SPECIES PROFILE

Eastern Small-Footed Bat

Myotis leibii

Federal Listing: Not listed
State Listing: Endangered
Global Rank: G3
State Rank: S1
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Element 1: Distribution and Habitat

1.1 Habitat Description

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 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Jennings 1997), although all of the individuals documented in New Hampshire were found on exposed surfaces (Reynolds, unpublished data).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 radiotagged 3 individuals (2 adult females and 1 adult male). Data from radiotagged bats revealed several roost sites, each within rock crevices in outcrops near the base of the Surry Mountain Lake dam. Although no radiotagged 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.

1.2 Justification

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.

1.3 Protection and Regulatory Status

No specific ESA regulation governs take, transport, or use of this species. Scientific collection or research requiring capture of individuals requires a permit through New Hampshire Fish and Game (NHFG). Possession of live bats requires a permit under NHFG FIS 800.

1.4 Population and Habitat 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 9 individuals from one locality (figure 1), and summer records are known from only 5 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), and Surry (Cheshire County; Chenger 2005). Only 1, 1, 2, 2, and 11 records from each locality exist, respectively.

1.5 Town Distribution Map

Not completed for this species.

1.6 Habitat Map

1.7 Sources of Information

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.

1.8 Extent and Quality of Data

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.

1.9 Distribution Research

Potential hibernacula should be surveyed to determine the winter distribution of eastern small-footed bats. To determine summer distribution, long-term, statewide mist-netting and echolocation surveys (use Anabat acoustic survey methods when mist-netting) should be completed. Initial mist-netting surveys might focus on locations near cliff faces and rock outcrops, and should record all banding records in the Northeast Banding Database developed by the Northeast Working Group on Bats (NEWGB). An intensive banding program using state-issued wing bands would yield data on the summer distribution of all bat species in New Hampshire and might provide insight into where summer populations overwinter.

Element 2: Species/Habitat Condition

2.1 Scale

Due to the small number of suitable mines in New Hampshire, each mine has been treated as a conservation planning unit under the habitat profile.

2.2 Relative Health of Populations

Eastern small-footed bats are known only from the Mascot Lead Mine (Coos County). The New Hampshire Natural Heritage Survey ranked Mascot Lead Mine as 'B/C', indicating 'fair to good quality and prospects for long-term conservation'. In 2004, 9 hibernating individuals were documented in this mine. Given the small number of surveys, there is not enough data to conduct an analysis of trends and viability of winter populations.

2.3 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 gat at Mascot Lead Mine. Lack of data on the distribution of eastern small-footed bats prohibits identification of conservation opportunities beyond the need to conduct additional habitat surveys.

2.4 Relative Quality of Habitat Patches

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. 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.

2.5 Habitat Patch 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'.

2.6 Habitat Management Status

The only ongoing habitat management action occurring in New Hampshire 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 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

2.7 Sources of Information

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).

2.8 Extent and Quality of Data

There have been 4 winter surveys at Mascot Lead Mine since 1987; 2 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).

2.9 Condition Assessment Research

Microclimate data (primarily temperature) must be obtained at Mascot Lead Mine for an entire winter season. Data logging probes should be mounted on rock surfaces near eastern small-footed bat roosts to obtain roost-specific data. These data can then be used to assess microclimate environments at potential hibernacula throughout the state. Summer surveys should include statewide mist-netting to better understand distribution, telemetry studies to determine habitat use, life history studies, and diet analyses.

Element 3: Species Threat Assessment

3.1.1 Recreation

See Caves / Mines Habitat.

3.1.2 Nonpoint Source Pollution

(A) Exposure Pathway

The only known summer roosting site of eastern small-footed bats in New Hampshire is the Surry Mountain Lake Dam, where bats roost in man-made boulder crevices along the southern outflow of the Surry Mountain Reservoir. To limit the amount of

plant material (especially woody material) growing in the rock slope, USACE sprays the rock slope with herbicide. It is unknown whether the direct application of herbicide on the roost area of eastern small-footed bats reduces the quality of the roost area or causes mortality of adult and young bats.

(B) Evidence
Vegetation management is part of the regular maintenance at water reservoirs operated by the USACE. Because bats have a high metabolic rate and localized foraging area, they are likely to be sensitive to pesticides (Schmidt et al. 2002). Indeed, data support this (Luckens and Davis 1964) and suggest that most of the exposure risk comes from direct contact at the roost (Clark et al. 1978). However, these studies also suggest that herbicides are less toxic than insecticides (Sullivan 1990).

Many toxic effects of pesticides involve the accumulation of toxins within fat tissue. At high doses, exposure can result in death at the roost site. At lower doses, the toxins may be released during periods of negative energy balance such as hibernation or lactation (Kunz et al. 1977). In adults, the main effect of an accumulating toxin would be increasing over-winter mortality at the hibernaculum as toxins are released into the bloodstream during arousal. For juveniles, the main effect would be a reduction in population recruitment through increased mortality due to the transfer of toxins through milk. It has also been suggested that young bats are at more risk of contact exposures due to their highly vascularized skin and lack of pelage (Kunz et al. 1977).

3.2 Sources of Information

Much of the information on the biology of eastern small-footed bats in caves and mines comes from published literature and from experts such as M. Brock Fenton of York University, Canada. Information on the biology of the foraging habitat of eastern small-footed bats comes from the published literature.

3.3 Extent and Quality of Data

The eastern small-footed bat is the least known of northeastern bats (Thomas 1993). Therefore, most data on threats to this species are based on its morphological and ecological similarity to other hibernating *Myotis* spp. For example, the effect of disturbance on hibernating bats (element 3.1.1) is well documented. In contrast, there are no data on the effects of wind resource development (element 3.1.2) on small-footed bats. Similarly, the effect of herbicides on bats (element 3.1.3) has not been documented in the literature.

3.4 Threat Assessment Research

Surveys should document the prevalence of eastern small-footed bats within the state and should determine the nature of herbicides used near potential maternity roosts. Mist-netting and radio-telemetry studies help locate any core roost habitat for eastern small-footed bats. Several years of capture and telemetry data at roost areas would determine site fidelity and reproductive success.

Element 4: Conservation Actions

4.1.1 Gating, Habitat Protection
See Caves/Mines.

4.1.2 Site-Selection and Pre-Construction Regulations, Regulation and Policy

4.1.3 Herbicide Management, Habitat Protection

(A) Herbicide Exposure at Roost Sites

(B) Justification
- There are no data on the exact effects of herbicides on bats. However, reducing or eliminating exposure to herbicides should be easy and would cost little.
- If rock-roosting bats are being exposed to high levels of herbicides, and that exposure is poisoning bats, then reducing exposure will have an immediate effect on population recruitment through reduced juvenile mortality and increased over-winter survivorship
- Modifying or eliminating herbicide usage at each USACE site is the appropriate scale for action.
- Given that eastern small-footed bats are the least studied bats in the Northeast, and given that the actions suggested will cost little, immediate action is appropriate.
- The exact nature of herbicide use (type, volume,

and timing), and the appropriate responses to it, should be determined.

(C) Conservation Performance Objective
The objective is to regulate herbicide application practices (type, volume, and timing) to minimize exposure.

(D) Performance Monitoring
The conservation action would be conducted at a USACE facility that uses boulder-retaining dams. The most likely location would be the Surry Mountain Reservoir because there are existing eastern small-footed bats using rock roosts at this site (Chenger 2005). Additionally, a control site would need to be established, either using a USACE facility that suspends vegetation management or finding an eastern small-footed colony that is not at herbicide exposure risk. Relative exposure would be compared between populations during the reproductive season (June through August) and in coordination with USACE personnel.

(E) Ecological Response Objective
The desired ecological response to reducing herbicide exposure is an increase in population recruitment within the exposed population.

(F) Response Monitoring
The response indicators required by this action could be collected in conjunction with radio telemetry studies that are focusing on habitat usage patterns in eastern small-footed bats. Therefore, the response measures would be inexpensive and would generate results that could immediately inform management decisions.

(G) Implementation
This conservation action will require having both treatment and control populations of eastern small-footed bats in reasonable proximity. The survey would most likely be done in coordination with radiotelemetry research, and therefore would be concentrated within a two-week time in late June and early August. The researchers would establish a reliable and non-invasive method of collecting data on herbicide loads. Because this action involves a state-listed species on federal land, potential partners include the NHFG, the United States Fish and Wildlife Service, and the USACE. Additional partnerships could be established with local non-governmental organizations (NGOs).

(H) Feasibility
The most difficult component of the conservation action will be finding two populations of eastern small-footed bats in proximity. Because so little is known about their abundance and distribution within the state, it will require extensive landscape-level surveying to find populations, and intensive radio telemetry to adequately understand their core roosting and foraging habitat.

4.2 Conservation Action Research

The conservation action research goal for eastern small-footed bats is to document their existence within the state and protect critical habitats and resources. The primary research action is to survey existing and potential hibernacula. This will include winter surveys of known and potential hibernacula and microclimate measurements at each site. These actions will inform future management decisions about the use of bat gates (element 4.1.1).

Element 5: References

5.1 Literature

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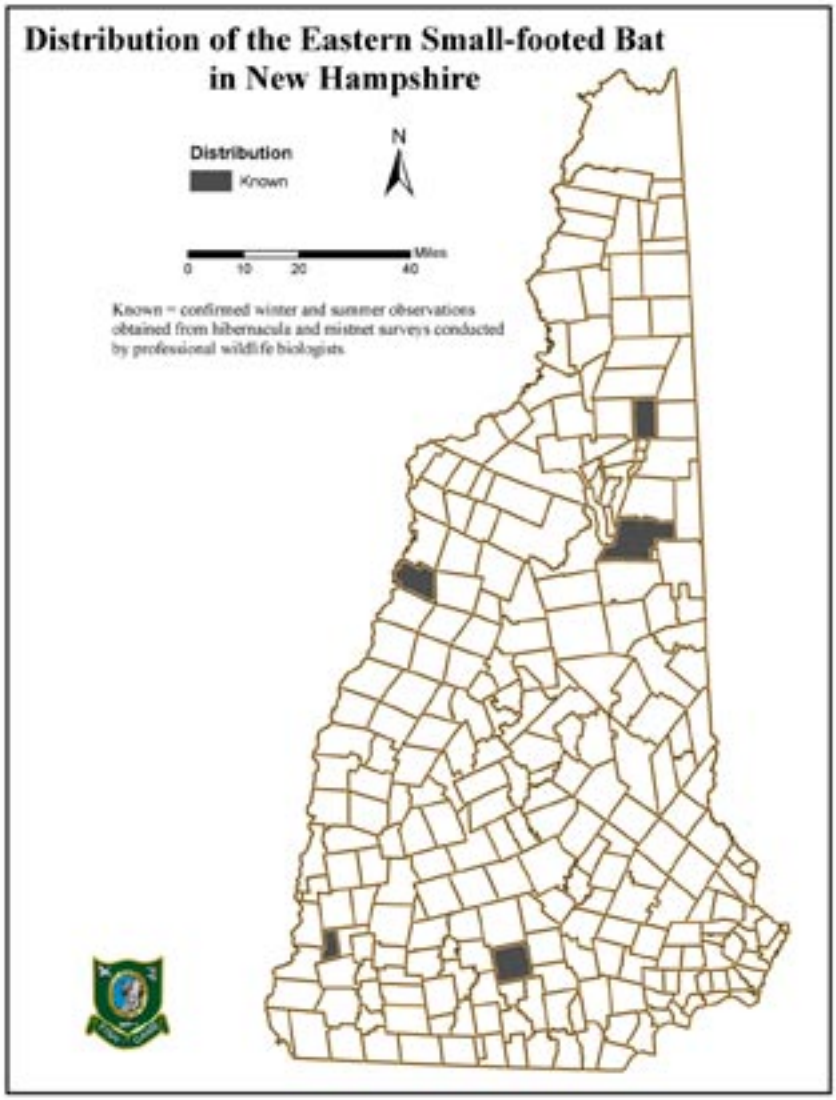
Distribution of the Eastern Small-footed Bat in New Hampshire
Distribution
Known
N
Miles
0 10 20 40
Known = confirmed winter and summer observations obtained from hibernacula and mistnet surveys conducted by professional wildlife biologists.