to gate installation (in 1992) found no tricolored bats, and two were documented in the winter following installation. The 2004 winter survey documented five tricolored bats. In 2015 there was one individual in Mascot Mine.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Habitat degradation and conversion due to changes in mine configuration from landowner & natural causes, including reopening or closing mines (Threat Rank: High)

Changes in the mine entrances can block access or change the temperature and humidity within the mine. Bats have specific ranges of temperatures and humidity they require for hibernating. Reopening of mines for active use can disturb or kill hibernating bats, or make the mine unsuitable for hibernating.

Disturbance from humans exploring bat hibernacula (Threat Rank: High)

Active cavers and casual cave explorers disturb bats when they enter occupied caves and mines. Noise, light, changes in temperature and airflow, and physical contact can all disturb bats (Thomas 1995). In winter during hibernation, these disturbances can cause bats to arouse from hibernation and thus use up precious stored energy. Bats susceptible to White-Nose Syndrome are especially vulnerable to disturbance, as the disease already causes increased numbers of arousals and depletion of stored fat.

Tricolored bats occurred in small numbers at all of NH’s known mine hibernacula prior to White-Nose Syndrome. The largest population occurred at a mine that is easily accessible by explorers.

Mortality and species impacts (loss of fitness) due to White-Nose Syndrome (Threat Rank: High)

Tricolored bats have been decimated by White-Nose Syndrome (WNS), a fungal disease that affects bats during hibernation. The fungus, *Pseudogymnoascus destructans*, grows into the wings, muzzles and ears of the bats (Lorch et al. 2011), disrupting metabolic functions (Meteyer et al. 2009, Cryan et al. 2013, Verant et al. 2014) and causing bats to arouse from hibernation more frequently and stay

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awake longer than uninfected bats (Lorch et al. 2011, Reeder et al. 2012). This causes them to use up stored energy (fat) at a much higher rate (Reeder et al. 2012). Bats cannot replenish their fat stores in winter as their food source is unavailable. They perish from starvation, some first flying out the hibernacula in mid-winter in a desperate search for food. Since bats are in hibernation they do not mount an immune response to this disease.

WNS was first found in NH in 2009. Winter surveys in 2010 showed a 75% decline and by 2011 declines had reached 99% for tricolored bats. Surveys over the winters of 2014 and 2015 echoed this with only two individuals found in two different hibernacula. However, the numbers of this species found in NH hibernacula has traditionally been very low. States with larger populations of tricolored bats have seen similar drops on overall populations (Turner et al. 2011).

Habitat conversion due to negative perceptions of bats by homeowners that results in loss of roosting habitat in buildings (Threat Rank: Medium)

Tricolored bats sometimes use human structures for roosting, usually in the attic or walls. Humans often do not like having bats roosting in their buildings, particularly in houses and businesses and so remove them, mostly through exclusion. Exclusions done when pups are in residence can lead to the death of the pups. Bats entering the parts of buildings that humans use may be killed due to fears about the bats.

List of Lower Ranking Threats:

Species impacts from agricultural pesticide use causing prey declines

Habitat degradation from succession that causes loss of drinking and foraging habitats

Habitat degradation from timber harvest that removes summer roosting and foraging areas

Habitat degradation from roads and powerline development

Mortality and conversion of migratory habitat due to wind turbine development

Habitat conversion and degradation due to removal of summer roosting and foraging areas

Actions to benefit this Species or Habitat in NH

Promote organic practices and integrated pest management (IPM)

Primary Threat Addressed: Species impacts from agricultural pesticide use causing prey declines

Specific Threat (IUCN Threat Levels): Pollution / Agricultural & forestry effluents / Herbicides & pesticides

Objective:

Provide technical assistance to organizations that provide education, technical assistance and funding to farmers and homeowners on organic growing practices and IPM.

General Strategy:

Work with the Northeast Organic Farmers Association, UNH Cooperative Extension, NRCS, nursery stock growers, garden centers, garden clubs, landscapers and others to educate farmers, homeowners and commercial landscapers on using IPM and organic practices

Political Location:

Statewide

Watershed Location:

Statewide

Develop standard processes to reduce the effect of wind energy production on bats

Primary Threat Addressed: Mortality and conversion of migratory habitat due to wind turbine development

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

Develop and implement rules on siting and operation of wind turbines to reduce mortality of bats during construction and operation

General Strategy:

Develop and implement siting rules that protect migration routes and occupied habitat from wind turbine development. Develop required operational mitigation measures such as curtailment to reduce bat mortality post-construction. Develop these in conjunction with nearby states to provide consistency to energy developers across the northeast.

Political Location:

Northeast, Statewide

Watershed Location:

Statewide

Monitor bat populations

Objective:

Continue to monitor hibernating and summer bat populations.

General Strategy:

Monitor hibernacula at least every three years for the presence and abundance of bats. Resurvey summer mist netting sites that have been historically monitored such as Surry Mountains Dam and New Boston Air Force Station.

Political Location:

Statewide

Watershed Location:

Statewide

Protect occupied roosting trees

Primary Threat Addressed: Habitat degradation from timber harvest that removes summer roosting and foraging areas

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

Prevent occupied roosting trees from being cut down.

General Strategy:

Develop voluntary BMPs for forestry that help landowners and foresters identify and protect known and potential roosting trees during harvesting operations. Provide these guidelines to organization

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building trails or otherwise potentially cutting trees. BMPs could include time of year restrictions for cutting, tree size limitation and other techniques. Coordinate with other states for consistency.

Political Location:

Northeast, Statewide

Watershed Location:

Statewide

Prevent disturbances to hibernating bats

Primary Threat Addressed: Disturbance from humans exploring bat hibernacula

Specific Threat (IUCN Threat Levels): Human intrusions & disturbance

Objective:

Prevent recreational use of known bat hibernacula during the hibernation period

General Strategy:

Through education, bat-friendly gates and other means prevent people from entering hibernacula during the hibernation period.

Political Location:

Coos County, Grafton County, Merrimack County, Rockingham County

Watershed Location:

Androscoggin-Saco Watershed, Upper CT Watershed, Middle CT Watershed, Pemi-Winni Watershed, Merrimack Watershed, Coastal Watershed

Protect summer colonies in buildings

Primary Threat Addressed: Habitat conversion due to negative perceptions of bats by homeowners that results in loss of roosting habitat in buildings

Specific Threat (IUCN Threat Levels): Human intrusions & disturbance

Objective:

Protect summer colonies in buildings without compromising public health

General Strategy:

Protect summer colonies by prohibiting exclusion of bats from buildings during the time they have non-volant young (May 15-August 15). Exceptions should be available in the case of a documented rabid bat in the building or other public health issue. Develop materials for wildlife control operators and homeowners about bats in houses and their reproductive cycle to build support for the rule change and compliance afterwards.

Political Location:

Statewide

Watershed Location:

Statewide

Participate in efforts regarding White-Nose Syndrome

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Primary Threat Addressed: Mortality and species impacts (loss of fitness) due to White-Nose Syndrome

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases / Invasive non-native/alien species/diseases / Named species

Objective:

Assist in the research, management and planning efforts to control the spread of, find a treatment for, and recover bat species affected by White-Nose Syndrome

General Strategy:

Participate in regional, national and international research, management and planning efforts to control the spread of, find a treatment for, and recover bat species affected by White-Nose Syndrome. Continue to participate in national research projects such as acoustic transects and emergence counts. Continue to participate in research efforts as requested. Participate in regional and national workshops, plans and projects for conservation, recovery and communications about White-Nose Syndrome.

Political Location:

National, Northeast, Statewide

Watershed Location:

Statewide

Protect hibernacula from structural damage

Primary Threat Addressed: Habitat degradation and conversion due to changes in mine configuration from landowner & natural causes, including reopening or closing mines

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

Protect hibernacula from structural damage such as changes to mine opening or configuration.

General Strategy:

Work with owners of hibernacula to encourage them to voluntarily refrain from changing the opening or the configuration of the interior of mines, unless it is to erect a bat-friendly gate over the opening. Encourage the installations of bat-friendly gates.

Political Location:

Coos County, Grafton County, Merrimack County, Rockingham County

Watershed Location:

Androscoggin-Saco Watershed, Upper CT Watershed, Middle CT Watershed, Pemi-Winni Watershed, Merrimack Watershed, Coastal Watershed

References, Data Sources and Authors

Data Sources

Town data on the tricolored bat's winter distribution were compiled from New Hampshire Natural

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Heritage Inventory – Bat Hibernaculum Record data sheets, museum specimens, and college/university teaching collections. Summer distribution was determined from the published and gray literature of bat research in New Hampshire, as well as from specimen collections. NHFG unpublished data includes capture records provided by researchers as part of their reporting requirements for obtaining scientific collecting permits in NH.

The winter distribution of tricolored bats at known hibernacula was determined from New Hampshire Natural Heritage Survey – Hibernacula Survey Data Sheets. Scott Reynolds and Heather Durham conducted 1999 and 2000 winter surveys (Durham 2000).

Data Quality

Data on the distribution of tricolored bats in New Hampshire are extremely limited but of high quality because qualified bat biologists identified the animals. The major knowledge gap is the paucity of occurrence records and research into distribution patterns.

The quality and extent of data varied between mines.

2015 Authors:

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2005 Authors:

Jacques Veilleux, Franklin Pierce University; D. Scott Reynolds, St. Paul's School

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Lorch, J. M., Muller, L. K., Russell, R. E., O'Connor, M., Lindner, D. L., & Blehert, D. S. (2013). Distribution and environmental persistence of the causative agent of white-nose syndrome,

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Long-tailed Shrew

Sorex dispar

Federal Listing	N/A
State Listing	SGCN
Global Rank	G4
State Rank	S4
Regional Status	Very High

Justification (Reason for Concern in NH)

The population status of long-tailed shrews is largely unknown, but they are thought to be rare (Degraaf and Yamasaki 2001). The species is likely difficult to trap and therefore they may be more abundant than current studies have shown.

Distribution

Little is known about the distribution and habitat of this species in New Hampshire. Trapping in the White Mountain National Forest of Maine and New Hampshire varied from 0.2-0.6 percent of the total capture (Yamasaki 1997).

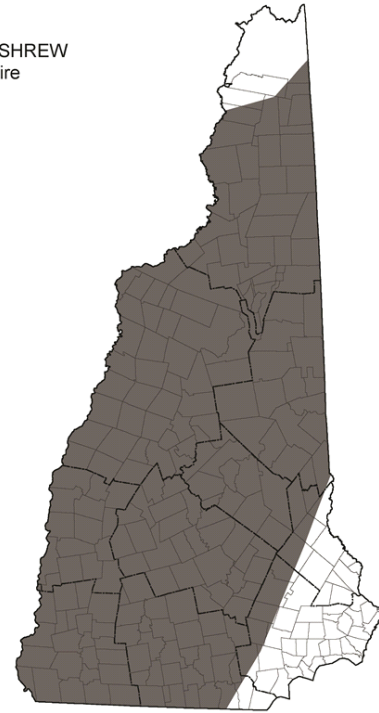
Habitat

Long-tailed shrews are found at higher elevations in the mountains of New Hampshire, Maine, Vermont and western Massachusetts (Degraaf and Yamasaki 2001). They inhabit cold, damp coniferous forests, typically near moss-covered rocks and logs that provide shady protective crevices or wooded talus slopes (Connor 1960, Richmond and Grimm 1950). They can also be found in deciduous and mixed forests. They are primarily insectivorous.

NH Wildlife Action Plan Habitats

- High Elevation Spruce-Fir Forest
- Northern Hardwood-Conifer Forest

Distribution of
LONG-TAILED SHREW
in New Hampshire



Distribution Map

Current Species and Habitat Condition in New Hampshire

There are insufficient data to draw conclusions about the population health or distribution of long-tailed shrew.

Population Management Status

There are no management efforts for long-tailed shrew in New Hampshire.

Regulatory Protection (for explanations, see Appendix I)

None

Quality of Habitat

Little is known about the distribution and habitat for long-tailed shrew in New Hampshire.

Habitat Protection Status

Little is known about the distribution and habitat for long-tailed shrew in New Hampshire.

Habitat Management Status

There are no habitat management efforts for long-tailed shrew.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

There are no threats ranked high or medium for this species.

List of Lower Ranking Threats:

Species impacts from the accumulation of heavy metals and pesticides from consumption of invertebrates

Habitat conversion from ski area expansion and development that removes talus habitat

Actions to benefit this Species or Habitat in NH

Conduct research on habitat needs and distribution

Primary Threat Addressed:

Objective:

General Strategy:

Political Location:

Watershed Location:

Support efforts to minimize air pollution leading to heavy metal deposition in the atmosphere

Primary Threat Addressed: Species impacts from the accumulation of heavy metals and pesticides from consumption of invertebrates

Specific Threat (IUCN Threat Levels): pollution

Objective:

General Strategy:

Political Location:

Watershed Location:

Minimize habitat conversion in high elevation habitats

Primary Threat Addressed: Habitat conversion from ski area expansion and development that removes talus habitat

Specific Threat (IUCN Threat Levels): Residential & commercial development

Objective:

General Strategy:

Political Location:

Watershed Location:

References, Data Sources and Authors

Data Sources

(DeGraaf and Yamasaki, 2001)

Nature Serve 2015

Information on habitat, population distribution, and status was collected from unpublished data, scientific literature, and limited agency data.

Data Quality

With the cooperation of the WMNF, Yamasaki conducted a 3-year systematic survey of small mammals between 1995 and 1997. This survey took place in potential habitats across three levels of vegetation management in the White Mountains region. Out of the 108 study sites surveyed across managed, unmanaged, and remote locations in the forest, long-tailed shrew captures varied between 0.1-0.7 captures per 100 trap-nights (Yamasaki 1997).

There is very little data on the condition of the species and its habitats statewide.

2015 Authors:

Jillian Kilborn, NHFG

2005 Authors:

Literature

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American Water Shrew (Eastern)

Sorex palustris albibarbis

Federal Listing	N/A
State Listing	
Global Rank	
State Rank	S5
Regional Status	High

Justification (Reason for Concern in NH)

Low trapping success in the White Mountains (Yamasaki 1997) seem to indicate that water shrews are less abundant than other shrew species. Little is known about the distribution and abundance of water shrews and is likely connected to its listing.

Distribution

Little is known about the distribution and habitat of this species in New Hampshire. Trapping in the White Mountain National Forests indicates they can be found 100m from streams in mature northern hardwood stands (D.Rudis pers. commun., Yamasaki 1997).

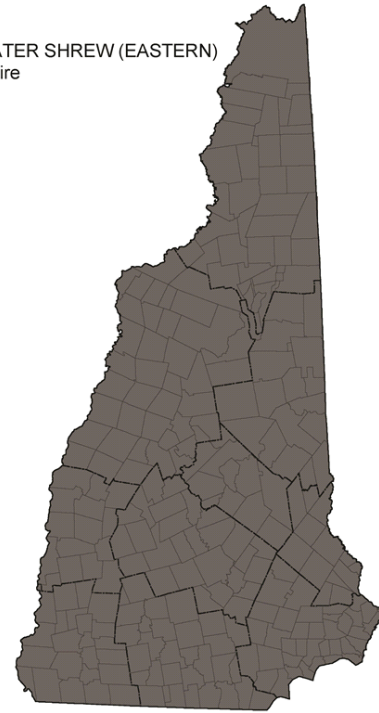
Habitat

The water shrew is found throughout the boreal and montane regions of New England, Labrador, Nova Scotia, Alaska and Canada (Cook et al. 1997, DeGraaf and Yamasaki 2001). Water shrews are most often found near water and wet areas, especially those with grass-sedge marsh or shrub zones along ponds and streams in coniferous forests (Ozoga and Gaertner 1963, Rabe 1981, Timm 1975, Spencer and Pettus 1966, Wrigley et al. 1979). Water shrews are primarily insectivorous, but their diet can include slugs earthworms snails and some fish spp. (Conaway 1952, Conaway and Pfitzer 1952, Sorenson 1962).

NH Wildlife Action Plan Habitats

- Northern Swamps

Distribution of
AMERICAN WATER SHREW (EASTERN)
in New Hampshire



Distribution Map

Current Species and Habitat Condition in New Hampshire

There are insufficient data to draw conclusions about the population health or distribution of water shrews.

Population Management Status

There are no management efforts for water shrews in New Hampshire.

Regulatory Protection (for explanations, see Appendix I)

None

Quality of Habitat

Data collected to assess Eastern Brook trout habitat throughout the northeast may provide a good base for assessing water shrew habitat in New Hampshire.

Habitat Protection Status

There are no habitat protection efforts for water shrews.

Habitat Management Status

There are no habitat management efforts for water shrews.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

There are no threats ranked high or medium for this species.

List of Lower Ranking Threats:

Species impacts from introduction of new predators into aquatic systems that cause changes in species composition alteration (bass)

Habitat degradation from removal of adequate riparian buffers that results in stream warming and bank instability

Habitat degradation from undersized stream crossings resulting in stream instability and sedimentation

Habitat impacts (fragmentation) from timber harvesting that removes an adequate riparian buffer

Actions to benefit this Species or Habitat in NH

Educate public on the implications of introductions

Primary Threat Addressed: Species impacts from introduction of new predators into aquatic systems that cause changes in species composition alteration (bass)

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases

Objective:

General Strategy:

Political Location:

Watershed Location:

Work with landowners and towns to help implement new stream crossing guidelines

Primary Threat Addressed: Habitat degradation from undersized stream crossings resulting in stream instability and sedimentation

Specific Threat (IUCN Threat Levels): Transportation & service corridors

Objective:

Appendix A: Mammals

General Strategy:

Political Location:

Watershed Location:

Identify and implement stream buffer requirements in NH

Primary Threat Addressed: Habitat impacts (fragmentation) from timber harvesting that removes an adequate riparian buffer

Specific Threat (IUCN Threat Levels): Biological Resource Use

Objective:

General Strategy:

Political Location:

Watershed Location:

References, Data Sources and Authors

Data Sources

DeGraaf and Yamasaki, 2001

Information on habitat, population distribution, and status was collected from unpublished data, scientific literature, and limited agency data.

Data Quality

With the cooperation of the WMNF, Yamasaki conducted a 3-year systematic survey of small mammals between 1995 and 1997. This survey took place in potential habitats across three levels of vegetation management in the White Mountains region. Out of the 108 study sites surveyed across managed, unmanaged, and remote locations in the forest, capture rate for water shrew was 0.2 to 0.4 percent of the samples on the White Mountain National Forest and Maine (0.17 captures per 100 trap nights on White Mountains; Yamasaki 1997).

There is very little data on the condition of the species and its habitats statewide.

2015 Authors:

Jillian Kilborn, NHFG

2005 Authors:

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New England Cottontail

Sylvilagus transitionalis

Federal Listing	N/A
State Listing	E
Global Rank	
State Rank	S1
Regional Status	Very High



Photo by NHFG

Justification (Reason for Concern in NH)

Since 1960, the distribution and abundance of NEC has declined substantially throughout New England (Johnston 1972, Jackson 1973, Litvaitis 1993). See section 1.4. NEC was identified as a ‘candidate’ species for federal listing in 2006 by the USFWS. In September 2015 the USFWS determined NEC was not warranted for federal listing due to the conservation measures effectively being implemented for its recovery.

Distribution

Decline of NEC was estimated at ~14% of historic range in Litvaitis et al. 2006. This included substantial decline within the occupied portions of NH, with only eastern cottontails and snowshoe hares found in the western portion of the state. Probably the most important disturbance that influenced the abundance of NEC was the clearing of forests for agriculture by European settlers and subsequent abandonment of these lands (Ahn et al. 2002, Hall et al. 2002). Cleared lands were abruptly abandoned in the mid-1800s for more productive farms in the midwestern United States. Many of these tracts reverted to second-growth forests (Irland 1982), and NEC and other early-successional forest species reached unprecedented levels of abundance throughout the northeastern United States in the early 1900s (DeGraaf and Miller 1996, Foster et al. 2002, Litvaitis et al. 2005b). Litvaitis (1993) used information on the rate of farmland abandonment and developed a simple model of forest succession to estimate the approximate recruitment of early-successional habitats. Most of the abandoned lands matured into closed-canopy forests by 1960 and species dependent on these habitats quickly declined, including NEC. If populations of NEC stabilized at reduced densities reached in the 1960s, conservation actions probably would not be needed. However, early-successional habitats in the northeastern United States continue to decline (Brooks 2003) and remaining populations of NEC in New Hampshire and elsewhere are vulnerable to extinction (Litvaitis and Villafuerte 1996).

Habitat

New England cottontails (hereafter referred to as ‘NEC’) occupy a variety of habitats including native shrublands and regenerating forests associated with small-scale disturbances that result from beavers (*Castor canadensis*), local windstorms, and human land uses. Less frequent but larger-scale disturbances (including hurricanes and wild fires) also provide early-successional habitats, especially near the Atlantic coast (Lorimer and White 2003). Habitats of NEC are described by vegetation structure (especially height and density) rather than specific plant communities (Eabry 1968). The most consistent characteristic of NEC habitat is dense understory cover (Fay and Chandler 1955, Eabry 1968, Linkkila 1971). Coniferous stems provide NEC with approximately 3 times the visual

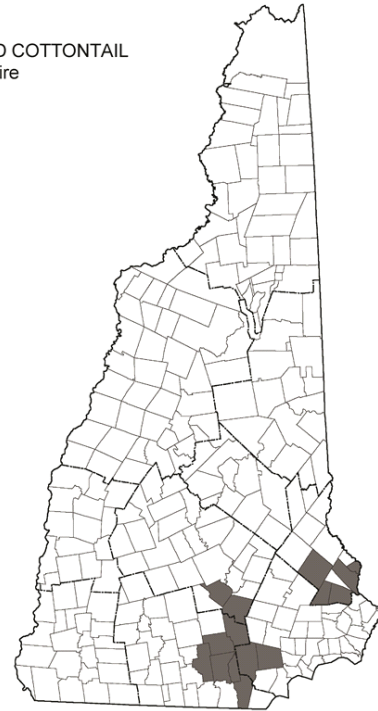
Appendix A: Mammals

obstruction of deciduous stems in winter (Litvaitis et al. 1985). NEC prefer sites with more than 50,000 stem-cover units/ha and are reluctant to venture more than 5 m from cover (Barbour and Litvaitis 1993). In regenerating stands or idle agricultural fields, NEC colonize after secondary succession has progressed and a woody understory is well developed (approximately 5 to 7 years). As the stand matures and young trees develop a closed canopy (approximately 20 to 25 years after disturbance), understory vegetation becomes sparse and the site is no longer suitable for NEC.

NH Wildlife Action Plan Habitats

- Shrublands

Distribution of
NEW ENGLAND COTTONTAIL
in New Hampshire



Distribution Map

Current Species and Habitat Condition in New Hampshire

Remaining populations of NEC in New Hampshire span a modest portion of the region that was occupied historically, including the Seacoast and Merrimack River Valley.

Population Management Status

Focus areas for management efforts were identified within the state as part of the Conservation Strategy for the New England Cottontail (Fuller and Tur 2012). Habitat management and population goals for the species were identified for each focus area, and targeted actions to accomplish these goals. Since 2009 over 950 acres have been managed for the species on public and private lands within the focus areas. In addition, a regional captive breeding program was initiated in 2011 and augmentation began in 2013.

Regulatory Protection (for explanations, see Appendix I)

- Federal Endangered Species Act - under consideration

Quality of Habitat

There are currently five known locations occupied by NEC in the Merrimack Valley (1) and Seacoast (4) regions of the state. These locations are not connected, and are comprised of 1 – >10 patches. Patches range from 2 – 20 acres in size and vary from year to year in occupancy. Smaller patches are dependent on the colonization of surplus rabbits from larger patches of habitat (Litvaitis and Villafuerte 1996). Currently there are no eastern cottontails documented as living sympatrically with NEC in the state, although eastern cottontails have been detected ~6km from known occupied NEC sites in the Merrimack Valley, and much closer in the Seacoast region separated by rivers and bays.

Habitat Protection Status

70% of habitat management projects implemented from 2008- 2014 were on conservation land including easement and fee owned parcels. Four out of the five occupied locations have protection of key habitat patches.

Habitat Management Status

Over 60 habitat management projects have been implemented to improve habitat for NEC in the state. An NEC Land Management Team comprised of partners from NRCS, NHFG, USFWS, and UNHCE meet 4-8 times a year to discuss potential projects, evaluate follow-up action on previously managed parcels and identify funding. The team will continue to work towards the goals identified for the focus areas which currently include 2000 acres by 2030.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

Habitat conversion due to development (Threat Rank: High)

Housing and commercial development permanently reduce available habitat and restoration potential.

The seacoast and Merrimack River valley are some of the most highly developed areas in NH. Some of the remaining large parcels are situated in commercial development zones, increasing the economic value of the land and challenges with implementing conservation.

Habitat degradation from less large scale timber harvesting and resulting patches of young forest (Threat Rank: High)

Natural forest maturation with associated land-use change.

Decline in successional habitat and associated species over the past 100 years (Litvaitis 1993).

Species impacts and mortality from subsidized or introduced predators (Threat Rank: Medium)

Predation is a natural source of mortality for rabbits. Increased predator density due to anthropogenic factors may alter the rate of mortality beyond what the local population can sustain. Lack of habitat also exacerbates the likelihood of predators.

Appendix A: Mammals

Oehler and Litvaitis (1996) study found coyotes and foxes increased in abundance as forest cover decreased and agricultural lands increased.

List of Lower Ranking Threats:

- Mortality from various diseases (tularemia)
- Species impacts from introduced or invasive animals (eastern cottontails)
- Habitat degradation from a lack of natural disturbance including beaver flooding, hurricanes, and fire

Actions to benefit this Species or Habitat in NH

Create early-successional habitat networks in landscapes currently occupied by NEC.

Primary Threat Addressed: Habitat degradation from a lack of natural disturbance including beaver flooding, hurricanes, and fire

Specific Threat (IUCN Threat Levels): Natural system modifications

Objective:

General Strategy:

Collaborate with conservation partners, private landowners, municipalities, state and federal agencies to create or manage early-successional habitat in a reserve design that would support the persistence of NEC on the landscape. Management could include timber harvest, brontosaurus mowing, seeding and planting of native shrubs or prescribed burning.

Political Location:

Hillsborough County, Strafford County

Watershed Location:

Merrimack Watershed, Coastal Watershed

Monitor distribution and trend of NEC in New Hampshire.

Objective:

General Strategy:

Coordinate with the regional effort to develop a monitoring protocol to track the distribution and trend of NEC over time. This protocol will need further adaptation to work at a more local scale within the state.

Political Location:

Watershed Location:

Monitor eastern cottontail distribution and determine status.

Primary Threat Addressed: Species impacts from introduced or invasive animals (eastern cottontails)

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases

Objective:

Appendix A: Mammals

General Strategy:

Currently there are no known sympatric populations of the eastern cottontail and NEC in NH. Monitor the range of eastern cottontail to determine if they are moving into focus areas where habitat management is occurring. Determine number and distribution of eastern cottontail in the occupied landscape. Evaluate the feasibility to trap and remove eastern cottontail from suitable habitat in areas currently not occupied with NEC.

Political Location:

Hillsborough County, Strafford County

Watershed Location:

Merrimack Watershed, Coastal Watershed

Coordinate with utility companies to manage rights-of-way

Primary Threat Addressed: Habitat degradation from a lack of natural disturbance including beaver flooding, hurricanes, and fire

Specific Threat (IUCN Threat Levels): Natural system modifications

Objective:

General Strategy:

Utility rights-of-way have the potential to facilitate cottontail movement among patches (Fenderson et al. 2014). Altering the management prescription of mowing all vegetation within the boundary every 3-4 years to a selective removal of tree species could enhance the available habitat and ensure its persistence on the landscape annually.

Political Location:

Hillsborough County, Strafford County

Watershed Location:

Merrimack Watershed, Coastal Watershed

Conserve core areas for long-term persistence of the species.

Primary Threat Addressed: Habitat conversion due to development

Specific Threat (IUCN Threat Levels): Residential & commercial development

Objective:

General Strategy:

Since the habitat for the species in NH is primarily ephemeral in nature, it is important to have large core patches protected within the species range. Protection will provide security and long-term management authority to ensure high quality habitat is present.

Political Location:

Hillsborough County, Strafford County

Watershed Location:

Merrimack Watershed, Coastal Watershed

Captive breeding and augmentation of NEC.

Appendix A: Mammals

Primary Threat Addressed: Habitat degradation from a lack of natural disturbance including beaver flooding, hurricanes, and fire

Specific Threat (IUCN Threat Levels): Natural system modifications

Objective:

General Strategy:

Continue to support and participate in regional captive breeding program. Evaluate expansion of facilities at Great Bay National Wildlife Refuge to increase capacity. Augment the population in declining patches and provide rapid colonization of new habitat patches. Monitor released NEC with radio telemetry to determine survival and effectiveness of release methods.

Political Location:

Hillsborough County, Strafford County

Watershed Location:

Merrimack Watershed, Coastal Watershed

Monitor habitat suitability in focus areas.

Objective:

General Strategy:

Employ long-term monitoring in conservation focus areas for New England cottontail to track habitat suitability over time and alert manager of potential deficiencies. A habitat suitability index has recently been developed by Warren et al (in draft) that could also be used to assist managers in evaluating sites for release of captive bred rabbits.

Political Location:

Watershed Location:

Monitor survival of NEC at restoration sites.

Primary Threat Addressed: Species impacts and mortality from subsidized or introduced predators

Specific Threat (IUCN Threat Levels): Invasive & other problematic species, genes & diseases

Objective:

General Strategy:

Monitor survival of rabbits with radio telemetry at various locations to determine threshold for significant impact of predators. In addition to rabbit survival, DNA analysis of pellets could be used to monitor rate of reproduction.

Political Location:

Watershed Location:

References, Data Sources and Authors

Data Sources

Information on current distribution of NEC came from a recent range-wide survey of the historic range of NEC (Litvaitis et al. 2006). In addition, annual surveys are conducted by NHFG to monitor extant patches within the state, and provide more detailed patch occupancy within an area. Sources of information include databases, expert review and consultation.

Data Quality

Surveys are conducted following protocols developed by UNH (Brubaker et al. 2014) to improve the rate of detection and minimize false negatives. Survey information in any one year is insufficient for the entire state, but covers all areas with reasonable effort every 2-3 years.

There has been sufficient research on patch-specific habitat features. This information would be complemented by additional efforts to understand landscape elements that influence metapopulation survival (Litvaitis and Villafuerte 1996). There is still some uncertainty of the health of the Merrimack Focus area population specifically.

2015 Authors:

Heidi Holman, NHFG

2005 Authors:

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Northern Bog Lemming

Synaptomys borealis sphagnicola

Federal Listing	N/A
State Listing	SC
Global Rank	G3
State Rank	S1
Regional Status	

Justification (Reason for Concern in NH)

Bog lemmings are an extremely rare mammal in New England and eastern Canada, making them vulnerable to local extirpation (Banfield 1974). Recent surveys in the White Mountains found one individual at 1 of 108 sites (Yamasaki, unpublished data). Only two other sites in the region have yielded specimens over the last 100 years. Comprehensive surveys for bog lemmings have not been conducted outside of the White Mountains; difficulty in properly identifying this species may contribute to its lack of detection. Considerable work is required to understand the habitat requirements of this rare mammal in northern New Hampshire, as it has been found in low numbers across a variety of northern forest, alpine, and sphagnum vegetative communities. Further surveys for bog lemmings in sphagnum-dominated vegetative communities might be productive as in Montana surveys (Reichel and Beckman 1993, Reichel and Beckman 1994, Reichel 1995, Reichel and Corn 1997).

Distribution

Three specimens of bog lemmings have been recorded in New Hampshire in the past 100 years in the White Mountains region (Preble 1899, Clough and Albright 1987, Yamasaki, unpublished data). Northern New Hampshire represents the southernmost edge of the range of bog lemmings in northern New England and eastern Canada (DeGraaf and Yamasaki 2001, NatureServe 2015). There are insufficient data to determine any further spatial distribution patterns.

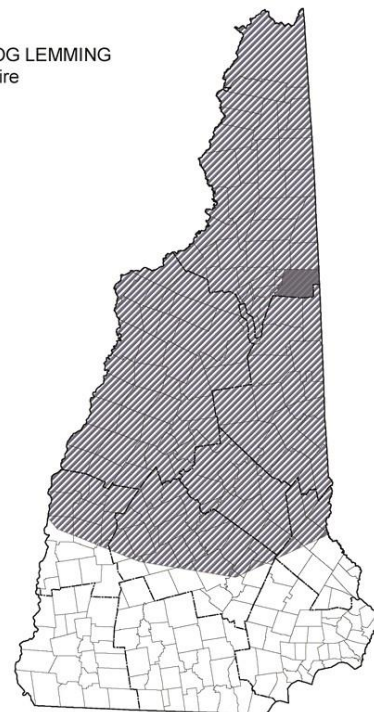
Habitat

The northern bog lemming (hereafter called bog lemming) is found in northern New England, New York, and eastern Canada in higher elevation mossy spruce woods (1,300 to 4,500 feet), low elevation spruce-fir, hemlock and beech forests, sphagnum bogs, damp weedy meadows, and alpine sedge meadows (Clough and Albright 1987, DeGraaf and Yamasaki 2001, Banfield 1974, Saunders 1988). Special habitat requirements include moist loose soils or leaf mold (Banfield 1974, DeGraaf and Yamasaki 2001). Bog lemmings feed on grasses and sedges and are active year-round. Bog lemmings use tunnels several inches below ground and shallow runways on the ground surface (Banfield 1974). In the summer, bog lemmings construct spherical nests of dried grasses in burrows, and in winter, it nests on the ground (Banfield 1974).

NH Wildlife Action Plan Habitats

- High Elevation Spruce-Fir Forest
- Lowland Spruce-Fir Forest
- Northern Hardwood-Conifer Forest

Distribution of
NORTHERN BOG LEMMING
in New Hampshire



Distribution Map

Current Species and Habitat Condition in New Hampshire

There are insufficient data to draw conclusions about the population health or distribution of bog lemmings.

Population Management Status

There are no management efforts for bog lemmings in New Hampshire.

Regulatory Protection (for explanations, see Appendix I)

- NH NHB Database - historic

Quality of Habitat

There are no data to with which to assess the relative quality of habitat patches for *S. borealis*.

Habitat Protection Status

All documented specimens in New Hampshire are within the proclamation boundary of the White Mountain National Forest. The bog lemming is recognized as a “Region 9 Regional Forester Sensitive Species” whose special concerns are addressed in the planning or analysis phases of management programs.

Habitat Management Status

There are no habitat management efforts for bog lemmings.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

There are no threats ranked high or medium for this species.

List of Lower Ranking Threats:

Habitat degradation from forestry practices

Habitat loss or conversion due to communication tower and wind turbine development

Habitat loss and conversion due to the development of ski areas

Actions to benefit this Species or Habitat in NH

Minimize or mitigate the loss of high elevation habitat due to development

Primary Threat Addressed: Habitat loss or conversion due to communication tower and wind turbine development

Specific Threat (IUCN Threat Levels): Energy production & mining

Objective:

General Strategy:

Political Location:

Watershed Location:

Provide technical assistance and outreach for management in potential habitat

Primary Threat Addressed: Habitat degradation from forestry practices

Specific Threat (IUCN Threat Levels): Biological resource use

Objective:

General Strategy:

Political Location:

Watershed Location:

Minimize or mitigate the loss or conversion of high elevation habitats

Primary Threat Addressed: Habitat loss and conversion due to the development of ski areas

Specific Threat (IUCN Threat Levels): Residential & commercial development

Objective:

General Strategy:

Political Location:

Watershed Location:

References, Data Sources and Authors

Data Sources

Information on habitat, population distribution, and status was collected from unpublished data, scientific literature, and limited agency data.

Information on habitat, population distribution, and status was collected from unpublished data, scientific literature, and limited agency data.

Data Quality

The bog lemming is probably the least understood mammal species in New Hampshire due to its rarity. With the cooperation of the WMNF, Yamasaki conducted a 3-year systematic survey of small mammals between 1995 and 1997. This survey took place in potential habitats across three levels of vegetation management in the White Mountains region. Directed searches used snap trap grids and 10-bucket, Y-shaped, drift fence pitfall sets to target rock voles (*Microtus chrotorrhinus*), long-tailed shrews (*Sorex dispar*), and northern bog lemmings. Out of the 108 study sites surveyed across managed, unmanaged, and remote locations in the forest, one managed site in a lowland spruce-fir stand yielded a bog lemming specimen (Yamasaki 1997). The positive identification was confirmed by the American Museum of Natural History where the specimen now resides.

While 10 years of small mammal sampling at the Bartlett Experimental Forest in Bartlett produced many specimens of small mammal species from the White Mountains region, including occasional specimens of southern bog lemmings, it produced no specimens of northern bog lemmings.

The bog lemming is probably the least understood mammal species in New Hampshire due to its rarity. Systematic searches in appropriate habitats in the White Mountain National Forest located 1 occurrence out of 108 sampled sites during a study from 1995 to 1997 (M. Yamasaki, USDA Forest Service, unpublished data).

2015 Authors:

Jillian Kilborn, NHFG

2005 Authors:

Mariko Yamasaki, USFS; Angela Karedes USFS

Literature

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Southern Bog Lemming

Synaptomys cooperi

Federal Listing	N/A
State Listing	
Global Rank	G5
State Rank	S4
Regional Status	Very High

Justification (Reason for Concern in NH)

Low trapping success in the White Mountains (Yamasaki 1997) seem to indicate that Southern Bog Lemmings are not common, and they are very locally distributed. They can be more abundant in localized pockets (DeGraaf and Yamasaki 2001).

Distribution

Little is known about the distribution and habitat of this species in New Hampshire. Trapping in the White Mountain National Forest of Maine and New Hampshire varied from 0.03 to 0.69 captures per 100 trap-nights (Yamasaki 1997).

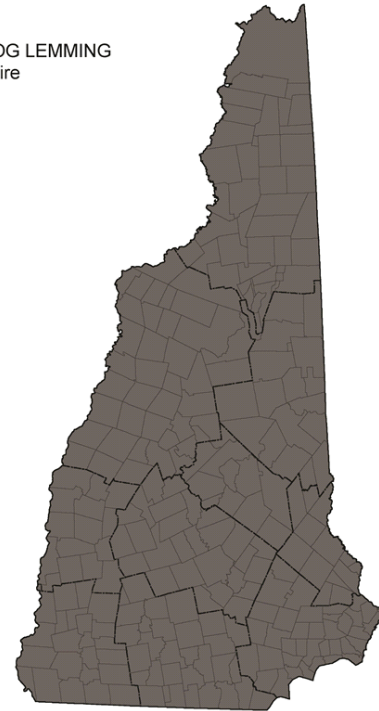
Habitat

The Southern Bog Lemming prefers boggy habitat and can be common in marshes, meadows and upland forests with a thick humus layer (Linzey 1981). Southern Bog Lemmings feed on the tender succulent parts of herbaceous plants and will occasionally eat mosses, fungi, bark, roots and some invertebrates (Linzey 1983). They also develop complex tunnel systems that are deep (6-12 in) below ground for resting, feeding and storing food.

NH Wildlife Action Plan Habitats

- Northern Hardwood-Conifer Forest

Distribution of
SOUTHERN BOG LEMMING
in New Hampshire



Distribution Map

Current Species and Habitat Condition in New Hampshire

There are insufficient data to draw conclusions about the population health or distribution of southern bog lemmings.

Population Management Status

There are no management efforts for southern bog lemmings in New Hampshire.

Regulatory Protection (for explanations, see Appendix I)

None

Quality of Habitat

Southern bog lemmings are likely widely distributed throughout New Hampshire, but with local abundance. Habitat use is also varied and therefore high quality habitat is likely contiguous patches of forested habitat with a thick layer of loose duff. This is likely most abundant in moist deciduous and mixed forests.

Habitat Protection Status

Little is known about the distribution and habitat for Southern Bog lemmings in New Hampshire specifically.

Habitat Management Status

There are no habitat management efforts for Southern bog lemmings.

Threats to this Species or Habitat in NH

Threat rankings were calculated by groups of taxonomic or habitat experts using a multistep process (details in Chapter 4). Each threat was ranked for these factors: Spatial Extent, Severity, Immediacy, Certainty, and Reversibility (ability to address the threat). These combined scores produced one overall threat score. Only threats that received a “medium” or “high” score have accompanying text in this profile. Threats that have a low spatial extent, are unlikely to occur in the next ten years, or there is uncertainty in the data will be ranked lower due to these factors.

There are no threats ranked high or medium for this species.

List of Lower Ranking Threats:

Habitat conversion and impacts from logging that converts mesic to xeric

Actions to benefit this Species or Habitat in NH

Technical assistance and outreach for timber operations in areas likely to have lemmings

Primary Threat Addressed: Habitat conversion and impacts from logging that converts mesic to xeric

Specific Threat (IUCN Threat Levels): Biological Resource Use

Objective:

General Strategy:

Political Location:

Watershed Location:

References, Data Sources and Authors

Data Sources

(DeGraaf and Yamasaki, 2001)

Information on habitat, population distribution, and status was collected from unpublished data, scientific literature, and limited agency data.

Data Quality

With the cooperation of the WMNF, Yamasaki conducted a 3-year systematic survey of small mammals between 1995 and 1997. This survey took place in potential habitats across three levels of vegetation management in the White Mountains region. Out of the 108 study sites surveyed across managed, unmanaged, and remote locations in the forest, Southern Bog lemming captures varied between 0.03 to 0.69 captures per 100 trap-nights (Yamasaki 1997).

There is very little data on the condition of the species and its habitats statewide.

Appendix A: Mammals

2015 Authors:

Jillian Kilborn, NHFG

2005 Authors:

Literature

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