NATIONAL ARCHIVES AND RECORDS ADMINISTRATION
1985

FEDERAL REGISTER

Vol. 78 Wednesday,
No. 191 October 2, 2013

Part III

Department of the Interior

Fish and Wildlife Service

50 CFR Part 17

Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species; Proposed Rule

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R5–ES–2011–0024; 4500030113]

RIN 1018–AY98

Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule; 12-month finding.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), announce a 12-month finding on a petition to list the eastern small-footed bat (*Myotis leibii*) and the northern long-eared bat (*Myotis septentrionalis*) as endangered or threatened under the Endangered Species Act of 1973, as amended (Act) and to designate critical habitat. After review of the best available scientific and commercial information, we find that listing the eastern small-footed bat is not warranted but listing the northern long-eared bat is warranted. Accordingly, we propose to list the northern long-eared bat as an endangered species throughout its range under the Act. We also determine that critical habitat for the northern long-eared bat is not determinable at this time. This proposed rule, if finalized, would extend the Act's protections to the northern long-eared bat. The Service seeks data and comments from the public on this proposed listing rule for the northern long-eared bat.

DATES: We will consider comments received or postmarked on or before December 2, 2013. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES** section, below) must be received by 11:59 p.m. Eastern Time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in the **FOR FURTHER INFORMATION CONTACT** section by November 18, 2013.

ADDRESSES: You may submit comments by one of the following methods:

(1) In the Search box, enter Docket No. FWS–R5–ES–2011–0024, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, click on the Proposed Rules link to locate this document. You may submit a comment by clicking on ''Comment Now!'' If your comments will fit in the provided comment box, please use this feature of *http://www.regulations.gov,* as it is most compatible with our comment review procedures. If you attach your comments as a separate document, our preferred file format is Microsoft Word. If you attach multiple comments (such as form letters), our preferred format is a spreadsheet in Microsoft Excel.

(2) *By hard copy:* Submit by U.S. mail or hand-delivery to: Public Comments Processing, Attn: FWS–R5–ES–2011–0024; Division of Policy and Directives Management; U.S. Fish and Wildlife Service; 4401 N. Fairfax Drive, MS 2042–PDM; Arlington, VA 22203.

We request that you send comments only by the methods described above. We will post all information received on *http://www.regulations.gov.* This generally means that we will post any personal information you provide us (see the Information Requested section below for more details).

FOR FURTHER INFORMATION CONTACT: Peter Fasbender, Field Supervisor, U.S. Fish and Wildlife Service, Green Bay Ecological Services Office, 2661 Scott Tower Dr., New Franken, Wisconsin, 54229; by telephone (920) 866–3650 or by facsimile (920) 866–1710. *mailto:* If you use a telecommunications device for the deaf (TDD), please call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Act, if a species is determined to be an endangered or threatened species throughout all or a significant portion of its range, we are required to promptly publish a proposal in the **Federal Register** and make a determination on our proposal within one year. Listing a species as an endangered or threatened species can only be completed by issuing a rule.

This document consists of:

- Our status review and finding that listing is warranted for the northern long-eared bat and not warranted for the eastern small-footed bat.
- A proposed rule to list the northern long-eared bat as an endangered species. This rule assesses best available information regarding the status of and threats to the northern long-eared bat.

The basis for our action. Under the Act, we can determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We have determined that the northern long-eared bat is in danger of extinction, predominantly due to the threat of white-nose syndrome (Factor C). However, other threats (Factors A, B, E) when combined with white-nose syndrome heighten the level of risk to the species.

We will seek peer review. We are seeking comments from knowledgeable individuals with scientific expertise to review our analysis of the best available science and application of that science and to provide any additional scientific information to improve this proposed rule. Because we will consider all comments and information we receive during the comment period, our final determination may differ from this proposal.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments or information from other concerned Federal and State agencies, the scientific community, or any other interested party concerning this proposed rule. We particularly seek comments regarding the northern long-eared bat concerning:

(1) The species' biology, range, and population trends, including:

(a) Habitat requirements for feeding, breeding, and sheltering;

(b) Genetics and taxonomy;

(c) Historical and current range, including distribution patterns;

(d) Historical and current population levels, and current and projected trends; and

(e) Past and ongoing conservation measures for the species, its habitat, or both.

(2) Any information on the biological or ecological requirements of the species, and ongoing conservation measures for the species and its habitat.

(3) Biological, commercial trade, or other relevant data concerning any threats (or lack thereof) to this species and regulations that may be addressing those threats.

(4) Current or planned activities in the areas occupied by the species and possible impacts of these activities on this species.

(5) Additional information regarding the threats to the species under the five listing factors, which are:

(a) The present or threatened destruction, modification, or curtailment of its habitat or range;

(b) Overutilization for commercial, recreational, scientific, or educational purposes;

(c) Disease or predation;

(d) The inadequacy of existing regulatory mechanisms; and

(e) Other natural or manmade factors affecting its continued existence.

(6) The reasons why areas should or should not be designated as critical habitat as provided by section 4 of the Act (16 U.S.C. 1531 *et seq.*), including the possible risks or benefits of designating critical habitat, including risks associated with publication of maps designating any area on which this species may be located, now or in the future, as critical habitat.

(7) The following specific information on:

(a) The amount and distribution of habitat for northern long-eared bat;

(b) What areas, that are currently occupied and that contain the physical and biological features essential to the conservation of this species, should be included in a critical habitat designation and why;

(c) Special management considerations or protection that may be needed for the essential features in potential critical habitat areas, including managing for the potential effects of climate change;

(d) What areas not occupied at the time of listing are essential for the conservation of this species and why;

(e) The amount of forest removal occurring within known summer habitat for this species;

(f) Information on summer roost habitat requirements that are essential for the conservation of the species and why; and

(g) Information on species winter habitat (hibernacula) features and requirements for the species.

(8) Information on the projected and reasonably likely impacts of changing environmental conditions resulting from climate change on the species and its habitat.

Please note that submissions merely stating support for or opposition to the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or threatened species must be made ''solely on the basis of the best scientific and commercial data available.''

You may submit your comments and materials concerning this proposed rule by one of the methods listed in **ADDRESSES**. We request that you send comments only by the methods described in the **ADDRESSES** section. If you submit information via *http://www.regulations.gov,* your entire submission—including any personal identifying information—will be posted on the Web site. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on *http://www.regulations.gov.* Please include sufficient information with your comments to allow us to verify any scientific or commercial information you include.

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on *http://www.regulations.gov,* or by appointment, during normal business hours, at the U.S. Fish and Wildlife Service, Green Bay, Wisconsin Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Background

Section 4(b)(3)(B) of the Act requires that, for any petition to revise the Federal Lists of Threatened and Endangered Wildlife and Plants that contains substantial scientific or commercial information that listing a species may be warranted, we make a finding within 12 months of the date of receipt of the petition on whether the petitioned action is: (a) Not warranted; (b) warranted; or (3) warranted, but the immediate proposal of a regulation implementing the petitioned action is precluded by other pending proposals to determine whether any species is endangered or threatened, and expeditious progress is being made to add or remove qualified species from the Federal Lists of Endangered and Threatened Wildlife and Plants. In this document, we have determined that the petitioned action to list the eastern small-footed bat is not warranted, but listing the northern long-eared bat is warranted and; therefore, we are publishing a proposed rule to list the northern long-eared bat.

Previous Federal Actions

On September 18, 1985 (50 FR 37958), November 21, 1991 (56 FR 58804), and November 15, 1994 (59 FR 58982), the Service issued notices of review identifying the eastern small-footed bat as a ''category-2 candidate'' for listing under the Act. However, on December 5, 1996 (50 FR 64481), the Service discontinued the practice of maintaining a list of species regarded as ''category-2 candidates,'' that is, taxa for which the Service had insufficient information to support issuance of a proposed listing rule.

On January 21, 2010, we received a petition from the Center for Biological Diversity, requesting that the eastern small-footed bat and northern long-eared bat be listed as endangered or threatened and that critical habitat be designated under the Act. The petition clearly identified itself as such and included the requisite identification information for the petitioner, as required by 50 CFR 424.14(a). In a February 19, 2010, letter to the petitioner, we acknowledged receipt of the petition and stated that we would review the petitioned request for listing and inform the petitioner of our determination upon completion of our review. On June 23, 2010, we received a notice of intent to sue (NOI) from the petitioner for failing to make a timely 90-day finding. In a letter dated July 20, 2010, we responded to the NOI, stating that we had assigned lead for the two bat species to the Services' Midwest and Northeast Regions, and that although completing the 90-day finding within the 90 days following our receipt of the petition was not practicable, the Regions were recently allocated funding to work on the findings and had begun review of the petition. On June 29, 2011, we published in the **Federal Register** (76 FR 38095) our finding that the petition to list the eastern small-footed bat and northern long-eared bat presented substantial information indicating that the requested action may be warranted, and we initiated a status review of the species. On July 12, 2011, the Service filed a proposed settlement agreement with the Center for Biological Diversity in a consolidated case in the U.S. District Court for the District of Columbia. The settlement agreement was approved by the court on September 9, 2011. As part of this settlement agreement, the Service agreed to complete a status review for the eastern small-footed bat and northern long-eared bat by September 30, 2013, and if warranted for listing, publish a proposed listing rule also by that date.

Species Information

Eastern Small-Footed Bat

Taxonomy and Species Description

The eastern small-footed bat (*Myotis leibii*) belongs to the Order Chiroptera, Suborder Microchiroptera, and Family Vespertilionidae (Best and Jennings 1997, p. 1). The eastern small-footed bat is considered monotypic, whereby no subspecies has been recognized (van Zyll de Jong 1984, p. 2525). This species has been identified by different scientific names: *Vespertilio leibii* (Audubon and Bachman 1842, p. 284) and *Myotis subulatus* (Miller and Allen 1928, p. 164). This species also has been identified by different common names: Leib's bat (Audubon and Bachman 1842, p. 284), least brown bat (Mohr 1936, p. 62), and Leib's masked bat or least bat (Hitchcock 1949, p. 47). The Service agrees with the treatment in Best and Jennings (1997, p. 1) regarding the scientific and common names and will refer to this species as eastern small-footed bat and recognizes it as a listable entity under the Act.

The eastern small-footed bat is one of the smallest North American bats, weighing from 3 to 8 grams (g) (0.1 to 0.3 ounces (oz)) (Merritt 1987, p. 94). Total body length is from 73 to 85 millimeters (mm) (2.9 to 3.4 inches (in)), tail length is from 31 to 34 mm (1.2 to 1.3 in), forearm length is from 30 to 36 mm (1.2 to 1.4 in), and wingspan is from 212 to 248 mm (8.4 to 9.8 in) (Barbour and Davis 1969, p. 103; Merritt 1987, p. 94; Erdle and Hobson 2001, p. 6; Amelon and Burhans 2006, p. 57). Eastern small-footed bats are recognized by their short hind feet (less than 8 mm (0.3 in)), short ears (less than 15 mm (0.6 in)), black facial mask, black ears, keeled calcar (a spur of cartilage that helps spread the wing membrane), and small flattened skull (Barbour and Davis 1969, p. 103; Best and Jennings 1997, p. 1). The wings and interfemoral membrane (the wing membrane between the tail and hind legs) are black. The dorsal fur is black at the roots and tipped with light brown, giving it a dark yellowish-brown appearance. The ventral fur is gray at the roots and tipped with yellowish-white (Audubon and Bachman 1842, pp. 284–285).

Distribution and Abundance

The eastern small-footed bat occurs from eastern Canada and New England south to Alabama and Georgia and west to Oklahoma. The species' range includes 26 states and 2 Canadian provinces, including Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Mississippi, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, Ontario, and Quebec. Relative to other species of bats in its range, eastern small-footed bats are considered uncommon (Best and Jennings 1997, p. 3). They historically have been considered rare because of their patchy distribution and generally low population numbers (Mohr 1932, p. 160). In areas with abundant summer habitat, however, they have been found to be relatively common (Brack *et al.,* unpublished manuscript). Johnson *et al.* (2011, p. 99) observed that capture success decreased as the distance increased from suitable roosting habitat. Eastern small-footed bats have also been noted for their ability to detect and avoid mist nets, which are typically relied upon for summer bat surveys (Barbour and Davis 1974, p. 84), suggesting their numbers could be underrepresented (Tyburec 2012).

Eastern small-footed bats have most often been detected during winter hibernacula (the areas where the bats hibernate during winter; primarily caves and mines) surveys (Barbour and Davis 1969, p. 103). Two-hundred eighty-nine hibernacula (includes cave and abandoned mine features only) have been identified across the species' range, though most contain just a few individuals. The majority of known hibernacula occur in Pennsylvania (n=55), New York (n=53), West Virginia (n=50), Virginia (n=33), Kentucky (n=26), and North Carolina (n=25), but hibernacula are also known from Tennessee (approximately 12), Arkansas (n=9), Maryland (n=7), Vermont (n=6), Missouri (n=3), Maine (n=2), Massachusetts (n=2), New Hampshire (n=2), New Jersey (n=2), Indiana (n=1), and Oklahoma (n=1). In Vermont, eastern small-footed bats were consistently found in very small numbers and often not detected at all during periodic surveys of hibernacula (Trombulak *et al.* 2001, pp. 53–57). Their propensity for hibernating in cracks and crevices in cave and mine floors and ceilings may also mean they are more often overlooked than other cave-hibernating bat species. The largest number of hibernating individuals ever reported for the species was 2,383, which were found in a mine in Essex County, New York (Herzog 2013, pers. comm.).

In Pennsylvania, eastern small-footed bats were observed at 55 of 480 (12 percent) hibernacula from 1984 to 2011, accounting for only 0.1 percent of the total bats observed during winter hibernacula surveys. The number of eastern small-footed bats observed per site fluctuates annually and ranges from 1 to 46 (mean = 4, median = 1). Summer mist-net surveys also confirm that eastern small-footed bats are observed less frequently than other bat species. From 1995 to 2011, of the 7,007 bat mist-net surveys conducted in Pennsylvania, only 104 surveys (2 percent) include eastern small-footed bat captures, representing only 0.3 percent of the total bats captured (Butchkoski 2011, unpublished data). Of the other states within the species' range, seven states (Alabama, Connecticut, Delaware, Indiana, Massachusetts, Mississippi, and Rhode Island) have no summer records, and of those States with summer records, the most have fewer than 20 capture locations (Service, unpublished data).

Illustrating the potential for under-representation of the species during hibernacula surveys, the following is an example from one state. From 1939 to 1944, over 100 caves were surveyed in Pennsylvania (and a portion of West Virginia), and out of these, eastern small-footed bats were observed at only 7 sites, totaling 363 individuals. In 1978 and 1979, the same seven caves were surveyed again, and no eastern small-footed bats were observed (Felbaum *et al.* 1995, p. 24). However, surveys conducted from 1980 to 1988, found eastern small-footed bats inhabiting 21 hibernacula from an 8-county area in Pennsylvania (Dunn and Hall 1989, p. 169), and by 2011, surveys had confirmed presence at 55 sites in a 14-county area (Pennsylvania Game Commission, unpublished data). This example is typical of the species' potential for fluctuation throughout its range.

Habitat

Winter Habitat

Eastern small-footed bats have been observed most often overwintering in hibernacula that include caves and abandoned mines (*e.g.,* limestone, coal, iron). Because they tolerate colder temperatures more so than other *Myotis* bats, they are most often encountered close to cave or mine entrances where humidity is low and temperature fluctuations may be high relative to more interior areas (Hitchcock 1949, p. 53; Barbour and Davis 1969, p. 104; Best and Jennings 1997, pp. 2–3; Veilleux 2007, p. 502). On occasion, however, they have been observed hibernating deep within cave interiors (Hitchcock 1965, p. 9; Gunier and Elder 1973, p. 490). In Pennsylvania, caves containing wintering populations of eastern small-footed bats have been found in hemlock-dominated forests in the foothills of mountains that rise to 610 meters (m) (2000 feet (ft)) (Mohr 1936, p. 63). Dunn and Hall (1989, p. 169) noted that 52 percent of Pennsylvania hibernacula used by eastern small-footed bats were small caves of less than 150 m (500 ft) in length. Before it was commercialized, the cave in Fourth Chute, Ontario was home to a relatively large number of hibernating eastern small-footed bats (n = 434) and is described in Hitchcock (1949, pp. 47–54) as follows: ‘‘the cave is in a limestone outcropping on the north bank of the Bonnechere River, at an elevation of 425 ft (130 m). Sinkholes and large openings to passages make this cave conspicuous. Most of the land immediately surrounding the cave area is open field or pasture, with wooded hills beyond. The part utilized by bats for hibernation lies farthest from the river, and is entered from one of the large, outside passageways through a narrow opening; the main passages are well ventilated by a through draft; the forests near Fourth Chute are mixed, with spruce and white cedar predominating among the conifers.’’ Eastern small-footed bats were found in cold, dry, drafty locations at Fourth Chute, usually in narrow cracks in the cave wall or roof (Hitchcock 1949, p. 53).

Winter habitat used by eastern small-footed bats may also include non-cave or non-mine features, such as rock outcrops and stone highway culverts. In Pennsylvania, eastern small-footed bats were observed hibernating multiple years during the months of January and March in a rock outcrop located high above the Juniata River. The bats were found in small cracks and crevices at the back of a 4.6-m (15-ft) depression in the rock outcrop. Big brown bats (*Eptesicus fuscus*) were also present. Temperatures within the cracks where bats were hibernating ranged from 1.7 to 8.3 °C (35 to 47 °F). Observers noted that it seemed a cold, unstable site for hibernating bats (Pennsylvania Game Commission, unpublished data). In West Virginia, an eastern small-footed bat was observed in a crack in a rock outcrop about 1.5 to 1.8 m (5 to 6 ft) above the ground in February (Stihler 2012, pers. comm.). Sasse *et al.* (in press) reported a single female eastern small-footed bat hibernating inside a stone highway culvert underneath a highway in Arkansas. Mohr (1936, p. 64) noted fluctuations in the number of eastern small-footed bats observed at hibernacula during winter surveys conducted 2 to 3 weeks apart, suggesting bats left caves and mines during warmer winter periods only to return when it became colder. Consequently, eastern small-footed bats may be utilizing non-cave or non-mine rock features during mild or milder portions of winters, but to what extent they may be doing so is largely unknown.

Summer Habitat

In the summer, eastern small-footed bats are dependent on emergent rock habitats for roosting and on the immediately surrounding forests for foraging (Johnson *et al.* 2009, p. 5). Eastern small-footed bats have been observed roosting singly or in small maternity colonies in talus fields and slopes, rock-outcrops, rocky ridges, sandstone boulders, shale rock piles, limestone spoil piles, rocky terrain of strip mine areas, and cliff crevices, but have also been found on humanmade structures such as buildings and expansion joints of bridges (Barbour and Davis 1969, p. 103; McDaniel *et al.* 1982, p. 93; Merritt 1987, p. 95; MacGregor and Kiser 1998, p. 175; Roble 2004, p. 43; Amelon and Burhans 2006, p. 58; Chenger 2008a, p. 10; Chenger 2008b, p. 6; Johnson *et al.* 2011, p. 100; Johnson and Gates 2008, p. 456; Hauser and Chenger 2010; Sanders 2010; Mumma and Capouillez 2011, p. 24; Thomson and O'Keefe 2011; Brack *et al.,* unpublished manuscript). Other humanmade features exploited by eastern small-footed bats include rocky dams, road cuts, rocky mine lands, mines, and rock fields within transmission-line and pipeline clearings (Sanders 2011, pers. comm.; Johnson *et al.* 2011, p. 99; Thomson and O'Keefe 2011). Roost sites are most often located in areas with full solar exposure, but have also been found in areas with moderate to extensive canopy cover (Johnson *et al.* 2011, p. 100; Brack *et al.* unpublished manuscript, pp. 9–15; Thomson and O'Keefe 2012). In New Hampshire, eastern small-footed bats have been observed roosting between boulder crevices along the southern outflow of the Surry Mountain Reservoir (Veilleux and Reynolds 2006, p. 330). In Vermont, one summer colony, containing approximately 30 eastern small-footed bats, was located in a slate roof of a house (Darling and Smith 2011, p. 4). Tuttle (1964, p. 149) reported two individuals found in April in Tennessee under a large flat rock at the edge of a quarry surrounded by woods and cow pastures (elevation 549 m (1,800 ft)). In Ontario, a colony of approximately 12 bats was found in July behind a shed door (Hitchcock 1955, p. 31). In addition, small numbers of adult and juvenile eastern small-footed bats have been observed using caves and mines as roosting habitat during the summer months in Maryland, Pennsylvania, Kentucky, Arkansas, West Virginia, and Virginia (Davis *et al.* 1965, p. 683; Krutzsch 1966, p. 121; Hall and Brenner 1968, p. 779; McDaniel *et al.* 1982, p. 93; Agosta *et al.* 2005, p. 1213; Reynolds, pers. comm.).

Summer foraging habitat used by eastern small-footed bats includes rivers, streams, riparian forests, upland forests, clearings, strip mines, and ridgetops (Chenger 2003, pp. 14–23; Chenger 2008a, pp. 10 and 69–71; Chenger 2008b, p. 6; Hauser and Chenger 2010; Johnson *et al.* 2009, p. 3; Mumma and Capouillez 2011, p. 24; Brack *et al.,* unpublished manuscript).

Biology

Hibernation

Eastern small-footed bats hibernate during the winter months to conserve energy from increased thermoregulatory demands and reduced food resources. To increase energy savings, individuals enter a state of torpor where internal body temperatures approach ambient temperature, metabolic rates are significantly lowered, and immune function declines (Thomas *et al.* 1990, p. 475; Thomas and Geiser 1997, p. 585; Bouma *et al.* 2010, p. 623). Periodic arousal from torpor naturally occurs in all hibernating mammals (Lyman *et al.* 1982, p. 92), although arousals remain among the least understood of hibernation phenomena (Thomas and Geiser 1997, p. 585). Numerous factors (*e.g.,* reduction of metabolic waste, body temperature theories, and water balance theory) have been proposed to account for the occurrence and frequency of arousals (Thomas and Geiser 1997, p. 585). Each time a bat arouses from torpor, it uses a significant amount of energy to warm its body and increase its metabolic rate. The cost and number of arousals are the two key factors that determine energy expenditures of hibernating bats in winter (Thomas *et al.* 1990, p. 475). For example, little brown bats (*Myotis lucifugus*) used as much fat during a typical arousal from hibernation as would be used during 68 days of torpor, and arousals and subsequent activity may constitute 84 percent of the total energy used by hibernating bats during the winter (Thomas *et al.* 1990, pp. 477–478).

Of all hibernating bats, eastern small-footed bats are among the last to enter hibernacula and the first to emerge in the spring (Barbour and Davis 1969, p. 104). Hibernation is approximately mid-November to March (Barbour and Davis 1969, p. 104; Dalton 1987, p. 373); however, there are indications that eastern small-footed bats are active during mild winter weather (Mohr 1936, p. 64; Fenton 1972, p. 5). Fenton (1972, p. 5) observed that when temperatures at hibernation sites rose above 4°

Celsius (C) (39.2 °F (F)), eastern small-footed bats, along with big brown bats, aroused and departed from caves and mines. Whether these bats departed to take advantage of prey availability during mild winter spells or seek out other hibernation sites was never determined. Frequent oscillations in microclimate near cave or mine entrances may contribute to frequent arousals from torpor by eastern small-footed bats (Hitchcock 1965, p. 8). Frequent arousals may deplete energy reserves at a faster rate than would more continuous torpor characteristic of other cave-hibernating bats, contributing to a lower survival rate compared to other *Myotis* bats (Hitchcock *et al.* 1984, p. 129). Eastern small-footed bats lose up to 16 percent of their body weights during hibernation (Fenton 1972, p. 5).

Eastern small-footed bats often hibernate solitarily or in small groups and have been found hibernating in the open, in small cracks in cave walls and ceilings, in rock crevices in cave or mine floors, and beneath rocks (Hitchcock 1949, p. 53; Davis 1955, p. 130; Martin *et al.* 1966, p. 349; Barbour and Davis 1969, p. 104; Banfield 1974, p. 52; Dalton 1987, p. 373). Martin *et al.* (1966, p. 349) observed up to 30 eastern small-footed bats hanging from the ceilings of two mines in New York. From one small fissure, Hitchcock (1949, p. 53) extracted 35 eastern small-footed bats that were packed so tightly that it appeared almost impossible for those farthest in to get air. This propensity for hibernating in narrow cracks and crevices may mean they are sometimes overlooked by surveyors. In Maryland, for example, far fewer eastern small-footed bats were observed by surveyors during internal hibernacula surveys than were caught in traps during spring emergence (Maryland Department of Natural Resources 2011, unpublished data).

Eastern small-footed bats have been observed hibernating in caves that also contain little brown bats, big brown bats, northern long-eared bats (*Myotis septentrionalis*), Indiana bats (*Myotis sodalis*), tri-colored bats (*Perimyotis subflavus*), Virginia big-eared bats (*Corynorhinus townsendii virginianus*), gray bats (*Myotis grisescens*), and Rafinesque's big-eared bats (*Corynorhinus rafinesquii rafinesquii*), and approximately equal numbers of males and females occupy the same areas and cluster together indiscriminately (Hitchcock 1949, pp. 48–49; Hitchcock 1965, pp. 6–8; Fenton 1972, p. 3; Best and Jennings 1997, p. 3; Hemberger 2011, unpublished data; Graeter 2011, unpublished data; Graham 2011, unpublished data). Fenton (1972, p. 5) commonly observed eastern small-footed bats hibernating in physical contact with big brown bats, usually in small clusters of fewer than five bats, but never close to or in contact with little brown or Indiana bats. Eastern small-footed bats often hibernate in a horizontal position, tucked between cracks and crevices, unlike most *Myotis* bats, which hang in the open (Merritt 1987, p. 95). When suspended, however, the position of the forearm is unique in that, instead of hanging parallel to the body, as in other *Myotis* bats, the forearms are somewhat extended (Banfield 1974, p. 52). Like most bat species, eastern small-footed bats exhibit high site fidelity to hibernacula, with individuals returning to the same site year after year (Gates *et al.* 1984, p. 166).

Migration and Homing

Eastern small-footed bats have been observed migrating up to 19 kilometers (km) (12 miles (mi)) (Hitchcock 1955, p. 31) and as little as 0.1 km (0.06 mi) from winter hibernacula to summer roost sites (Johnson and Gates 2008, p. 456). The distance traveled is probably influenced by the availability of hibernacula and roosting sites across the landscape (Johnson and Gates 2008, p. 457). But in general, data suggest that this species hibernates in proximity to its summer range (van Zyll de Jong 1985, p. 119; Divoll *et al.* 2011). Eastern small-footed bats show a definite homing ability (Best and Jennings 1997, p. 4). Marked bats were present in the same cave in consecutive winters, and when moved to a different cave during the winter, they returned to the original cave the following winter (Mohr 1936, p. 64). In the Mammoth Cave region of Kentucky, eastern small-footed bats are fairly common in late summer in the groups of migrating bats, although the whereabouts of these bats at other seasons is unknown (Barbour and Davis 1969, p. 104).

Summer Roosts

Both males and females change summer roost sites often, even daily, although they typically are moving short distances within a general area (Chenger 2003, pp. 14–23; Johnson *et al.* 2011, p. 100; Brack *et al.,* unpublished manuscript). Chenger (2009, p. 7) suggests that eastern small-footed bats roost in low numbers over a wide area, such as talus fields, as a predator-avoidance strategy (Chenger 2009, p. 7). Frequent roost-switching may be another means of avoiding potential predators. Johnson *et al.* 2011 (pp. 98–101) radiotracked five lactating female bats and five nonreproductive males and observed that females and males switched roosts on average every 1.1 days. Males traveled an average of 41 m (135 ft) between consecutive roosts. Females traveled an average of 67 m (218 ft) between consecutive roosts, and roosts were closer to ephemeral water sources than those used by males.

Johnson *et al.* 2011 (p. 103) hypothesized that roost selection is based on either avoiding detection by predators or minimizing energy expenditures. They observed that roosts were located within 15 m (50 ft) from vegetation or forest edge and in areas with low canopy cover, which consequently provided a short distance to protective cover and high solar exposure. It appears eastern small-footed bats exhibit fidelity to their summer roosting areas, as demonstrated by the recapture of banded bats in successive years at the Surry Mountain Reservoir and Acadia National Park (Divoll *et al.* 2013; Veilleux and Moosman, unpublished data).

Reproduction

Available data regarding the eastern small-footed bat suggest that females of this species form small summer colonies, with males roosting singly or in small groups (Erdle and Hobson 2001, p. 10; Johnson *et al.* 2011, p. 100). Small maternity colonies of 12 to 20 individuals occurring in buildings have been reported (Merritt 1987, p. 95). Eastern small-footed bats are thought to be similar to sympatric *Myotis* that breed in the fall; spermatozoa are stored in the uterus of hibernating females until spring ovulation, and a single pup is born in May or June (Barbour and Davis 1969, p. 104; Amelon and Burhans 2006, p. 58). Brack *et al.* (unpublished manuscript) captured two female eastern small-footed bats in the fall that appeared to have recently mated as noted by fluids around the vagina. Two female eastern small-footed bats caught on June 20 and 24 were pregnant, and 16 female bats caught from June 23 to July 15 were lactating (Brack *et al.,* unpublished manuscript).

Adult longevity is estimated to be up to 12 years in the wild (Hitchcock 1965, p. 11). Estimated mean annual survival is low compared to other *Myotis,* and survival rates are significantly lower for females than for males, 42 and 75 percent, respectively (Hitchcock *et al.* 1984, p. 128). The lower rate of survival of females may be a result of a combination of factors: The greater demands of reproduction on females; the higher metabolic rates and less frequent torpor; and the greater exposure to possible disease-carrying parasites in maternity colonies

(Hitchcock *et al.* 1984, p. 127). Low survivorship in combination with low reproductive potential (*i.e.,* one offspring produced per year) (Best and Jennings 1997, p. 2) may explain why eastern small-footed bats are generally uncommon (Hitchcock *et al.* 1984, p. 129).

Foraging Behavior and Home Range

Eastern small-footed bats have low wing loading and high, frequency-modulated echolocation calls, making them capable of foraging efficiently in cluttered forest interiors (Johnson *et al.* 2009, p. 5). Although some accounts state that this species emerges early in the evening (van Zyll de Jong 1985, p. 119), Brack *et al.* (unpublished manuscript) found that activity peaked well after dark, and low post-midnight activities point to the possibility of a bimodal activity period. Most observations indicate that eastern small-footed bats fly slow and close to the ground, usually at heights from 0.6 to 3.5 m (2 to 11.5 ft) (Davis *et al.* 1965, p. 683; Brack *et al.,* unpublished manuscript).

Using ridgelines, streams, and forested roads as travel corridors, eastern small-footed bats have been observed travelling from 0.8 to 13.2 km (0.5 to 8.2 mi) between daytime roost sites and foraging areas (Chenger 2003, pp. 14–23; Chenger 2008b, p. 6; Johnson *et al.* 2009, p. 3; Mumma and Capouillez 2011, p. 24). Considerable declines in eastern small-footed bat capture rates have been observed with increasing distance from available rock habitat; and short distances between roosts and capture sites suggest these bats have small home ranges (Johnson *et al.* 2011, p. 104). Observed home range varies from 10.2 to 1,405 hectares (ha) (25 to 3,472 acres (ac)) (Johnson *et al.* 2009, p. 3; Mumma and Capouillez 2011, p. 25), although core habitat for three male and two female eastern small-footed bats ranged from 4 to 75 ha (10 to 185 ac) (50 percent fixed kernel utilization distribution) (Mumma and Capouillez 2011, p. 25).

Food habits of eastern small-footed bats are those of a generalist, although moths (Lepidoptera), true flies (Diptera), and beetles (Coleoptera) compose most of their diet (Johnson and Gates 2007, p. 319; Moosman *et al.* 2007, p. 355; Brack *et al.,* unpublished manuscript). Presence of spiders (Araneae) and crickets (Gryllidae) in the diet suggest eastern small-footed bats capture some prey via gleaning (Moosman *et al.* 2007, p. 358). Gleaning behavior is characterized by catching prey on surfaces via echolocation; calls are generally short in duration, high frequency, and of low intensity, characteristics that are difficult for some invertebrate prey to detect (Faure *et al.* 1993, p. 174).

Species Information

Northern Long-Eared Bat

Taxonomy and Species Description

The northern long-eared bat belongs to the order Chiroptera, suborder Microchiroptera, family Vespertilionidae, subfamily Vesperitilionae, genus Myotis, subgenus Myotis (Caceres and Barclay 2000, p. 1). The northern long-eared bat was considered a subspecies of Keen's long-eared Myotis (*Myotis keenii)* (Fitch and Schump 1979, p. 1), but was recognized as a distinct species by van Zyll de Jong in 1979 (1979, p. 993) based on geographic separation and difference in morphology (as cited in Caceres and Pybus 1997 p. 1; Caceres and Barclay 2000, p. 1; Nagorsen and Brigham 1993, p. 87; Whitaker and Hamilton 1998, p. 99; Whitaker and Mumford 2009, p. 207; Simmons 2005, p. 516). No subspecies have been described for this species (Nagorsen and Brigham 1993, p. 90; Whitaker and Mumford 2009, p. 214; van Zyll de Jong 1985, p. 94). This species has been recognized by different common names, such as: Keen's bat (Whitaker and Hamilton 1998, p. 99), northern myotis bat (Nagorsen and Brigham 1993, p. 87, Whitaker and Mumford 2009, p. 207), and the northern bat (Foster and Kurta 1999, p. 660). For the purposes of this finding, we refer to this species as the northern long-eared bat, and recognize it as a listable entity under the Act.

A medium-sized bat species, the northern long-eared bat adult body weight averages 5 to 8 g (0.2 to 0.3 ounces), with females tending to be slightly larger than males (Caceres and Pybus 1997, p. 3). Average body length ranges from 77 to 95 mm (3.0 to 3.7 in), tail length between 35 and 42 mm (1.3 to 1.6 in), forearm length between 34 and 38 mm (1.3 to 1.5 in), and wingspread between 228 and 258 mm (8.9 to 10.2 in) (Caceres and Barclay 2000, p. 1; Barbour and Davis 1969, p. 76). Pelage (fur) colors include medium to dark brown on its back, dark brown, but not black, ears and wing membranes, and tawny to pale-brown fur on the ventral side (Nagorsen and Brigham 1993, p. 87; Whitaker and Mumford 2009, p. 207). As indicated by its common name, the northern long-eared bat is distinguished from other *Myotis* species by its long ears (average 17 mm (0.7 in), Whitaker and Mumford 2009, p. 207) that, when laid forward, extend beyond the nose but less than 5 mm (0.2 in) beyond the muzzle (Caceres and Barclay 2000, p. 1). The tragus (projection of skin in front of the external ear) is long (average 9 mm (0.4 in); Whitaker and Mumford 2009, p. 207), pointed, and symmetrical (Nagorsen and Brigham 1993, p. 87; Whitaker and Mumford 2009, p. 207). Within its range, the northern long-eared bat can be confused with the little brown bat or the western long-eared myotis (*Myotis evotis*). The northern long-eared bat can be distinguished from the little brown bat by its longer ears, tragus, slightly longer tail, and less glossy pelage (Caceres and Barclay 2000, p. 1). The northern long-eared bat can be distinguished from the western long-eared myotis by its darker pelage and paler membranes (Caceres and Barclay 2000, p. 1).

Distribution and Abundance

The northern long-eared bat ranges across much of the eastern and north central United States, and all Canadian provinces west to the southern Yukon Territory and eastern British Columbia (Nagorsen and Brigham 1993, p. 89; Caceres and Pybus 1997, p. 1; Environment Yukon 2011, p. 10). In the United States, the species' range reaches from Maine west to Montana, south to eastern Kansas, eastern Oklahoma, Arkansas, and east to the Florida panhandle (Whitaker and Hamilton 1998, p. 99; Caceres and Barclay 2000, p. 2; Wilson and Reeder 2005, p. 516; Amelon and Burhans 2006, pp. 71–72). The species' range includes the following 39 States (including the District of Columbia, which we count as one of the ''States''): Alabama, Arkansas, Connecticut, Delaware, the District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming. Historically, the species has been most frequently observed in the northeastern United States and in Canadian Provinces, Quebec and Ontario, with sightings increasing during swarming and hibernation (Caceres and Barclay 2000, p. 2). However, throughout the majority of the species' range it is patchily distributed, and historically was less common in the southern and western portions of the range than in the northern portion of the range (Amelon and Burhans 2006, p. 71).

Although they are typically found in low numbers in inconspicuous roosts, most records of northern long-eared bats are from winter hibernacula surveys (Caceres and Pybus 1997, p. 2) (for more information on use of hibernacula, see *Biology* below). More than 780 hibernacula have been identified throughout the species' range in the United States, although many hibernacula contain only a few (1 to 3) individuals (Whitaker and Hamilton 1998, p. 100). Known hibernacula (sites with one or more winter records) include: Arkansas (n=20), Connecticut (n=5), Georgia (n=1), Illinois (n=36), Indiana (n=25), Kentucky (n=90), Maine (n=3), Maryland (n=11), Massachusetts (n=7), Michigan (n=94), Minnesota (n=11), Missouri (n=>111), Nebraska (n=2), New Hampshire (n=9), New Jersey (n=8), New York (n=58), North Carolina (n=20), Oklahoma (n=4), Ohio (n=3), Pennsylvania (n=112), South Carolina (n=2), South Dakota (n=7), Tennessee (n=11), Vermont (n=13 (23 historical)), Virginia (n=8), West Virginia (n=104), and Wisconsin (n=45). Other states within the species' range have no known hibernacula (due to no suitable hibernacula present or lack of survey effort). They are typically found roosting in small crevices or cracks on cave or mine walls or ceilings, thus are easily overlooked during surveys and usually observed in small numbers (Griffin 1940, pp. 181–182; Barbour and Davis 1969, p. 77; Caire *et al.* 1979, p. 405; Van Zyll de Jong 1985, p. 9; Caceres and Pybus 1997, p. 2; Whitaker and Mumford 2009, pp. 209–210).

The U.S. portion of the northern long-eared bat's range can be described in four parts, as discussed below: the eastern population, Midwestern population, the southern population, and the western population.

Eastern Population

Historically, the northern long-eared bat was most abundant in the eastern portion its range (Caceres and Barclay 2000, p. 2). Northern long-eared bats have been consistently caught during summer mist nets surveys and detected during acoustic surveys in eastern populations. Large numbers of northern long-eared bats have been found in larger hibernacula in Pennsylvania (*e.g.,* an estimated 881 individuals in a mine in Bucks County, Pennsylvania in 2004). Fall swarm trapping conducted in September–October 1988–1989, 1990–1991, and 1999–2000 at two hibernacula with large historical numbers of northern long-eared bats had total captures ranging from 6 to 30 bats per hour, which demonstrated that the species was abundant at these hibernacula (Pennsylvania Game Commission, unpublished data, 2012).

In Delaware, the species is rare and no hibernacula are documented within the State; however, there is a historical record from Newcastle County in 1970 (Niederriter 2012, pers. comm.). In Connecticut, the northern long-eared bat was historically one of the most commonly encountered bats in the State and had been documented statewide (Dickson 2011, pers. comm.). In Maine, 3 hibernacula are known (all on private land), and the species has also been found in the summer in Acadia National Park (DePue 2012, unpublished data) where northern long-eared bats were found to be fairly common in 2009–2010 (242 northern long-eared bats captured comprising 27 percent of the total captures for the areas surveyed) (NPS 2010).

In Maryland, three of seven known hibernacula for the species are railroad tunnels, and no summer mist net or acoustic surveys have been conducted for the species (Feller 2011, unpublished data). In Massachusetts, there are 7 known hibernacula, 42 percent of which are privately owned. In New Hampshire, northern long-eared bats are known to inhabit at least nine mines and two World War II bunkers and have been found in summer surveys, including at Surry Mountain Dam (Brunkhurst 2012, unpublished data). In the White Mountain National Forest in New Hampshire in 1993–1994, northern long-eared was one of the most common species captured (27 percent) (Sasse and Pekins 1996, pp. 93–95). In New Jersey, one of the seven known hibernacula is a cave, and the remainder are mines (Markuson 2011, unpublished data). Northern long-eared bats consisted of 6 to 14 percent of total number of captures at Wallkill River National Wildlife Refuge in New Jersey from 2006–2010 (Kitchell and Wight 2011).

In Vermont, prior to 2009, the species was found in 23 hibernacula, totaling an estimated 595 animals, which was thought to be an under-estimate due to the species' preference for hibernating in hibernacula cracks and crevices. Summer capture data (2001–2007) indicated that northern long-eared bats comprised 19 percent of bats captured; it was considered the second most common bat species in the State (Smith 2011, unpublished data). In Virginia, they were historically considered "fairly common" during summer mist net surveys; however, they are considered "uncommon" during winter hibernacula surveys (Reynolds 2012, unpublished data).

In West Virginia, northern long-eared bats are found regularly in hibernacula surveys, but typically in small numbers (less than 20 individuals) in caves (Stihler 2012, unpublished data). The species has also been found in 41 abandoned coal mines in winter surveys conducted from 2002 to 2011 in the New River Gorge National River and Gauley River National Recreation Area, both managed by the National Park Service (NPS); the largest number observed was 157 in one of the NPS mines (NPS 2011, unpublished data). Northern long-eared bats are considered common in summer surveys in West Virginia; in summer records from 2006–2011 northern long-eared bat captures comprised 46 to 49 percent of all bat captures (Stihler 2012, pers. comm.).

Northern long-eared bats have been observed in 58 hibernacula in abandoned mines, caves, and tunnels in New York. They have also been observed in summer mist net and acoustic surveys. Summer mist-net surveys in New York from 2003–2008 resulted in a range of 0.21–0.47 bats/net night and declined to 0.012 bats/net night in 2011 (Herzog 2012, unpublished data). They have also been observed on Fort Drum in New York, where acoustic surveys (2003–2010) and mist net surveys (1999, 2007) have monitored the summer population (Dobony 2011, unpublished data). There are no known hibernacula in Rhode Island; however, there were 6 records from 2011 mist-net surveys in Washington County (Brown 2012, unpublished data).

Midwest Population

The northern long-eared bat is commonly encountered in summer mist-net surveys throughout the majority of the Midwest and is considered fairly common throughout much of the region. However, the species is often found infrequently and in small numbers in hibernacula surveys throughout most of the Midwest. In Missouri, northern long-eared bats were listed as a State species of conservation concern until 2007, after which it was decided the species was more common than previously thought because they were commonly captured in mist net surveys (Elliot 2013, pers. comm.). Historically, the northern long-eared bat was considered quite common throughout much of Indiana, and was the fourth or fifth most abundant bat species in the State in 2009. The species has been captured in at least 51 counties, is often captured in mist-nets along streams, and is the most common bat taken by trapping at mine entrances (Whitaker and Mumford 2009, pp. 207–

208). The abundance of northern long-eared bats appears to vary within Indiana during the summer. For example, during 3 summers (1990–1992) of mist-netting surveys in the northern half of Indiana, 37 northern long-eared bats were captured at 22 of 127 survey sites, which represented 4 percent of all bats captured (King 1993, p. 10). In contrast, northern long-eared bats were the most commonly captured bat species (38 percent of all bats captured) during three summers (2006–2008) of mist netting on two State forests in south-central Indiana (Sheets *et al.* 2013, p. 193). Indiana has 25 hibernacula with winter records of one or more northern long-eared bats. However, it is very difficult to find individuals in caves and mines during hibernation in large numbers in Indiana hibernacula (Whitaker and Mumford 2009, p. 208).

In Michigan, the northern long-eared bat is known from 25 counties and is not commonly encountered in the State except in parts of the northern Lower Peninsula and portions of the Upper Peninsula (Kurta 1982, p. 301; Kurta 2013, pers. comm.). The majority of hibernacula in Michigan are in the far northern and western Upper Peninsula; therefore, there are very few cave-hibernating bats in general in the southern half of the Lower Peninsula during the summer because the distance to hibernacula is too great (Kurta 2013, pers. comm.). It is thought that the few bats that do spend the summer in the southern half of the Lower Peninsula may hibernate in caves or mines in neighboring states, such as Indiana (Kurta 1982, pp. 301–302; Kurta 2013, pers. comm.).

In Wisconsin, the species is reported to be uncommon (Amelon and Burhans 2006, pp. 71–72). ‘‘Although the northern long-eared bat can be found in many parts of Wisconsin, it is clearly not abundant in any one location. The department has determined that the Northern long-eared bat is one of the least abundant bats in Wisconsin through cave and mine hibernacula counts, acoustic surveys, mist-netting in summer foraging areas and harp trap captures during the fall swarming period’’ (Redell 2011, pers. comm.). Northern long-eared bats are regularly caught in mist-net surveys in the Shawnee National Forest in southern Illinois (Kath 2013, pers. comm.). Further, the average number of northern long-eared bats caught during surveys between 1999 and 2011 at Oakwood Bottoms in the Shawnee National Forest has been fairly consistent (Carter 2012, pers. comm.). In Iowa, there are only summer mist net records for the species; in 2011 there were eight records (including three lactating females) from west-central Iowa (Howell 2011, unpublished data). In Minnesota, one mine in St. Louis County may contain a large number of individuals, possibly over 3,000; however, this is a very rough estimate since the majority of the mine cannot be safely accessed for surveys (Nordquist 2012, pers. comm.). In Ohio, there are three known hibernacula and the largest population in Preble County has had more than 300 bats. In general, northern long-eared bats are also regularly collected as incidental catches in mist-net surveys for Indiana bats in Ohio (Boyer 2012, pers. comm.).

Southern Population

The northern long-eared bat is less common in the southern portion of its range than in the northern portion of the range (Amelon and Burhans 2006, p. 71) and, in the South, is considered more common in states such as Kentucky and Tennessee, and more rare in the southern extremes of the range (*e.g.,* Alabama, Georgia, South Carolina). In Alabama, the northern long-eared bat is rare, while in Tennessee it is uncommon (Amelon and Burhans 2006, pp. 71–72). In Tennessee, northern long-eared bats were found in summer mist-net surveys conducted through summer of 2010 in addition to hibernacula censuses. Northern long-eared bats were found in 11 caves surveyed in 2011 in Tennessee (Pelren 2011, pers. comm.). In 2000, during sampling of bat populations in the Kisatchie National Forest, Louisiana, three northern long-eared bat specimens were collected; these were the first official records of the species from Louisiana (Crnkovic 2003, p. 715). In Georgia, northern long-eared bats have been found at 1 of 5 known hibernacula in the State and 24 summer records were found between 2007 and 2011. Mist-net surveys were conducted in the Chattahoochee National Forest in 2001–2002 and 2006–2007, with 51 total records for the species (Morris 2012, unpublished data). Northern long-eared bats have been found in 20 hibernacula within North Carolina (Graeter 2011, unpublished data). In the summer of 2007, (Morris *et al.* 2009, p. 356) six northern long-eared bats were captured in Washington County, North Carolina. Both adults and juveniles were captured, suggesting that there is a reproducing resident population (Morris *et al.* 2009, p. 359). In Kentucky, although typically found in small numbers, northern long-eared bats were historically found in the majority of hibernacula in Kentucky and have been a commonly captured species during summer surveys (Hemberger 2012, pers. comm.). The northern long-eared bat can be found throughout the majority of Kentucky, with historical records in 91 of its 120 counties. Eighty-five counties have summer records, and 68 of those include reproductive records (*i.e.,* captures of juveniles or pregnant, lactating, or post-lactating adult females) (Hemberger 2012, pers. comm.). In South Carolina, there are two known hibernacula: one is a cave that had 26 bats present in 1995, but has not been surveyed since, and the other is a tunnel where only one bat was found in 2011 (Bunch 2011, unpublished data). Northern long-eared bats are known from 20 hibernacula in Arkansas, although they are typically found in very low numbers (Sasse 2012, unpublished data). Surveys in the Ouachita Mountains of central Arkansas from 2000–2005 tracked 17 males and 23 females to 43 and 49 day roosts, respectively (Perry and Thill 2007, pp. 221–222). The northern long-eared bat is known to occur in seven counties along the eastern edge of Oklahoma, (Stevenson 1986, p. 41). The species has been recorded in 21 caves (7 of which occur on the Ozark Plateau National Wildlife Refuge) during the summer. The species has regularly been captured in summer mist-net surveys at cave entrances in Adair, Cherokee, Sequoyah, Delaware, and LeFlore counties, and are often one of the most common bats captured during mist-net surveys at cave entrances in the Ozarks of northeastern Oklahoma (Stark 2013, pers. comm.). Small numbers of northern long-eared bats (typical range of 1–17 individuals) also have been captured during mist-net surveys along creeks and riparian zones in eastern Oklahoma.

Western Population

The northern long-eared bat is generally less common in the western portion of its range than in the northern portion of the range (Amelon and Burhans 2006, p. 71) and is considered common in only small portions of the western part of its range (*e.g.,* Black Hills of South Dakota) and uncommon or rare in the western extremes of the range (*e.g.,* Wyoming, Kansas, Nebraska) (Caceres and Barclay 2000, p. 2). The northern long-eared bat has been observed hibernating and residing during the summer and is considered abundant in the Black Hills National Forest in South Dakota. Capture and banding data for survey efforts in the Black Hills of South Dakota and Wyoming showed northern long-eared bats to be the second most common bat banded (159 of 878 total bats) during 3 years of survey effort (Tigner and Aney

1994, p. 4). South Dakota contains seven known hibernacula, five of which are abandoned mines. The largest number of individuals was found in a hibernaculum near Hill City, South Dakota; 40 individuals were found in this mine in the winter of 2002–2003 (Tigner and Stukel 2003, pp. 27–28). A summer population was found on the habitats in Dakota Prairie National Grassland and Custer National Forest in 2005 (Lausen undated, unpublished data). Also, northern long-eared bats have been captured during the summer along the Missouri River in South Dakota (Swier 2006, p. 5; Kiesow and Kiesow 2010, pp. 65–66). Summer surveys in North Dakota (2009–2011) documented the species in the Turtle Mountains, the Missouri River Valley, and in the Badlands (Gillam and Barnhart 2011, pp. 10–12). No hibernacula are known within North Dakota; however, there has been very limited survey effort in the State (Riddle 2012, pers. comm.).

Northern long-eared bats have been observed at two quarries located in east-central Nebraska, but there is no survey data for either of these sites (Geluso 2011, unpublished data). They are also known to summer in the northwestern parts of Nebraska, specifically Pine Ridge in Sheridan County (only males have been documented), and a reproducing population has been documented north of Valentine in Cherry County (Benedict *et al.* 2000, pp. 60–61). During an acoustic survey conducted during the summer of 2012 the species was common in Cass County (east-central Nebraska), but was uncommon or absent from extreme southeastern Nebraska (White *et al.* 2012, p. 2). The occurrence of this species in Cass County, Nebraska is likely attributable to limestone quarries in the region that are used as hibernacula by this species and others (White *et al.* 2012, p. 3).

During acoustic and mist net surveys conducted throughout Wyoming in the summers of 2008–2011, 27 separate observations of northern long-eared bats were made in the northeast part of the State and breeding was confirmed (Wyoming Game and Fish Department 2012, unpublished data). To date, there are no known hibernacula in Wyoming and it is unclear if there are existing hibernacula, although the majority of potential hibernacula (abandoned mines) within the State occur outside of the northern long-eared bat's range (Tigner and Stukel 2003, p. 27; Wyoming Game and Fish Department 2012). Montana has only one known record: a male collected in an abandoned coal mine in 1978 in Richland County (Montana Fish, Wildlife, and Parks 2012). In Kansas, the northern long-eared bat was first found in summer mist-net surveys in 1994 and 1995 in Osborne and Russell counties, before which the species was thought to only migrate through parts of the State (Sparks and Choate 1995, p. 190).

Canada Population

The northern long-eared bat occurs throughout the majority of the forested regions of Canada, although it is found in higher abundance in eastern Canada than in western Canada, similar to in the United States (Caceres Pybus 1997, p. 6). However, the scarcity of records in the western parts of Canada may be due to more limited survey efforts. It has been estimated that approximately 40 percent of the northern long-eared bat's global range is in Canada; however, due to the species being relatively common and widespread, limited effort has been made to determine overall population size within Canada (COSEWIC 2012, p.9). The range of the northern long-eared bat in Canada includes Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland and Labrador, Northwest Territories, Nova Scotia, Prince Edward Island, Ontario, Quebec, Saskatchewan, and Yukon (COSEWIC 2012, p. 4). There are no records of the species overwintering in Yukon and Northwest Territories (COSEWIC 2012, p. 9).

Habitat

Winter Habitat

Northern long-eared bats predominantly overwinter in hibernacula that include caves and abandoned mines. Hibernacula used by northern long-eared bats are typically large, with large passages and entrances (Raesly and Gates 1987, p. 118), relatively constant, cooler temperatures (0 to 9 °C (32 to 48 °F) (Raesly and Gates 1987, p. 18; Caceres and Pybus 1997, p. 2; Brack 2007, p. 744), and with high humidity and no air currents (Fitch and Shump 1979, p. 2; Van Zyll de Jong 1985, p. 94; Raesly and Gates 1987 p. 118; Caceres and Pybus 1997, p. 2). The sites favored by northern long-eared bats are often in very high humidity areas, to such a large degree that droplets of water are often observed on their fur (Hitchcock 1949, p. 52; Barbour and Davis 1969, p. 77). Northern long-eared bats typically prefer cooler and more humid conditions than little brown bats, similar to the eastern small-footed bat and big brown bat, although the latter two species tolerate lower humidity than northern long-eared bats (Hitchcock 1949, p. 52–53; Barbour and Davis 1969, p. 77; Caceres and Pybus 1997, p. 2). Northern long-eared bats are typically found roosting in small crevices or cracks in cave or mine walls or ceilings, often with only the nose and ears visible, thus are easily overlooked during surveys (Griffin 1940, pp. 181–182; Barbour and Davis 1969 p.77; Caire *et al.* 1979, p. 405; Van Zyll de Jong 1985, p.9; Caceres and Pybus 1997, p. 2; Whitaker and Mumford 2009, pp. 209–210). Caire *et al.* (1979, p. 405) and Whitaker and Mumford (2009, p. 208) commonly observed individuals exiting caves with mud and clay on their fur, also suggesting the bats were roosting in tighter recesses of hibernacula. They are also found hanging in the open, although not as frequently as in cracks and crevices (Barbour and Davis 1969, p.77, Whitaker and Mumford 2009, pp. 209–210). In 1968, Whitaker and Mumford (2009, pp. 209–210) observed three northern long-eared bats roosting in the hollow core of stalactites in a small cave in Jennings County, Indiana.

To a lesser extent, northern long-eared bats have been found overwintering in other types of habitat that resemble cave or mine hibernacula, including abandoned railroad tunnels, more frequently in the northeast portion of the range. Also, in 1952 three northern long-eared bats were found hibernating near the entrance of a storm sewer in central Minnesota (Goehring 1954, p. 435). Kurta and Teramino (1994, pp. 410–411) found northern long-eared bats hibernating in a hydro-electric dam facility in Michigan. In Massachusetts, northern long-eared bats have been found hibernating in the Sudbury Aqueduct, a structure created in the late 1800s to transfer water, but that is rarely used for this purpose today (French 2012, unpublished data). Griffin (1945, p. 22) found northern long-eared bats in December in Massachusetts in a dry well, and commented that these bats may regularly hibernate in ‘‘unsuspected retreats’’ in areas where caves or mines are not present.

Summer Habitat

During the summer, northern long-eared bats typically roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags (Sasse and Perkins 1996, p. 95; Foster and Kurta 1999, p. 662; Owen *et al.* 2002, p. 2; Carter and Feldhamer 2005, p. 262; Perry and Thill 2007, p. 222; Timpone *et al.* 2010, p. 119). Males and non-reproductive females' summer roost sites may also include cooler locations, including caves and mines (Barbour and Davis 1969, p. 77; Amelon and Burhans 2006, p. 72). Northern long-eared bats have also been observed roosting in colonies in humanmade structures, such as buildings, barns, a park pavilion, sheds, cabins, under eaves of buildings, behind window shutters, and in bat houses (Mumford and Cope 1964, p. 72; Barbour and Davis 1969, p. 77; Cope and Humphrey 1972, p. 9 ; Amelon and Burhans 2006, p. 72; Whitaker and Mumford 2009, p. 209; Timpone *et al.* 2010, p. 119; Joe Kath 2013, pers. comm.).

The northern long-eared bat appears to be somewhat opportunistic in tree roost selection, selecting varying roost tree species and types of roosts throughout its range, including tree species such as black oak (*Quercus velutina*), northern red oak (*Quercus rubra*), silver maple (*Acer saccharinum*), black locust (*Robinia pseudoacacia*), American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), sourwood (*Oxydendrum arboreum*), and shortleaf pine (*Pinus echinata*) (*e.g.,* Mumford and Cope 1964, p. 72; Clark *et al.* 1987, p. 89; Sasse and Pekins 1996, p. 95; Foster and Kurta 1999, p. 662; Lacki and Schwierjohann 2001, p. 484; Owen *et al.* 2002, p. 2; Carter and Feldhamer 2005, p. 262; Perry and Thill 2007, p. 224; Timpone *et al.* 2010, p. 119). Northern long-eared bats most likely are not dependent on a certain species of trees for roosts throughout their range; rather, certain tree species will form suitable cavities or retain bark and the bats will use them opportunistically (Foster and Kurta 1999, p. 668). Carter and Felhamer (2005, p. 265) speculated that structural complexity of habitat or available roosting resources are more important factors than the actual tree species.

Many studies have documented the northern long-eared bat's selection of live trees and snags, with a range of 10 to 53 percent selection of live roosts found (Sasse and Perkins 1996, p. 95; Foster and Kurta 1999, p. 668; Lacki and Schwierjohann 2001, p. 484; Menzel *et al.* 2002, p. 107; Carter and Feldhamer 2005, p. 262; Perry and Thill 2007, p. 224; Timpone *et al.* 2010, p. 118). Foster and Kurta (1999, p. 663) found 53 percent of roosts in Michigan were in living trees, whereas in New Hampshire, 34 percent of roosts were in snags (Sasse and Pekins 1996, p. 95). The use of live trees versus snags may reflect the availability of such structures in study areas (Perry and Thill 2007, p. 224) and the flexibility in roost selection when there is a sympatric bat species present (*e.g.,* Indiana bat) (Timpone *et al.* 2010, p. 120). In tree roosts, northern long-eared bats are typically found beneath loose bark or within cavities and have been found to use both exfoliating bark and crevices to a similar degree for summer roosting habitat (Foster and Kurta 1999, p. 662; Lacki and Schwierjohann 2001, p. 484; Menzel *et al.* 2002, p. 110; Owen *et al.* 2002, p. 2; Perry and Thill 2007, p. 222; Timpone *et al.* 2010, p. 119).

Canopy coverage at northern long-eared bat roosts has ranged from 56 percent in Missouri (Timone *et al.* 2010, p. 118), 66 percent in Arkansas (Perry and Thill 2007, p. 223), greater than 75 percent in New Hampshire (Sasse and Pekins 1996, p. 95), to greater than 84 percent in Kentucky (Lacki and Schwierjohann 2001, p. 487). Studies in New Hampshire and British Columbia have found that canopy coverage around roosts is lower than in available stands (Caceres 1998; Sasse and Pekins 1996, p. 95). Females tend to roost in more open areas than males, likely due to the increased solar radiation, which aids pup development (Perry and Thill 2007, p. 224). Fewer trees surrounding maternity roosts may also benefit juvenile bats that are starting to learn to fly (Perry and Thill 2007, p. 224). However, in southern Illinois, northern long-eared bats were observed roosting in areas with greater canopy cover than in random plots (Carter and Feldhamer 2005, p. 263). Roosts are also largely selected below the canopy, which could be due to the species' ability to exploit roosts in cluttered environments; their gleaning behavior suggests an ability to easily maneuver around obstacles (Foster and Kurta 1999, p. 669; Menzel *et al.* 2002, p. 112).

Female northern long-eared bats typically roost in tall, large-diameter trees (Sasse and Pekins 1996, p. 95). Studies have found that the diameter-at-breast height (dbh) of northern long-eared bat roost trees was greater than random trees (Lacki and Schwierjohann 2001, p. 485) and others have found both dbh and height of selected roost trees to be greater than random trees (Sasse and Pekins 1996, p. 97; Owen *et al.* 2002 p. 2). However, other studies have found that roost tree mean dbh and height did not differ from random trees (Menzel *et al.* 2002, p. 111; Carter and Feldhamer 2005, p. 266). Lacki and Schwierjohann (2001, p. 486) have also found that northern long-eared bats roost more often on upper and middle slopes than lower slopes, which suggests a preference for higher elevations due to increased solar heating.

Biology

Hibernation

Similar to the eastern small-footed bat description above, the northern long-eared bats hibernate during the winter months to conserve energy from increased thermoregulatory demands and reduced food resources. In general, northern long-eared bats arrive at hibernacula in August or September, enter hibernation in October and November, and leave the hibernacula in March or April (Caire *et al.* 1979, p. 405; Whitaker and Hamilton 1998, p. 100; Amelon and Burhans 2006, p. 72). However, hibernation may begin as early as August (Whitaker and Rissler 1992, p. 56). In Copperhead Cave in west-central Indiana, the majority of bats enter hibernation during October, and spring emergence occurs mainly from about the second week of March to mid-April (Whitaker and Mumford 2009, p. 210). In Indiana, northern long-eared bats become more active and start feeding outside the hibernaculum in mid-March, evidenced by stomach and intestine contents. This species also showed spring activity earlier than little brown bats and tri-colored bat (Whitaker and Rissler 1992, pp. 56–57). In northern latitudes, such as in upper Michigan's copper-mining district, hibernation for northern long-eared bats and other *myotis* species may begin as early as late August and may last for 8 to 9 months (Stones and Fritz, 1969, p. 81; Fitch and Shump 1979, p. 2). Northern long-eared bats have shown a high degree of philopatry (using the same site multiple years) for a hibernaculum (Pearson 1962, p. 30), although they may not return to the same hibernaculum in successive seasons (Caceres and Barclay 2000, p. 2).

Typically, northern long-eared bats are not abundant and compose a small proportion of the total number of bats hibernating in a hibernaculum (Barbour and Davis 1969, p. 77; Mills 1971, p. 625; Caire *et al.* 1979, p. 405; Caceres and Barclay 2000, pp. 2–3). Although usually found in small numbers, the species typically inhabits the same hibernacula with large numbers of other bat species, and occasionally are found in clusters with these other bat species. Other species that commonly occupy the same habitat include: little brown bat, big brown bat, eastern small-footed bat, tri-colored bat, and Indiana bat (Swanson and Evans 1936, p. 39; Griffin 1940, p. 181; Hitchcock 1949, pp. 47–58; Stones and Fritz 1969, p. 79; Fitch and Shump 1979, p. 2). Whitaker and Mumford (2009, pp. 209–210), however, infrequently found northern long-eared bats hibernating beside little brown bats, Indiana bats, or tri-colored bats, since they found few hanging on side walls or ceilings of cave passages. Barbour and Davis (1969, p. 77) found that the species is never abundant and rarely recorded in concentrations of over 100 in a single hibernaculum.

Northern long-eared bats often move between hibernacula throughout the winter, which may further decrease population estimates (Griffin 1940, p. 185; Whitaker and Rissler 1992b, p. 131; Caceres and Barclay 2000 pp. 2–3). Whitaker and Mumford (2009, p. 210) found that this species flies in and out of some of the mines and caves in southern Indiana throughout the winter. In particular, the bats were active at Copperhead Cave periodically all winter, with northern long-eared bats being more active than other species (such as little brown bat and tri-colored bat) hibernating in the cave. Though northern long-eared bats fly outside of the hibernacula during the winter, they do not feed; hence the function of this behavior is not well understood (Whitaker and Hamilton 1998, p. 101). However, it has been suggested that bat activity during winter could be due in part to disturbance by researchers (Whitaker and Mumford 2009, pp. 210–211).

Northern long-eared bats exhibited significant weight loss during hibernation. In southern Illinois, weight loss during hibernation was found in male northern long-eared bats, with individuals weighing an average of 6.6 g (0.2 ounces) prior to 10 January, and those collected after that date weighing an average of 5.3 g (0.2 ounces) (Pearson 1962, p. 30). Whitaker and Hamilton (1998, p. 101) reported a weight loss of 41–43 percent over the hibernation period for northern long-eared bats in Indiana. In eastern Missouri, male northern long-eared bats lost an average of 3 g (0.1 ounces) during the hibernation period (late October through March), and females lost an average of 2.7 g (0.1 ounces) (Caire *et al.* 1979, p. 406).

Migration and Homing

While the northern long-eared bat is not considered a long-distance migratory species, short migratory movements between summer roost and winter hibernacula between 56 km (35 mi) and 89 km (55 mi) have been documented (Nagorsen and Brigham 1993 p. 88; Griffith 1945, p. 53). However, movements from hibernacula to summer colonies may range from 8 to 270 km (5 to 168 mi) (Griffin 1945, p. 22).

Several studies show a strong homing ability of northern long-eared bats in terms of return rates to a specific hibernaculum, although bats may not return to the same hibernaculum in successive winters (Caceres and Barclay 2000, p. 2). Banding studies in Ohio, Missouri, and Connecticut show return rates to hibernacula of 5.0 percent (Mills 1971, p. 625), 4.6 percent (Caire *et al.* 1979, p. 404), and 36 percent (Griffin 1940, p. 185), respectively. An experiment showed an individual bat returned to its home cave up to 32 km (20 mi) away after being removed 3 days prior (Stones and Branick 1969, p. 158). Individuals have been known to travel between 56 and 97 km (35 and 60 mi) between caves during the spring (Caire *et al.* 1979, p. 404; Griffin 1945, p. 20).

Summer Roosts

Northern long-eared bats switch roosts often (Sasse and Perkins 1996, p. 95), typically every 2–3 days (Foster and Kurta 1999, p. 665; Owen *et al.* 2002, p. 2; Carter and Feldhamer 2005, p. 261; Timpone *et al.* 2010, p. 119). In Missouri, the longest time spent roosting in one tree was 3 nights; however, the up to 11 nights spent roosting in a humanmade structure has been documented (Timpone *et al.* 2010, p. 118). Similarly, Carter and Feldhamer (2005, p. 261) found that the longest a northern long-eared bat used the same tree was 3 days; in West Virginia, the average time spent at one roost was 5.3 days (Menzel *et al.* 2002, p. 110). Bats switch roosts for a variety of reasons, including, temperature, precipitation, predation, parasitism, and ephemeral roost sites (Carter and Feldhamer 2005, p. 264). Ephemeral roost sites, with the need to proactively investigate new potential roost trees prior to their current roost tree becoming uninhabitable (*e.g.,* tree falls over), may be the most likely scenario (Kurta *et al.* 2002, p. 127; Carter and Feldhamer 2005, p. 264; Timpone *et al.* 2010, p. 119). In Missouri, Timpone *et al.* (2010, p. 118) radiotracked 13 northern long-eared bats to 39 roosts and found the mean distance between the location where captured and roost tree was 1.7 km (1.1 mi) (range 0.07–4.8 km (0.04–3.0 mi), and the mean distance traveled between roost trees was 0.67 km (0.42 mi) (range 0.05–3.9 km (0.03–2.4 mi)). In Michigan, the longest distance the same bat moved between roosts was 2 km (1.2 mi) and the shortest was 6 m (20 ft) (Foster and Kurta 1999, p. 665). In New Hampshire, the mean distance between foraging areas and roost trees was 602 m (1975 ft) (Sasse and Pekins 1996, p. 95). In the Ouachita Mountains of Arkansas, Perry and Thill (2007, p. 22) found that individuals moved among snags that were within less than 2 ha (5 ac).

Some studies have found tree roost selection to differ slightly between male and female northern long-eared bats. Male northern long-eared bats have been found to more readily use smaller diameter trees for roosting than females, suggesting males are more flexible in roost selection than females (Lacki and Schwierjohann 2001, p. 487; Broders and Forbes 2004, p. 606; Perry and Thill 2007, p. 224). In the Ouachita Mountains of Arkansas, both sexes primarily roosted in snags, although females roosted in snags surrounded by fewer midstory trees than did males (Perry and Thill 2007, p. 224). In New Brunswick, Canada, Broders and Forbes (2004, pp. 606–607) found that there was spatial segregation between male and female roosts, with female maternity colonies typically occupying more mature, shade-tolerant deciduous tree stands and males occupying more conifer-dominated stands. In northeastern Kentucky, males do not use colony roosting sites and are typically found occupying cavities in live hardwood trees, while females form colonies more often in both hardwood and softwood snags (Lacki and Schwierjohann 2001, p. 486).

The northern long-eared bat is comparable to the Indiana bat in terms of summer roost selection, but appears to be more opportunistic (Carter and Feldhamer 2005, pp. 265–266; Timpone *et al.* 2010, p. 120–121). In southern Michigan, northern long-eared bats used cavities within roost trees, living trees, and roosts with greater canopy cover more often than does the Indiana bat, which occurred in the same area (Foster and Kurta 1999, p. 670). Similarly, in northeastern Missouri, Indiana bats typically roosted in snags with exfoliating bark and low canopy cover, whereas northern long-eared bats used the same habitat in addition to live trees, shorter trees, and trees with higher canopy cover (Timpone *et al.* 2010 pp. 118–120). Although northern long-eared bats are more opportunistic than Indiana bats, there may be a small amount of roost selection overlap between the two species (Foster and Kurta 1999, p. 670; Timpone *et al.* 2010, pp. 120–121).

Reproduction

Breeding occurs from late July in northern regions to early October in southern regions and commences when males begin to swarm hibernacula and initiate copulation activity (Whitaker and Hamilton 1998, p. 101; Whitaker and Mumford 2009, p. 210; Caceres and Barclay 2000, p. 2; Amelon and Burhans 2006, p. 69). Copulation occasionally occurs again in the spring (Racey 1982, p. 73). Hibernating females store sperm until spring, exhibiting a delayed fertilization strategy (Racey 1979, p.

392; Caceres and Pybus 1997, p. 4). Ovulation takes place at the time of emergence from the hibernaculum, followed by fertilization of a single egg, resulting in a single embryo (Cope and Humphrey 1972, p. 9; Caceres and Pybus 1997, p. 4; Caceres and Barclay 2000, p. 2); gestation is approximately 60 days (Kurta 1994, p. 71). Males are reproductively inactive until late July, with testes descending in most males during August and September (Caire *et al.* 1979, p. 407; Amelon and Burhans 2006, p. 69).

Maternity colonies, consisting of females and young, are generally small, numbering from about 30 (Whitaker and Mumford 2009, p. 212) to 60 individuals (Caceres and Barclay 2000, p. 3); however, one group of 100 adult females was observed in Vermilion County, Indiana (Whitaker and Mumford 2009, p. 212). In West Virginia, maternity colonies in two studies had a range of 7–88 individuals (Owen *et al.* 2002, p. 2) and 11–65 individuals, with a mean size of 31 (Menzel *et al.* 2002, p. 110). Lacki and Schwierjohann (2001, p. 485) found that the population size of colony roosts declined as the summer progressed with pregnant females using the largest colonies (mean=26) and post-lactating females using the smallest colonies (mean=4), with the largest overall reported colony size of 65 bats. Other studies have also found that the number of individuals within a maternity colony typically decreases from pregnancy to post-lactation (Foster and Kurta 1999, p. 667; Lacki and Schwierjohann 2001, p. 485; Garroway and Broders 2007, p. 962; Perry and Thill 2007, p. 224; Johnson *et al.* 2012, p. 227). Female roost site selection, in terms of canopy cover and tree height, changes depending on reproductive stage; relative to pre- and post-lactation periods, lactating northern long-eared bats have been shown to roost higher in tall trees situated in areas of relatively less canopy cover and tree density (Garroway and Broders 2008, p. 91).

Adult females give birth to a single pup (Barbour and Davis 1969). Birthing within the colony tends to be synchronous, with the majority of births occurring around the same time (Krochmal and Sparks 2007, p. 654). Parturition (birth) likely occurs in late May or early June (Caire *et al.* 1979, p. 406; Easterla 1968, p. 770; Whitaker and Mumford 2009, p. 213), but may occur as late as July (Whitaker and Mumford 2009, p. 213). Broders *et al.* (2006, p. 1177) estimated a parturition date of July 20 in New Brunswick. Lactating and post-lactating females were observed in mid-June in Missouri (Caire *et al.* 1979, p. 407), July in New Hampshire and Indiana (Sasse and Pekins 1996, p. 95; Whitaker and Mumford 2009, p. 213), and August in Nebraska (Benedict 2004, p. 235). Juvenile volancy (flight) occurs by 21 days after parturition (Krochmal and Sparks 2007, p. 651, Kunz 1971, p. 480) and as early as 18 days after parturition (Krochmal and Sparks 2007, p. 651). Subadults were captured in late June in Missouri (Caire *et al.* 1979, p. 407), early July in Iowa (Sasse and Pekins 1996, p. 95), and early August in Ohio (Mills 1971, p. 625).

Adult longevity is estimated to be up to 18.5 years (Hall 1957, p. 407), with the greatest recorded age of 19 years (Kurta 1995, p. 71). Most mortality for northern long-eared and many other species of bats occurs during the juvenile stage (Caceres and Pybus 1997, p. 4).

Foraging Behavior and Home Range

The northern long-eared bat has a diverse diet including moths, flies, leafhoppers, caddisflies, and beetles (Nagorsen and Brigham 1993, p. 88; Brack and Whitaker 2001, p. 207; Griffith and Gates 1985, p. 452), with diet composition differing geographically and seasonally (Brack and Whitaker 2001, p. 208). Feldhamer *et al.* (2009, p. 49) noted close similarities of all *Myotis* diets in southern Illinois, while Griffith and Gates (1985, p. 454) found significant differences in the diets of northern long-eared bat and little brown bat. The most common insects found in the diets of northern long-eared bats are lepidopterans (moths) and coleopterans (beetles) (Feldhamer *et al.* 2009, p. 45; Brack and Whitaker 2001, p. 207) with arachnids (spiders) also being a common prey item (Feldhamer *et al.* 2009, p. 45).

Foraging techniques include hawking (catching insects in flight) and gleaning in conjunction with passive acoustic cues (Nagorsen and Brigham 1993, p. 88; Ratcliffe and Dawson 2003, p. 851). Observations of northern long-eared bats foraging on arachnids (Feldhamer *et al.* 2009, p. 49), presence of green plant material in their feces (Griffith and Gates 1985, p. 456), and non-flying prey in their stomach contents (Brack and Whitaker 2001, p. 207) suggest considerable gleaning behavior. Northern long-eared bats have the highest frequency call of any bat species in the Great Lakes area (Kurta 1995, p. 71). Gleaning allows this species to gain a foraging advantage for preying upon moths because moths are less able to detect these high frequency echolocation calls (Faure *et al.* 1993, p. 185). Emerging at dusk, most hunting occurs above the understory, 1 to 3 m (3 to 10 ft) above the ground, but under the canopy (Nagorsen and Brigham 1993, p. 88) on forested hillsides and ridges, rather than along riparian areas (Brack and Whitaker 2001, p. 207; LaVal *et al.* 1977, p. 594). This coincides with data indicating that mature forests are an important habitat type for foraging northern long-eared bats (Caceres and Pybus 1998, p. 2). Occasional foraging also takes place over forest clearings and water, and along roads (Van Zyll de Jong 1985, p. 94). Foraging patterns indicate a peak activity period within 5 hours after sunset followed by a secondary peak within 8 hours after sunset (Kunz 1973, p. 18–19). Brack and Whitaker (2001, p. 207) did not find significant differences in the overall diet of northern long-eared bats between morning (3 a.m. to dawn) and evening (dusk to midnight) feedings; however there were some differences in the consumption of particular prey orders between morning and evening feedings. Additionally, no significant differences existed in dietary diversity values between age classes or sex groups (Brack and Whitaker 2001, p. 208).

Female home range size may range from 19 to 172 ha (47–425 acres) (Lacki *et al.* 2009, p. 5). Owen *et al.* (2003, p. 353) estimated average maternal home range size to be 65 ha (161 ac). Home range size of northern long-eared bats in this study site was small relative to other bat species, but this may be due to the study's timing (during the maternity period) and the small body size of *M. septentrionalis* (Owen *et al.* 2003, pp. 354–355). The mean distance between roost trees and foraging areas of radio-tagged individuals in New Hampshire was 620 m (2034 ft) (Sasse and Pekins 1996, p. 95).

Summary of Factors Affecting the Species

Section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, we may list a species based on any of the following five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination. Each of these factors is discussed below.

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the eastern small-footed and northern long-eared bats. Effects to both the eastern small-footed bat and northern long-eared bat from these factors are discussed together where the species are affected similarly.

There are several factors presented below that affect both the eastern small-footed and the northern long-eared bats to a greater or lesser degree; however, we have found that no other threat is as severe and immediate to the northern long-eared bat's persistence as the disease, white-nose syndrome (WNS), discussed below in Factor C. WNS is currently the predominant threat to the species, and if WNS had not emerged or was not affecting the northern long-eared bat populations to the level that it has, we presume the species' would not be experiencing the dramatic declines that it has since WNS emerged. Therefore, although we have included brief discussions of other factors affecting both species, the focus of the discussion below is on WNS.

Factor A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

Hibernation Habitat

Modifications to bat hibernacula by erecting physical barriers (*e.g.,* doors, gates) to control cave access and mining can affect the thermal regime of the habitat, and thus the ability of the cave or mine to support hibernating bats, including the northern long-eared and, in some cases, the eastern small-footed bat. For example, the Service's Indiana Bat Draft Recovery Plan (2007, pp. 71–74) presents a discussion of well-documented examples of these type of effectss to cave-hibernating species that are also applicable to our discussion here. Modifications to cave and mine entrances, such as the addition of gates or other structures intended to exclude humans, not only restricts flight and movement (Hemberger 2011, unpublished data), but also changes airflow and alters internal microclimates of the caves and mines and eliminating their utility as hibernacula. For example, Richter *et al.* (1993, p. 409) attributed the decline in the number of Indiana bats at Wyandotte Cave, Indiana (which harbors one of the largest known population of hibernating Indiana bats), to an increase in the cave's temperature resulting from restricted airflow caused by a stone wall erected at the cave's entrance. After the wall was removed, the number of Indiana bats increased markedly over the next 14 years (Richter *et al.* 1993, p. 412; Brack *et al.* 2003, p. 67). In an eastern small-footed bat example, the construction associated with commercializing the Fourth Chute Cave in Ontario, Canada, eliminated the circulation of cold air in one of the unvisited passages where a relatively large number of eastern small-footed bats hibernated. These bats were completely displaced as a result of the warmer microclimate produced (Mohr 1972, p. 36). Correctly installed gates, however, at other locations (*e.g.,* Aitkin Cave, Pennsylvania) have led to increases in eastern small-footed bat populations (Butchkoski 2012, pers. comm.). An example of northern long-eared bats likely being affected occurred when John Friend Cave in Maryland was filled with large rocks in 1981, which closed the only known entrance to the cave (Gates *et al.* 1984, p. 166).

In addition to the direct access modifications to caves discussed above, debris buildup at entrances or on cave gates can also significantly modify the cave or mine site characteristics through restricting airflow, altering the temperature of hibernacula, and restricting water flow. Water flow restriction could lead to flooding, thus drowning hibernating bats (Amelon and Burhans 2006, p. 72; Hemberger 2011, unpublished data). In Minnesota, 5 of 11 known northern long-eared bat hibernacula are known to flood, presenting a threat to hibernating bats (Nordquist 2012, pers. comm.). In Massachusetts, one of the known hibernacula for northern long-eared bats is a now unused aqueduct that on very rare occasions may fill up with water and make the hibernaculum unusable (French 2012, unpublished data). Flooding has been noted in hibernacula in other States within the range of the northern long-eared bat, but to a lesser degree. Although modifications to hibernacula can lead to mortality of both species, it has not had population-level effects.

Mining operations, mine passage collapse (subsidence), and mine reclamation activities can also affect bats and their hibernacula. Internal and external collapse of abandoned coal mines was identified as one of the primary threats to eastern small-footed and northern long-eared bat hibernacula at sites located within the New River Gorge National River and Gauley River National Recreation Area in West Virginia (Graham 2011, unpublished data). Collapse of hibernacula entrances or areas within the hibernacula, as well as quarry and mining operations that may alter known hibernacula, are considered threats to northern long-eared bats within Kentucky (Hemberger 2011, unpublished data). In States surveyed for effects to northern long-eared bats by hibernacula collapse, responses varied, with the following number of hibernacula in each State reported as susceptible to collapse: 1 (of 7) in Maryland, 3 (of 11) in Minnesota, 1 (of 5) in New Hampshire, 4 (of 15) in North Carolina, 1 (of 2) in South Carolina, and 1 (of 13) in Vermont (Service 2011, unpublished data).

Before current cave protection laws, there were several reported instances where mines were closed while bats were hibernating and entombing entire colonies (Tuttle and Taylor 1998, p. 8). Several caves were historically sealed or mined in Maryland prior to cave protection laws, although bat populations were undocumented (Feller 2011, unpublished data). For both the eastern small-footed and northern long-eared bats, loss of potential winter habitat through mine closures has been noted as a concern in Virginia, although visual inspections of openings are typically conducted to determine whether gating is warranted (Reynolds 2011, unpublished data). In Nebraska, closing quarries, and specifically sealing quarries in Cass and Sapry Counties, is considered a potential threat to northern long-eared bats (Geluso 2011, unpublished data).

In general, threats to the integrity of bat hibernacula have decreased since the Indiana bat was listed as endangered in 1967, and since the implementation of Federal and State cave protection laws. Increasing awareness about the importance of cave and mine microclimates to hibernating bats and regulation under the Act have helped to alleviate the destruction or modification of hibernation habitat, at least where the Indiana bat is present (Service 2007, p. 74). The eastern small-footed bat and northern long-eared bat have likely benefitted from the protections given to the Indiana bat and its winter habitat, as both species' ranges overlap significantly with the Indiana bat's range.

Disturbance of Hibernating Bats

Human disturbance of hibernating bats has long been considered a threat to cave-hibernating bat species like the eastern small-footed and northern long-eared bats, and is discussed in detail in the Service's Indiana Bat Draft Recovery Plan (2007, pp. 80–85). The primary forms of human disturbance to hibernating bats result from cave commercialization (cave tours and other commercial uses of caves), recreational caving, vandalism, and research-related activities (Service 2007, p. 80). Arousal during hibernation causes the greatest amount of energy depletion in hibernating bats (Thomas *et al.* 1990, p. 477). Human disturbance at hibernacula, specifically non-tactile disturbance such as changes in light and sound, can cause bats to arouse more frequently, causing premature energy store depletion and starvation, as well as increased tactile disturbance of bats to other individuals (Thomas *et al.* 1995, p. 944; Speakman *et al.* 1991, p. 1103), leading to marked reductions in bat populations (Tuttle 1979, p. 3). Prior to the outbreak of WNS, Amelon and Burhans (2006, p. 73) indicated that ‘‘the widespread recreational use of caves and indirect or direct disturbance by humans during the hibernation period pose the greatest known threat to this species (northern long-eared bat).’’ Olson *et al.* (2011, p. 228), hypothesized that decreased visits by recreational users and researchers were related to an increase in the hibernating bat population (including northern long-eared bats) at Cadomin Cave in Alberta, Canada. Disturbance during hibernation could cause movements within or between caves (Beer 1955, p. 244).

Human disturbance is a potential threat at approximately half of the known eastern small-footed bat hibernacula in the States of Kentucky, Maryland, North Carolina, Vermont, and West Virginia (Service, unpublished data). Of the States in the northern long-eared bat’s range that assessed the possibility of human disturbance at bat hibernacula, 93 percent (13 of 14) identified potential effects from human disturbance for at least 1 of the known hibernacula for this species in their state (Service, unpublished data). Eight of these 14 States (Arkansas, Kentucky, Maine, Minnesota, New Hampshire, North Carolina, South Carolina, and Vermont) indicated the potential for human disturbance at over 50 percent of the known hibernacula in that State. Nearly all States without WNS identified human disturbance as the primary threat to hibernating bats, and all others (including WNS-positive States) noted human disturbance as a secondary threat (WNS was predominantly the primary threat in these States) or of significant concern (Service, unpublished data).

The threat of commercial use of caves and mines during the hibernation period has decreased at many sites known to harbor Indiana bats, and we believe that this also applies to eastern small-footed and northern long-eared bats. However, effects from recreational caving are more difficult to assess. In addition to unintended effects of commercial and recreational caving, intentional killing of bats in caves by shooting, burning, and clubbing has been documented, although there are no data suggesting that eastern small-footed bats have been killed by these activities (Tuttle 1979, pp. 4, 8). Intentional killing of northern long-eared bats has been documented at a small percentage of hibernacula (*e.g.,* several cases of vandalism at hibernacula in Kentucky, one case of shooting disturbance in Maryland, one case of bat torching in Massachusetts where approximately 100 bats (northern long-eared bats and other species) were killed) (Service, unpublished data), but we do not have evidence that this is happening on a large enough scale to have population-level effects.

In summary, while there are isolated incidents of previous disturbance to both bat species due to recreational use of caves in both species, we conclude that there is no evidence suggesting that this threat in itself has led to population declines in either species.

Summer Habitat

Eastern small-footed bats roost in a variety of natural and manmade rock features, whereas northern long-eared bats roost predominantly in trees and to a lesser extent in manmade structures, as discussed in detail in the *Species Information* section above. We know of only one documented account where vandals were responsible for destroying a portion of an eastern small-footed bat roost located in Maryland (Feller 2011, unpublished data). More commonly, roost habitat for both the eastern small-footed bat and northern long-eared bat is at risk of modification or destruction. In Pennsylvania, for example, highway construction, commercial development, and several wind-energy projects may remove eastern small-footed bat roosting habitat (Librandi-Mumma 2011, pers. comm.). Some of the highest rates of development in the conterminous United States are occurring within the range of eastern small-footed and northern long-eared bats (Brown *et al.* 2005, p. 1856) and contribute to loss of forest habitat.

Wind-energy development is rapidly increasing throughout the eastern small-footed bat and northern long-eared bats’ ranges, particularly in the States of New Hampshire, New York, Pennsylvania, and Massachusetts. As well, Iowa, Illinois, Minnesota, Oklahoma, and North Dakota are within the top 10 States for wind power capacity (in megawatts) (installed projects) in the United States (American Wind Energy Association 2012, p. 6). If projects are sited in forested habitats, effects from wind-energy development may include forest-clearings associated with turbine placement, road construction, turbine lay-down areas, transmission lines, and substations. In Maryland, wind power development has been proposed in areas with documented eastern small-footed bat and northern long-eared bat summer habitat (Feller 2011, unpublished data). In Pennsylvania, the majority of wind-energy projects are located in habitats characterized as mountain ridge-top, cliffs, steep slopes, or isolated hills with steep, often vertical sides (Mumma and Capouillez 2011, pp. 11–12). Eastern small-footed bats were confirmed through bat mist-net surveys at 7 of 34 proposed wind-energy project sites in Pennsylvania, and northern long-eared bats were confirmed at all 34 proposed wind project sites (Mumma and Capouillez 2011, pp. 62–63). See *Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence* for a discussion on effects to bats from the operation of wind turbines.

Another activity that may modify or destroy eastern small-footed bat roosting habitat is mined-land reclamation, whereby rock habitats (*e.g.,* rock piles, cliffs, spoil piles) are removed from previously mined lands. The Office of Surface Mining Reclamation and Enforcement and its partners are responsible for reclaiming and restoring lands degraded by mining operations. Mining sites eligible for restoration are numerous in the States of Pennsylvania, Ohio, West Virginia, and Kentucky. Reclaiming these sites often involves the removal of exposed rock habitats that may be used as eastern small-footed bat roost habitat (Sanders 2011, pers. comm.). The number of potential roost sites that have been destroyed or that may be destroyed in the future and the potential effect of this destruction on eastern small-footed bat populations are largely unknown. Despite the potential negative effects of this activity, there are no data available suggesting a decrease in the number of eastern small-footed bats from mined-land reclamation activities. Since northern long-eared bats are not known to use exposed rock habitat for roost sites, mined-land reclamation does not affect this species.

Surface coal mining is also common in the central Appalachian region, which includes portions of Pennsylvania, West Virginia, Virginia, Kentucky, and Tennessee, and is one of the major drivers of land cover change in the region (Sayler 2008, unpaginated). Surface coal mining also may destroy forest habitat in parts of the Illinois Basin in southwest Indiana, western Kentucky, and Illinois (King

2013, pers. comm.). One major form of surface mining is mountaintop mining, which is widespread throughout eastern Kentucky, West Virginia, and southwestern Virginia (Palmer *et al.* 2010, p. 148). Mountaintop mining involves the clearing of upper elevation forests, stripping of topsoil, and use of explosives to break up rocks to access buried coal. The excess rock is sometimes pushed into adjacent valleys, where it buries existing streams (Palmer *et al.* 2010, p. 148). Hartman *et al.* (2005, p. 96) reported significant reductions in insect densities in streams affected with fill material, including lower densities of coleopterans, a primary food source of eastern small-footed and northern long-eared bats (Griffith and Gates 1985, p. 452; Johnson and Gates 2007, p. 319; Moosman *et al.* 2007, p. 355; Feldhamer *et al.* 2009, p. 45). The effect of mountaintop mining on eastern small-footed bat and northern long-eared bat populations is largely unknown.

The effect of forest removal related to the eastern small-footed bat is poorly understood. Forest management can influence the availability and characteristics of non-tree roost sites, such as those used by eastern small-footed bats, although the resulting effects on bats and bat populations are poorly known (Hayes and Loeb 2007, p. 215). Since eastern small-footed bats often forage in forests immediately surrounding roost sites, forest management may affect the quality of foraging habitat (Johnson *et al.* 2009, p. 5). Scientific evidence and anecdotal observations support the hypotheses that bats respond to prey availability, that prey availability is influenced by forest management, and that influences of forest management on prey populations affect bat populations (Hayes and Loeb 2007, p. 219). In addition, forest management activities that influence tree density directly alter the amount of vegetative clutter (*e.g.,* tree density) in an area. As a result, forest management can directly influence habitat suitability for bats through changes in the amount of vegetative clutter (Hayes and Loeb 2007, p. 217). Eastern small-footed bats are capable of foraging in cluttered forest interiors, but as discussed in the *Species Information* section above, they have also been found foraging in clearings, in strip mine areas, and over water. Johnson and Gates (2008, p. 459) suggest that a better understanding of the required spatial extent and structure of forest cover along ridgelines and rock outcrops, as well as additional foraging activity requirements, is needed to aid conservation efforts for the eastern small-footed bat.

Although there is still much to learn about the effects of forest removal on northern long-eared bats and their associated summer habitat, studies to date have found that the northern long-eared bat shows a varied degree of sensitivity to timber harvesting practices. Several studies (as discussed in the *Species Information* section above) have found that the species uses a wide range of tree species for roosting, suggesting that forest succession may play a larger role in roost selection (than tree species) (Silvis *et al.* 2012, p. 6). Studies have found that female bat roosts are more often (*i.e.,* greater than what would be expected from random chance) located in areas with partial harvesting than in random sites, which may be due to trees located in more open habitat receiving greater solar radiation and therefore speeding development of young (Menzel *et al.* 2002, p. 112; Perry and Thill 2007, pp. 224–225). In the Appalachians of West Virginia, diameter-limit harvests (70–90 year-old stands, with 30–40 percent of the basal area removed in the past 10 years) rather than intact forest was the habitat type most selected by northern long-eared bats (Owen *et al.* 2003, p. 356). Cryan *et al.* (2001, p. 49) found several northern long-eared bat roost areas in recently harvested (less than 5 years) stands in the Black Hills of South Dakota, although the largest colony (n=41) was found in a mature forest stand that had not been harvested in over 50 years. In intensively managed forests in the central Appalachians, Owen *et al.* (2002, p. 4) found roost availability was not a limiting factor for the northern long-eared bat, since bats often chose black locust and black cherry as roost trees, which were quite abundant since these trees often regenerate quickly after disturbance (*e.g.,* timber harvest).

It is possible that this flexibility in roosting habits allows northern long-eared bats to be adaptable in managed forests, which allows them to avoid competition for roosting habitat with more specialized species, such as the Indiana bat (Timpone *et al.* 2010, p. 121). However, the northern long-eared bat has shown a preference for contiguous tracts of forest cover for foraging (Owen *et al.* 2003, p. 356; Yates and Muzika 2006, p. 1245). Jung *et al.* (2004, p. 333) found that it is important to retain snags and provide for recruitment of roost trees during selective harvesting in forest stands that harbor bats. If roost networks are disturbed through timber harvesting, there may be more dispersal and fewer shared roost trees, which may lead to less communication between bats in addition to less disease transmission (Johnson *et al.* 2012, p. 230). In the Appalachians, Ford *et al.* (2006, p. 20) assessed that northern long-eared bats may be a suitable management indicator species for assessing mature forest ecosystem integrity, since they found male bats using roosts in mature forest stands of mostly second growth or regenerated forests.

There is conflicting information on sensitivities of male versus female northern long-eared bats to forestry practices and resulting fragmentation. In Arkansas, Perry and Thill (2007, p. 225) found that male northern long-eared bats seem to prefer more dense stands for summer roosting, with 67 percent of male roosts occurring in unharvested sites versus 45 percent of female roosts. The greater tendency of females to roost in more open forested areas than males may be due to greater solar radiation experienced in these openings, which could speed growth of young in maternity colonies (Perry and Thill 2007, p. 224). Lacki and Schwierjohann (2001, p. 487) stated that silvicultural practices could meet both male and female roosting requirements by maintaining large-diameter snags, while allowing for regeneration of forests. However, Broders and Forbes (2004, p. 608) found that timber harvest may have negative effects on female bats since they use forest interiors at small scales (less than 2 km (1.2 mi) from roost sites). They also found that males are not as limited in roost selection and they do not have the energetic cost of raising young; therefore males may be less affected than females (Broders and Forbes 2004, p. 608). Henderson *et al.* (2008, p. 1825) also found that forest fragmentation effects northern long-eared bats at different scales based on sex; females require a larger unfragmented area with a large number of suitable roost trees to support a colony, whereas males are able to use smaller areas (more fragmented). Henderson and Broders (2008, pp. 959–960) examined how female northern long-eared bats use the forest-agricultural landscape on Prince Edward Island, Canada, and found that bats were limited in their mobility and activities are constrained where suitable forest is limited. However, they also found that bats in relatively fragmented areas used a building for colony roosting, which suggests an alternative for a colony to persist in an area with fewer available roost trees. Although we are still learning about the effect of forest removal on northern long-eared bats and their associated summer habitat, studies to date have found that the northern long-eared bat shows a varied degree of sensitivity to timber harvesting practices and the amount of forest removal occurring varies by State.

Natural gas development from shale is expanding across the United States, particularly throughout the range of the northern long-eared and eastern small-footed bat. Natural gas extraction involves fracturing rock formations and uses highly pressurized fluids consisting of water and various chemicals to do so (Hein 2012, p. 1). Natural gas extraction, particularly across the Marcellus Shale region, which includes large portions of New York, Pennsylvania, Ohio, and West Virginia, is expected to expand over the coming years. In Pennsylvania, for example, nearly 2,000 Marcellus natural gas wells have already been drilled or permitted, and as many as 60,000 more could be built by 2030, if development trends continue (Johnson 2010, pp. 8, 13). Habitat loss and degradation due to this practice could occur in the form of forest clearing for well pads and associated infrastructure (*e.g.,* roads, pipelines, and water impoundments), which would decrease the amount of suitable interior forest habitat available to northern long-eared and eastern small-footed bats for establishing maternity colonies and for foraging, in addition to further isolating populations and, therefore, potentially decreasing genetic diversity (Johnson 2010, p. 10; Hein 2012, p. 6). Since northern long-eared bats and eastern small-footed bats have philopatric tendencies, loss or alteration of forest habitat for natural gas development may also put additional stress on females when returning to summer roost or foraging areas after hibernation if females were forced to find new roosting or foraging areas (expend additional energy) (Hein 2012, pp. 11–12).

Conservation Efforts To Reduce Habitat Destruction, Modification, or Curtailment of Its Range

Although there are various forms of habitat destruction and disturbance that present potential adverse effects to the northern long-eared bat, this is not considered the predominant threat to the species. Even if all habitat-related stressors were eliminated or minimized, the significant effects of WNS on the northern long-eared bat would still be present. Therefore, below we present a few examples, but not a comprehensive list, of conservation efforts that have been undertaken to lessen effects from habitat destruction or disturbance to northern long-eared and eastern small-footed bats. One of the threats to bats in Michigan is the closure of unsafe mines in such a way that bats are trapped within or excluded; however, there have been efforts by the Michigan Department of Natural Resources and others to work with landowners who have open mines to encourage them to install bat-friendly gates to close mines to humans, but allow access to bats (Hoving 2011, unpublished data). The NPS has proactively taken efforts to minimize effects to bat habitat resulting from vandalism, recreational activities, and abandoned mine closures (Plumb and Budde 2011, unpublished data). In addition, the NPS is properly gating, using a ‘‘bat-friendly design, abandoned coal mine entrances as funding permits (Graham 2011, unpublished data). All known hibernacula within national grasslands and forestlands of the Rocky Mountain Region of the U.S. Forest Service are closed during the winter hibernation period, primarily due to the threat of white-nose syndrome, although this will reduce disturbance to bats in general inhabiting these hibernacula (U.S. Forest Service 2013, unpaginated). Concern over the importance of bat roosts, including hibernacula, fueled efforts by the American Society of Mammalogists to develop guidelines for protection of roosts, many of which have been adopted by government agencies and special interest groups (Sheffield *et al.* 1992, p. 707).

Summary of the Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

We have identified several activities, such as constructing physical barriers at cave accesses, mining, flooding, vandalism, development, and timber harvest, that may modify or destroy habitat for the eastern small-footed bat and northern long-eared bat. Although such activities occur, these activities alone do not have significant, population-level effects on either species.

Factor B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

There are very few records of either species being collected specifically for commercial, recreational, scientific, or educational purposes, and thus we do not consider such collection activities to pose a threat to either species. Disturbance of hibernating bats as a result of recreational use and scientific research activities in hibernacula is discussed under Factor A.

Factor C. Disease or Predation

Disease

White-Nose Syndrome

White-nose syndrome is an emerging infectious disease responsible for unprecedented mortality in some hibernating insectivorous bats of the northeastern United States (Blehert *et al.* 2009, p. 227), and poses a considerable threat to several hibernating bat species throughout North America (Service 2010, p. 1). Since its first documented appearance in New York in 2006, WNS has spread rapidly throughout the Northeast and is expanding through the Midwest. As of August 2013, WNS has been confirmed in 22 States (Alabama, Connecticut, Delaware, Georgia, Illinois, Indiana, Kentucky, Maine, Maryland, Massachusetts, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, Vermont, Virginia, and West Virginia) and 5 Canadian provinces (New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec). Four additional States (Arkansas, Iowa, Minnesota, and Oklahoma) are considered suspect for WNS based on the detection of the causative fungus on bats within those States, but with no associated disease to date. Service biologists and partners estimate that at least 5.7 million to 6.7 million bats of several species have now died from WNS (Service 2012, p. 1). Dzal *et al.* (2011, p. 393) documented a 78-percent decline in the summer activity of little brown bats in New York State, coinciding with the arrival and spread of WNS, suggesting large-scale population effects. Turner *et al.* (2011, p. 22) reported an 88-percent decline in the number of hibernating bats at 42 sites from the States of New York, Pennsylvania, Vermont, Virginia, and West Virginia. Furthermore, Frick *et al.* (2010, p. 681) predicted that the little brown bat, formerly the most common bat in the northeastern United States, will likely become extinct in the region by 2026 (potential loss of some 6.5 million bats) if current trends continue. Similarly, Thogmartin *et al.* (2013, p. 171) predicted that WNS is likely to extirpate the federally endangered Indiana bat over large parts of its range. These predicted trends in little brown bats and Indiana bats may or may not also be indicative of population trends in other bat species like the eastern small-footed and northern long-eared bats.

The first evidence of WNS was documented in a photograph taken from Howes Cavern, 52 km (32 mi) west of

Albany, New York, on February16, 2006 (Blehert *et al.* 2009, p. 227). Prior to the arrival of WNS, surveys of six species of hibernating bats in New York State revealed that populations had been stable or increasing in recent decades (Service 2010, p. 1). Decreases in some species of bats at WNS-infected hibernacula have ranged from 30 to 99 percent (Frick *et al.* 2010, p. 680).

The pattern of spread has generally followed predictable trajectories along recognized migratory pathways and overlapping summer ranges of hibernating bat species. Therefore, Kunz and Reichard (2010, p. 12) assert that WNS is spread mainly through bat-to-bat contact; however, evidence suggests that fungal spores can be transmitted by humans (United States Geologic Survey (USGS) National Wildlife Health Center, Wildlife Health Bulletin 2011–05), and bats can also become infected by coming into contact with contaminated cave substrate (Darling 2012, pers. comm.). Six North American hibernating bat species (little brown bat, Indiana bat, northern long-eared bat, eastern small-footed bat, big brown bat, and tri-colored bat), are known to be affected by WNS; however, the effect of WNS varies by species. The fungus that causes WNS has been detected on three additional species; the southeastern bat (*Myotis austroriparius*), and gray bat (*Myotis grisescens*), and cave bat (*Myotis velifer*). White-nose syndrome is caused by the recently described psychrophilic (cold-loving) fungus, currently known as *Geomyces destructans. Geomyces destructans* may be nonnative to North America, and only recently arrived on the continent (Puechmaille *et al.* 2011, p. 8). The fungus grows on and within exposed tissues of hibernating bats (Lorch *et al.* 2011, p. 376; Gargas *et al.* 2009, pp. 147–154)), and the diagnostic feature is the white fungal growth on muzzles, ears, or wing membranes of affected bats, along with epidermal (skin) erosions that are filled with fungal hyphae (branching, filamentous structures of fungi) (Blehert *et al.* 2009, p. 227; Meteyer 2009, p. 412). *Geomyces destructans* grows optimally at temperatures from 5 to 10 °C (41 to 50 °F), the same temperatures at which bats typically hibernate (Blehert *et al.* 2009, p. 227). Temperatures in WNS-affected hibernacula seasonally range from 2 to 14 °C (36 to 57 °F), permitting year-round growth, and may act as a reservoir maintaining the fungus (Blehert *et al.* 2009, p. 227). Growth is slow, and no growth occurs at temperatures above 24 °C (75 °F) (Gargas *et al.* 2009, p. 152). Bats that are found in more humid regions of hibernacula may be more susceptible to WNS, but further research is needed to confirm this hypothesis. Declines in Indiana bats have been greater under more humid conditions, suggesting that growth of the fungus and either intensity or prevalence of infections are higher in more humid conditions (Langwig *et al.* 2012a, p. 1055). Although *G. destructans* has been isolated from five bat species from Europe, research suggests that bat species in Europe may be immunologically or behaviorally resistant, having coevolved with the fungus (Wibbelt *et al.* 2010, p. 1241). Pikula *et al.* (2012, p. 210), however, confirmed that bats found dead in the Czech Republic exhibited lesions consistent with WNS infection.

In addition to the presence of the white fungus, initial observations showed that bats affected by WNS were characterized by some or all of the following: (1) Depleted fat reserves by mid-winter; (2) a general unresponsiveness to human disturbance; (3) an apparent lack of immune response during hibernation; (4) ulcerated, necrotic, and scarred wing membranes; and (5) aberrant behaviors, including shifts of large numbers of bats in hibernacula to roosts near the entrances or unusually cold areas, large numbers of bats dispersing during the day from hibernacula during mid-winter, and large numbers of fatalities, either inside the hibernacula, near the entrance, or in the immediate vicinity of the entrance (WNS Science Strategy Report 2008, p. 2; Service 2010, p. 2). Although the exact process by which WNS leads to death remains undetermined, it is likely that the immune function during torpor compromises the ability of hibernating bats to combat the infection (Bouma *et al.* 2010, p. 623; Moore *et al.* 2011, p. 10).

Early hypotheses suggested that WNS may affect bats before the hibernation season begins, causing bats to arrive at hibernacula with insufficient fat to survive the winter. Alternatively, a second hypothesis suggests that bats arrive at hibernacula unaffected and enter hibernation with sufficient fat stores, but then become affected and use fat stores too quickly as a result of disruption to hibernation physiology (WNS Science Strategy Group 2008, p. 7). More recent observations, however, suggest that bats are arriving to hibernacula with sufficient or only slightly lower fat stores (Turner 2011, pers. comm.), and that although body weights of WNS-infected bats were consistently at the lower end of the normal range, in one study 12 of 14 bats (10 little brown bats, 1 big-brown bat, and 1 tri-colored bat) had an appreciable degree of fat stores (Courtin *et al.* 2010, p. 4).

Boyles and Willis (2010, pp. 92–98) hypothesized that infection by *Geomyces destructans* alters the normal arousal cycles of hibernating bats, particularly by increasing arousal frequency, duration, or both. In fact, Reeder *et al.* (2012, p. 5) and Warnecke *et al.* (2012, p. 2) did observe an increase in arousal frequency in laboratory studies of hibernating bats infected with *G. destructans.* A disruption of this torpor-arousal cycle could easily cause bats to metabolize fat reserves too quickly, thereby leading to starvation. For example, skin irritation from the fungus might cause bats to remain out of torpor for longer than normal to groom, thereby exhausting their fat reserves prematurely (Boyles and Willis 2010, p. 93).

Due to the unique physiological importance of wings to hibernating bats in relation to the damage caused by *Geomyces destructans,* Cryan et al. (2010, pp. 1–8) suggests that mortality may be caused by catastrophic disruption of wing-dependent physiological functions. The authors hypothesize that *G. destructans* may cause unsustainable dehydration in water-dependent bats, trigger thirst-associated arousals, cause significant circulatory and thermoregulatory disturbance, disrupt respiratory gas exchange, and destroy wing structures necessary for flight control (Cryan *et al.* 2010, p. 7). The wings of winter-collected WNS-affected bats often reveal signs of infection, whereby the degree of damage observed suggests functional impairment. Emaciation is a common finding in bats that have died from WNS (Cryan *et al.* 2010, p. 3). Cryan *et al.* (2010, p. 3) hypothesized that disruption of physiological homeostasis, potentially caused by *G. destructans* infection, may be sufficient to result in emaciation and mortality. The authors hypothesized that wing damage caused by *G. destructans* infections could sufficiently disrupt water balance to trigger frequent thirst-associated arousals with excessive winter flight, and subsequent premature depletion of fat stores. In related research, Cryan *et al.* (2013, p. 398) found, after analyzing blood from hibernating bats infected with WNS, that electrolytes, sodium and chloride, tended to decrease as wing damage increased in severity. Proper concentrations of electrolytes are necessary for maintaining physiologic homeostasis, and any imbalance could be life-threatening (Cryan *et al.* 2013, p. 398). Although the exact mechanism by which WNS affects bats is still in question, the effect it has on many hibernating bat species is well documented as well as the high levels of mortality it causes in some susceptible bat species.

Effects of White-Nose Syndrome on the Eastern Small-Footed Bat

Eastern small-footed bats are known to be susceptible to WNS. As of 2011, of the 283 documented eastern small-footed bat hibernacula, 86 (31 percent) were WNS-positive (Service 2011, unpublished data). Only three eastern small-footed bats have been collected, tested, and confirmed positive for WNS by histology: One bat collected and euthanized from New York in 2009, one bat found dead in Pennsylvania in 2011, and one bat found dead from South Carolina in 2013 (Ballmann 2011, pers. comm.; Last 2013a, pers. comm.). An additional eastern small-footed bat collected in winter 2011–2012 from the Mammoth Cave Visitor Center in Kentucky, was submitted to the Southeastern Cooperative Wildlife Disease Study; however, this bat tested negative for WNS. Biologists also observed approximately five dead eastern small-footed bats with obvious signs of fungal infection in Virginia (Reynolds 2011, pers. comm.).

To determine whether WNS is causing a population-level effect to eastern small-footed bats, the Service began by reviewing winter hibernacula survey data. By comparing the most recent pre-WNS count to the most recent post-WNS count, Turner *et al.* (2011, p. 22) reported a 12-percent decline in the number of hibernating eastern small-footed bats at 25 hibernacula in New York, Pennsylvania, Vermont, Virginia, and West Virginia. Data analyzed in this study were limited to sites with confirmed WNS mortality for at least 2 years and sites with comparable survey effort across pre- and post-WNS years. Based on a review of pre-WNS hibernacula count data over multiple years at 12 of these sites, the number of eastern small-footed bats fluctuated between years.

When we compared the most recent post-WNS eastern small-footed bat count to pre-WNS observations, we found that post-WNS counts were within the normal observed range at nine sites (75 percent), higher at two sites (17 percent), and lower at only one site (8 percent). In addition, although Langwig *et al.* (2012a, p. 1052) reported a significantly lower population growth rate compared to pre-WNS population growth rates for eastern small-footed bat, they found that the species was not declining significantly at hibernacula in New York, Vermont, Connecticut, and Massachusetts. Langwig *et al.* (2012b, p. 15) also observed lower prevalence of *Geomyces destructans* on eastern small-footed bat wing and muzzle tissue during late hibernation, compared to other bat species (*e.g.,* little brown bats). Lastly, biologists did not observe fungal growth (although the fungus may not be visible after the first couple of years) on eastern small-footed bats during 2013 hibernacula surveys in New York, Pennsylvania, and North Carolina, even though it was observed on other bat species (*e.g.,* little brown bats) within the same sites (although a few, not all, eastern small-footed bats viewed under ultraviolet light did show signs of mild infections), nor did they observe reduced numbers of eastern small-footed bats compared to pre-WNS years (Graeter 2013, pers. comm.; Herzog 2013, pers. comm.; Turner 2013, unpublished data). In fact, biologists in New York observed the largest number of hibernating eastern small-footed bats ever reported (2,383) during surveys conducted in 2013, up from 1,727 reported in 1993 using roughly comparable survey effort (Herzog 2013, pers. comm.). In summary, WNS does not appear to have caused a significant population decline in hibernating eastern small-footed bats.

Summer survey data are limited for the eastern small-footed bat. We know of only three studies that have attempted to quantify changes in the number of non-hibernating eastern small-footed bats since the spread of WNS (Francl *et al.* 2012; Nagel and Gates 2012; Moosman *et al.* in press). At one study location, Surry Mountain Reservoir, New Hampshire, bats were mist-netted over multiple years before and after the emergence of WNS (Moosman *et al.* in press). Researchers observed a significant decline in the relative abundance of eastern small-footed bats between 2005 and 2011, based on reductions in capture rates. However, they found that the probability of capturing greater than or equal to one eastern small-footed bat on any given visit during the 7 years of study was similar across years, although the probability of capturing other species (*e.g.,* northern long-eared and little brown bats) declined over time. Moosman *et al.* (unpublished data) also noted that the observed decline in relative abundance of eastern small-footed bats at their site should not be solely attributed to WNS because of the potential for bats to become trap-shy due to repeated sampling efforts.

Eastern small-footed bats are noted for their ability to detect and avoid mist-nets, perhaps more so than other bat species within their range (Tyburec 2012, unpaginated). In addition, Francl *et al.* (2012, p. 34) compared bat mist-net data collected from 31 counties in West Virginia prior to the detection of WNS (1997 to 2008) to 8 West Virginia and 1 extreme southwestern Pennsylvania counties surveyed in 2010. Researchers reported a 16-percent decline in the post-WNS capture rate for eastern small-footed bats, although they acknowledge the small sample size may have inherently higher variation and bias compared to more common species that showed consistently negative trends (*e.g.,* northern long-eared, little brown, and tri-colored bats) (Francl *et al.* 2012, p. 40). Lastly, during acoustic surveys for bats, Nagel and Gates (2012, p. 5) reported a 63-percent increase in the number of eastern small-footed bat passes during acoustic surveys from 2010 to 2012 in western Maryland, although large declines in bat passes were observed for other species (*e.g.,* northern long-eared, little brown/Indiana, and tri-colored bats).

Several factors may influence why eastern small-footed bats are potentially less susceptible to WNS than other *Myotis* bats. First, during mild winters, eastern small-footed bats may not enter caves and mines or, if they do, may leave during mild periods. Although there are few winter observations of this species outside of cave and mine habitat, it was first speculated in 1945 as a possibility. In trying to explain why so many bats banded in the summer were unaccounted for during winter hibernacula surveys, Griffin (1945, p. 22) suggested that bats may be using alternate hibernacula such as small, deep crevices in rocks, which he suggested would provide a bat with adequate protection from freezing. Neubaum *et al.* (2006, p. 476) observed many big brown bats choosing hibernation sites in rock crevices and speculated that this pattern of roost selection could be common for other species. Time spent outside of cave and mine habitat by eastern small-footed bats means less time for the fungus to grow because environmental conditions (*e.g.,* temperature and humidity) are suboptimal for fungus growth.

A second factor that may influence lower susceptibility of eastern small-footed bats to WNS is that this bat species tends to enter cave or mine habitat later (mid-November) and leave earlier (mid-March) compared to other *Myotis* bats, again providing less time for the fungus to grow, and less energy expenditure than other species that hibernate longer. Third, when eastern small-footed bats are present at caves and mines, they are most frequently observed at the entrances, where humidity is low and temperature fluctuations are high, which consequently does not provide ideal environmental conditions for fungal growth. Cryan *et al.* (2010, p. 4) suggest that eastern small-footed bats may be less susceptible to evaporative water loss, since they often select drier areas of hibernacula, and therefore may be less susceptible to succumbing to WNS. Big brown bats also tend to select drier, more ventilated areas for hibernation, and consequently, Blehert *et al.* (2009, p. 227) and Courtin *et al.* (2010, p. 4) did not observe the fungus in big brown bat specimens. Lastly, unlike some other gregarious bats (*e.g.,* little brown bats), eastern small-footed bats frequently roost solitarily or deep within cracks, possibly further reducing their exposure to the fungus.

Fenton (1972, p. 5) never observed eastern small-footed bats close to or in contact with little brown or Indiana bats, both highly gregarious species experiencing severe population declines. Solitary hibernating habits have also been suggested as one of the reasons why big brown bats appear to have been only moderately affected by WNS (Ford *et al.* 2011, p. 130). Laboratory studies conducted by Blehert *et al.* (2011) further support this hypothesis. In their study, only healthy bats that came into direct contact with infected bats or were inoculated with pure cultures of *Geomyces destructans* developed lesions consistent with WNS. Healthy bats housed with infected bats in such a way as to prohibit animal-to-animal contact but still allow for potential aerosols to be transmitted from sick bats did not develop any detectable signs of WNS.

In conclusion, there are several factors that may explain why eastern small-footed bats appear to be less susceptible to WNS than other cave bat species. These factors include hibernacula selection (cave versus non-cave), total time spent hibernating in hibernacula, location within the hibernacula (areas with lower humidity and higher temperature fluctuation), and solitary roosting behavior.

Effects of White-Nose Syndrome on the Northern Long-Eared Bat

The northern long-eared bat is known to be susceptible to WNS, and mortalities due to the disease have been confirmed. The USGS National Wildlife Health Center in Madison, Wisconsin, received 79 northern long-eared bat submissions since 2007, of which 65 were tested for WNS. Twenty-eight of the 65 northern long-eared bats tested were confirmed as positive for WNS by histopathology and another 10 were suspect (Ballmann 2013, pers. comm.). In addition, 9 of 14 northern long-eared bats in 2012–2013 were positive, and 1 was suspect (Last 2013b, pers. comm.); all the WNS-positive submissions were from Tennessee, Kentucky, and Ohio. The New York Department of Environmental Conservation has confirmed 29 northern long-eared bats submitted with signs of WNS, at minimum (there are still bat carcasses that have not been analyzed yet), since 2007 in New York (Okonieski 2012, pers. comm.).

Due to WNS, the northern long-eared bat has experienced a sharp decline in the northeastern part of its range, as evidenced in hibernacula surveys. The northeastern United States is very close to saturation (WNS found in majority of hibernacula) for the disease, with the northern long-eared bat being one of the species most severely affected by the disease (Herzog and Reynolds 2012, p. 10). Turner *et al.* (2011, p. 22) compared the most recent pre-WNS count to the most recent post-WNS count for 6 cave bat species; they reported a 98-percent decline between pre- and post-WNS in the number of hibernating northern long-eared bats at 30 hibernacula in New York, Pennsylvania, Vermont, Virginia, and West Virginia. Data analyzed in this study were limited to sites with confirmed WNS mortality for at least 2 years and sites with comparable survey effort across pre and post-WNS years. In addition to the Turner *et al.* (2011) data, the Service conducted an additional analysis that included data from Connecticut (n=3), Massachusetts (n=4), and New Hampshire (n=4), and added one additional site to the previous Vermont data. We used a similar protocol for analyses as used in Turner *et al.* (2011); our analysis was limited to sites where WNS has been present for at least 2 years. The combined overall rate of decline seen in hibernacula count data for the 8 States is approximately 99 percent.

In hibernacula surveys in New York, Vermont, Connecticut, and Massachusetts, hibernacula with larger populations of northern long-eared bats experienced greater declines, suggesting a density-dependent decline due to WNS (Langwig *et al.* 2012a, p. 1053). Also, although some species' populations (*e.g.,* tri-colored bat, Indiana bat) stabilized at drastically reduced levels compared to pre-WNS, each of the 14 populations of northern long-eared bats became locally extinct within 2 years due to disease, and no population was remaining 5 years post-WNS (Langwig *et al.* 2012, p. 1054). During 2013 hibernacula surveys at 34 sites where northern long-eared bats were also observed prior to WNS in Pennsylvania, researchers found a 99-percent decline (from 637 to 5 bats) (Turner 2013, unpublished data).

Due to favoring small cracks or crevices in cave ceilings, making them more challenging to locate during hibernacula surveys, data in some States (particularly those with a greater number of caves with more cracks or crevices) may not give an entirely clear picture of the level of decline the species is experiencing (Turner *et al.* 2011, p. 21). When dramatic declines due to WNS occur, the overall rate of decline appears to vary by site; some sites experience the progression from the detection of a few bats with visible fungus to widespread mortality after a few weeks, while at other sites this may take a year or more (Turner *et al.* 2011, pp. 20–21). For example, in Massachusetts, WNS was first confirmed in February of 2008, and by 2009, ''the population (northern long-eared bat) was knocked down, and the second year the population was finished'' (French 2012, pers. comm.). Further, in Virginia, Reynolds (2012, pers. comm.) reported that ''not all sites are on the same 'WNS time frame,' but it appears the effects will be similar, suggesting that all hibernacula in the mountains of Virginia will succumb to WNS at one time or another.'' We have not yet seen the same level of decline in the Midwestern and southern parts of the species' range, although we expect similar rates of decline once the disease arrives or becomes more established.

Although the disease has not yet spread throughout the species' entire range (WNS is currently found in 22 of 39 States where the northern long-eared bat occurs), it continues to spread, and we have no reason not to expect that where it spreads, it will have the same impact to the affected species (Coleman 2013, pers. comm.). The current rate of spread has been rapid, spreading from the first documented occurrence in New York in February 2006, to 22 states and 5 Canadian provinces by July 2013. There is some uncertainty as to the timeframe when the disease will spread throughout the species' range and when resulting mortalities as witnessed in the currently affected area will occur in the rest of the range. Researchers have suggested that there may be a 'slow down' in the spread of the disease in the Great Plains (Frick and Kilpatrick 2013, pers. comm.); however, this is on the western edge of the northern long-eared bat's range where the species is naturally less common and, therefore, offers little respite to the species. A few models have attempted to project the spread of *Geomyces destructans* and WNS, and although they have differed in the timing of the disease spreading throughout the continental United States, all were in agreement that WNS will indeed spread throughout the United States (Hallam *et al.* 2011, p. 8; Maher *et al.* 2012, pp. 4–5). One of these models suggests that there may be a temperature-dependent boundary in southern latitudes that may offer refuge to WNS-susceptible bats. However, this would likely provide little relief to the northern long-eared bat, since the species' range only slightly enters these southern states (Hallam *et al.* 2011, pp. 9–11). In addition, human transmission could introduce the spread of the fungus to new locations that are far removed from the current known locations (e.g., spread the fungus farther than an infected bat could transmit it within their natural movement patterns) (Coleman 2013, pers. comm.).

Long-term (including pre- and post-WNS) summer data for the northern long-eared bat are somewhat limited; however, the available data parallel the population decline exhibited in hibernacula surveys. Summer data can corroborate and confirm the decline to the species seen in hibernacula data. Summer surveys from 2005–2011 near Surry Mountain Lake in New Hampshire showed a 99-percent decline in capture success of northern long-eared bats post-WNS, which is similar to the hibernacula data for the State (a 95-percent decline) (Brunkhurst 2012, unpublished data).

The northern long-eared bat is becoming less common on the Vermont landscape as well. Pre-WNS, the species was the second most common bat species in the State; however, it is now one of the least likely to be encountered, with the change in effort to capture one bat increasing by nearly 13 times, and approximately a 94-percent overall reduction in captures in mist-net surveys (Darling and Smith 2011, unpublished data). In eastern New York, captures of northern long-eared bats have declined dramatically, approximately 93 percent, for the species from pre-WNS (Herzog 2012, unpublished data). Prior to discovery of WNS in West Virginia, northern long-eared bat mist-net captures comprised 41 percent of all captures and 24 percent post-WNS (2010) and at a rate of 23 percent of historical rates (Francl *et al.* 2012, pp. 35–36). In addition, pregnancy peaked more than 2 weeks earlier post-WNS than pre-WNS (May 20 versus June 7, respectively) and the proportion of juveniles declined by more than half in mid-August; it is unclear if this change will have population-level effects on the species at this time (Francl *et al.* 2012, p. 36). Ford *et al.* (2011, p. 127) conducted summer acoustic surveys on Fort Drum, New York, from 2003–2010, including pre-WNS (2003–2008) and post-WNS (2008–2010). Although activity still rose from early summer to late summer for northern long-eared bats, the overall activity levels for the species declined from pre- to post-WNS (Ford *et al.* 2011, pp. 129–130). Similarly, Nagel and Gates (2012, p. 5) reported a 78-percent decrease in northern long-eared bat passes (as compared to a 63-percent increase in the number of eastern small-footed bats mentioned above) during acoustic surveys between 2010 and 2012 in western Maryland. ''Due to the greatest recorded decline in regional hibernacula counts (Turner *et al.* 2011), the northern long-eared bat is of particular concern (to researchers in Pennsylvania)'' (Turner 2013, unpublished data). Therefore, researchers in Pennsylvania selected two sites to study in 2010 and 2011, where pre-WNS swarm trapping had previously been conducted. The capture rates at the first site declined by 95 percent and at the second site by 97 percent, which corroborates documented interior hibernacula declines (Turner 2013 unpublished data; Turner *et al.* 2011, p. 18).

Although northern long-eared bats are known to awaken from a state of torpor sporadically throughout the winter and move between hibernacula (Griffin 1940, p. 185; Whitaker and Rissler 1992b, p. 131; Caceres and Barclay 2000 pp. 2–3), they have not been observed roosting regularly outside of caves and mines during the winter, as species that are less susceptible to WNS (*e.g.,* big brown bat) have. Northern long-eared bats may be more susceptible to evaporative water loss (and therefore more susceptible to WNS) due to their propensity to roost in the most humid parts of the hibernacula (Cryan *et al.* 2010, p. 4). As described in the *Hibernation* section above, northern long-eared bats roost in areas within hibernacula that have higher humidity, possibly leading to higher rates of infection, as Langwig *et al.* (2012a, p. 1055) found with Indiana bats. Also, northern long-eared bats prefer cooler temperatures within hibernacula: 0 to 9 °C (32 to 48 °F) (Raesly and Gates 1987, p. 18; Caceres and Pybus 1997, p. 2; Brack 2007, p. 744), which are within the optimal growth limits of *Gyomyces destructans* (5 to 10 °C (41 to 50 °F)) (Blehert *et al.* 2009, p. 227).

The northern long-eared bat may also spend more time in hibernacula than other species that are less susceptible (*e.g.,* eastern small-footed bat (see *Effects of White-nose Syndrome on the Eastern Small-footed Bat* section, above)), which allows more time for the fungus to infect bats and grow; northern long-eared bats enter the cave or mine in October or November (although they may enter as early as August) and leave the hibernaculum in March or April (Caire *et al.* 1979, p. 405; Whitaker and Hamilton 1998, p. 100; Amelon and Burhans 2006, p. 72). Furthermore, the northern long-eared bat occasionally roosts in clusters or in the same hibernacula as other bat species that are also susceptible to WNS (see *Hibernation* section, above); therefore, northern long-eared bats may have increased susceptibility to bat-to-bat transmission of WNS.

Given the observed dramatic population declines attributed to WNS, as described above, we are greatly concerned about this species' persistence where WNS has already spread. The area currently affected by WNS constitutes the core of the northern long-eared bat's range, where the species was most common prior to WNS; the species is less common in the southern and western parts of its range and is considered to be rare in the northwestern part of its range (Caceres and Barclay 2000, p. 2; Harvey 1992, p. 35), the areas where WNS has not yet been detected. Furthermore, the rate at which WNS has spread has been rapid; it was first detected in New York in 2006, and has spread west at least as far as Illinois and Missouri, south as far as Georgia and South Carolina, and north as far as southern Quebec and Ontario as of 2013. Although this spread rate may slow or have reduced effects in the more southern and western parts of the species' range (Frick and Kilpatrick 2013, pers. comm.), general agreement is that WNS will indeed spread throughout the United States (Hallam *et al.* 2011, p. 8; Maher *et al.* 2012, pp. 4–5). WNS has already had a substantial effect on northern long-eared bats in the core of its range and is likely to spread throughout the species' entire range within a short time; thus we consider it to be the predominant threat to the species rangewide.

Other Diseases

Infectious diseases observed in North American bat populations include rabies, histoplasmosis, St. Louis encephalitis, and Venezuelan equine encephalitis (Burek 2001, p. 519; Rupprecht *et al.* 2001, p. 14; Yuill and Seymour 2001, pp. 100, 108). Rabies is the most studied disease of bats, and can lead to mortality, although antibody evidence suggests that some bats may recover from the disease (Messenger *et al.* 2003, p. 645) and retain immunological memory to respond to subsequent exposures (Turmelle *et al.* 2010, p. 2364). Bats are hosts of rabies in North America (Rupprecht *et al.* 2001, p. 14), accounting for 24 percent of all wild animal cases reported during 2009 (Centers for Disease Control and Prevention 2011). Although rabies is detected in up to 25 percent of bats submitted to diagnostic labs for testing, less than 1 percent of bats sampled randomly from wild populations test positive for the virus (Messenger *et al.* 2002, p. 741). Eastern small-footed and northern long-eared bats are among the species reported positive for rabies virus infection (Constantine 1979, p. 347; Burnett 1989, p. 12; Main 1979, p. 458); however, rabies is not known to have appreciable effects to either species.

Histoplasmosis has not been associated with eastern small-footed bats or northern long-eared bats and may be limited in these species compared to other bats that form larger aggregations with greater exposure to guano-rich substrate (Hoff and Bigler 1981, p. 192). St. Louis encephalitis antibody and high concentrations of Venezuelan equine encephalitis virus have been observed in big brown bats and little brown bats (Yuill and Seymour 2001, pp. 100, 108), although data are lacking on the prevalence of these viruses in eastern small-footed bats. Eastern equine encephalitis has been detected in northern long-eared bats (Main 1979, p. 459), although no known population declines have been found due to presence of the virus. Northern long-eared bats are also known to carry a variety of pests including chiggers, mites, bat bugs, and internal helminthes (Caceres and Barclay 2000, p. 3). None of these diseases or pests, however, has caused the record level of bat mortality like that observed since the emergence of WNS.

Predation

Typically, animals such as owls, hawks, raccoons, skunks, and snakes prey upon bats, although a limited number of animals consume bats as a regular part of their diet (Harvey *et al.* 1999, p. 13). Eastern small-footed and northern long-eared bats experience a very small amount of predation; therefore, predation does not appear to be a major cause of mortality (Caceres and Pybus 1997, p. 4; Whitaker and Hamilton 1998, p. 101).

Predation has been observed at a limited number of hibernacula within the range of the northern long-eared and eastern small-footed bats. Of the State and Federal agency responses received pertaining to eastern small-footed bat hibernacula and the threat of predation, only 8 out of 80 responses (10 percent) reported hibernacula as being prone to predation. For northern long-eared bats, 1 hibernacula in Maine, 3 in Maryland (2 of which were due to feral cats), 1 in Minnesota, and 10 in Vermont were reported as being prone to predation. In one instance, domestic cats were observed killing bats at a hibernaculum used by northern long-eared bat and eastern small-footed bat in Maryland, although the species of bat killed was not identified (Feller 2011, unpublished data). Turner (1999, personal observation) observed a snake (species unknown) capture an emerging Virginia big-eared bat (*Corynorhinus townsendii virginianus*) in West Virginia. The bat was captured in flight while the snake was perched along the top of a bat gate at the cave's entrance. Tuttle (1979, p. 11) observed (eastern) screech owls (*Otus asio*) capturing emerging gray bats.

Northern long-eared bats are known to be affected to a small degree by predators at summer roosts. Avian predators, such as owls and magpies, are known to successfully take individual bats as they roost in more open sites, although this most likely does not have an effect on the overall population size (Caceres and Pybus 1997, p. 4). In addition, Perry and Thill (2007, p. 224) observed a black rat snake (*Elaphe obsoleta obsoleta*) descending from a known maternity colony snag in the Ouachita Mountains of Arkansas. In summary, since bats are not a primary prey source for any known natural predators, it is unlikely that predation has substantial effects on either species at this time.

Conservation Efforts To Reduce Disease or Predation

As mentioned above, WNS is a disease that is responsible for unprecedented mortality in some hibernating bats in the northeast, like the northern long-eared bat, and it continues to spread throughout the range of the northern long-eared bat and eastern small-footed bat. Although conservation efforts have been undertaken to help reduce the spread of the disease through human-aided transmission, these efforts have only been in place for a few years and it is too early to determine how effective they are in decreasing the rate of spread. In 2008, the Service, along with several other State and Federal agencies, initiated a national plan (A National Plan for Assisting States, Federal Agencies, and Tribes in Managing White-Nose Syndrome in Bats (WNS National Plan, *http://static.whitenosesyndrome.org/sites/default/files/white-nose_syndrome_national_plan_may_2011.pdf*)) that details the elements critical to investigating and managing WNS, along with identifying actions and roles for agencies and entities involved with the effort (Service 2011, p. 1). In addition to bat-to-bat transmission of the disease, fungal spores can be transmitted by humans (USGS National Wildlife Health Center, Wildlife Health Bulletin 2011–05). Therefore, the WNS Decontamination Team (a sub-group under the WNS National Plan), created a decontamination protocol (Service 2012, p. 2) that provides specific procedures to ensure human transmission risk to bats is minimized.

The Service also issued an advisory calling for a voluntary moratorium on all caving activity in States known to have hibernacula affected by WNS, and all adjoining States, unless conducted as part of an agency-sanctioned research or monitoring project (Service 2009). The Western Bat Working Group has also developed a White-nose Syndrome Action Plan, a comprehensive strategy to prevent the spread of WNS, that covers States currently outside the range of WNS (Western Bat Working Group 2010, p. 1–11). Although the majority of State and Federal agencies and tribes within the northern long-eared bat's and eastern small-footed bat's ranges have adopted the recommendations and protocols in the WNS National Plan, these are not mandatory or required. For example, in Virginia, the decontamination procedures are recommended for cavers; however, although the Virginia Department of Game and Inland Fisheries currently has closed the caves on the agencies' properties, they are reviewing this policy in light of the extensive spread of WNS throughout the State.

The NPS is currently updating their cave management plans (for parks with caves) to include actions to minimize the risk of WNS spreading to uninfected caves. These actions include WNS education, screening visitors for disinfection, and closure of caves if necessary (NPS 2013, *http://www.nature.nps.gov/biology/WNS*). In April 2009, all caves and mines on U.S. Forest Service lands in the Eastern Region were closed on an emergency basis in response to the spread of WNS. Eight National Forests in the Eastern Region contain caves or mines that are used by bats; caves and mines on seven of these National Forests (Allegheny, Hoosier, Ottawa, Mark Twain, Mononqahela, Shawnee, and Wayne) are currently closed, and no closure is needed for the one mine on the eighth National Forest (Green Mountain) because it is already gated with a bat-friendly structure. Forest supervisors continue to evaluate the most recent information on WNS to inform decisions regarding extending cave and mine closures for the purpose of limiting the spread of WNS (U.S. Forest Service 2013, *http://www.fs.fed.us/r9/wildlife/wildlife/bats.php*). Caves and mines on U.S. Forest Service lands in the Rocky Mountain Region were closed on an emergency basis in 2010, in response to WNS, but since then have been reopened, with some exceptions (U.S. Forest Service 2013, *http://www.fs.usda.gov/detail/r2/home/?cid=stelprdb5319926*). In place of the emergency closures, the Rocky Mountain Region will implement an adaptive management strategy that will require registration to access an open cave, prohibit use of clothing or equipment used in areas where WNS is found, require decontamination procedures prior to entering any and all caves, and close all known cave hibernacula during the winter hibernation period. Although the above mentioned WNS-related conservation measures may help reduce or slow the spread of the disease, these efforts are not currently enough to ameliorate the population-level effect to the northern long-eared bat.

Summary of Disease and Predation

In summary, while populations of several species of hibernating bats (*e.g.,* little brown bat, Indiana bat, northern long-eared bat, tri-colored bat) have experienced mass mortality due to WNS, populations of the eastern small-footed bat appear to be stable, and if they are in decline, the level of impact is not discernible at this time. Summer monitoring data are scarce, and the little data we have are inconclusive. However, based on the best available scientific information, we conclude that disease does not have an appreciable effect on the eastern small-footed bat.

Unlike the eastern small-footed bat, the northern long-eared bat has experienced a sharp decline, estimated at approximately 99 percent (from hibernacula data), in the northeastern portion of its range, due to the emergence of WNS. Summer survey data have confirmed rates of decline observed in northern long-eared bat hibernacula data post-WNS. The species is highly susceptible to WNS where the disease currently occurs in the East, and there is no reason to expect that western populations will be resistant to the disease. Thus, we expect that similar declines as seen in the East will be experienced in the future throughout the majority of the species' range. This is currently viewed as the predominant threat to the species, and if WNS had not emerged or was not affecting northern long-eared bat populations to the level that it has, we presume the species would not be declining to the degree observed.

As bats are not a primary prey source for any known natural predators, it is unlikely that predation is significantly affecting either species at this time.

Factor D. The Inadequacy of Existing Regulatory Mechanisms

Under this factor, we examine whether existing regulatory mechanisms are inadequate to address the threats to the species discussed under the other factors. Section 4(b)(1)(A) of the Act requires the Service to take into account ''those efforts, if any, being made by any State or foreign nation, or any political subdivision of a State or foreign nation, to protect such species. . . .'' In relation to Factor D under the Act, we interpret this language to require the Service to consider relevant Federal, State, and tribal laws, regulations, and other such mechanisms that may minimize any of the threats we describe in threat analyses under the other four factors, or otherwise enhance conservation of the species. We give strongest weight to statutes and their implementing regulations and to management direction that stems from those laws and regulations. An example would be State governmental actions enforced under a State statute or constitution, or Federal action under statute.

Having evaluated the significance of the threat as mitigated by any such conservation efforts, we analyze under Factor D the extent to which existing regulatory mechanisms are inadequate to address the specific threats to the species. Regulatory mechanisms, if they exist, may reduce or eliminate the effects from one or more identified threats. In this section, we review existing State, Federal, and local regulatory mechanisms to determine whether they effectively reduce or remove threats to the eastern small-footed bat or northern long-eared bat.

No existing regulatory mechanisms have been designed to protect the species against WNS, the primary threat to the northern long-eared bat; thus, despite regulatory mechanisms that are currently in place, the species is still at risk. There are, however, some mechanisms in place to provide some protection from other factors that may act cumulatively with WNS. As such, the discussion below provides a few examples of such existing regulatory mechanisms, but is not a comprehensive list.

Federal

Several laws and regulations help Federal agencies protect bats on their lands, such as the Federal Cave Resources Protection Act (16 U.S.C. 4301 *et seq.*) that protects caves on Federal lands and National Environmental Policy Act (42 U.S.C. 4321 *et seq.*) review, which serves to mitigate effects to bats due to construction activities on federally owned lands. The NPS has additional laws, policies, and regulations that protect bats on NPS units, including the NPS Organic Act od 1916 (16 U.S.C. 1 *et seq.*), NPS management policies (related to exotic species and protection of native species), and NPS policies related to caves and karst systems (provides guidance on placement of gates on caves not only to address human safety concerns but also for the preservation of sensitive bat habitat) (Plumb and Budde 2011, unpublished data). Even if a bat species is not listed under the Endangered Species Act, the NPS works to minimize effects to the species. In addition, the NPS Research Permitting and Reporting System tracks research permit applications and investigator annual reports, and NPS Management Policies require non-NPS studies conducted in parks to conform to NPS policies and guidelines regarding the collection of bat data (Plumb and Budde 2011, unpublished data).

The northern long-eared bat is considered a ''sensitive species'' throughout U.S. Forest Service's Eastern Region (USDA Forest Service 2012). As such, the northern long-eared bat must receive, ''special management emphasis to ensure its viability and to preclude trends toward endangerment that would result in the need for Federal listing. There must be no effects to sensitive species without an analysis of the significance of adverse effects on the populations, its habitat, and on the viability of the species as a whole. It is essential to establish population viability objectives when making decisions that would significantly reduce sensitive species numbers'' (Forest Service Manual (FSM) 2672.1).

State

The eastern small-footed bat is State-listed as endangered in Maryland and New Hampshire; State-listed as threatened in Kentucky, Pennsylvania, South Carolina, and Vermont; and considered as a species of special concern in Connecticut, Delaware, Georgia, Indiana, Massachusetts, Missouri, New Jersey, New York, North Carolina, Ohio, Oklahoma, Tennessee, Virginia, and West Virginia. The level of protection provided under these laws varies by State, but most prohibit take, possession, or transport of listed species. For example, in Maryland, a person may not take, possess, transport, export, process, sell, offer for sale, or ship nongame wildlife (MD Code, Natural Resources, sec. 10–2A–01–09); however, effects to summer roosting habitat and direct mortality from wind energy development projects under 70 Megawatts (MW) are currently exempted from protections offered to the eastern small-footed bat (Feller 2011, unpublished data). In Pennsylvania, however, a House Bill proposed in the General Assembly, if passed, would not allow any ''commonwealth agency to take action to classify or consider wildlife, flora or fauna as threatened or endangered unless the wildlife, flora or fauna is protected under the Endangered Species Act of 1973'' (General Assembly of Pennsylvania 2013, p. 2).

The northern long-eared bat is listed in very few of the States within the species' range. The northern long-eared bat is listed as endangered under the Massachusetts endangered species act, under which all listed species are, ''protected from killing, collecting, possessing, or sale and from activities that would destroy habitat and thus directly or indirectly cause mortality or disrupt critical behaviors.'' In addition, listed animals are specifically protected from activities that disrupt nesting, breeding, feeding, or migration (Massachusetts Division of Fisheries and Wildlife 2012, unpublished document). In Wisconsin, all cave bats, including the northern long-eared bat, were listed as threatened in the State in 2011, due to previously existing threats and the impending threat of WNS (Redell 2011, pers. comm.). Certain development projects (*e.g.,* wind energy), however, are excluded from regulations in place to protect the species in Wisconsin (Wisconsin Department of Natural Resources, unpublished document, 2011, p. 4). The northern long-eared bat is considered as some form of species of concern in 17 States: ''Species of Greatest Concern'' in Alabama and Rhode Island; ''Species of Greatest Conservation Need'' in Delaware, Iowa, and Vermont; ''Species of Concern'' in Ohio and Wyoming; ''Rare Species of Concern'' in South Carolina; ''Imperiled'' in Oklahoma; ''Critically Imperiled'' in Louisiana; and ''Species of Special Concern'' in Indiana, Maine, Minnesota, New Hampshire, North Carolina, Pennsylvania, and South Carolina.

In the following States, there is either no State protection law or the northern long-eared bat is not protected under the existing law: Arkansas, Connecticut, Florida, Georgia, Illinois, Kansas, Kentucky, Maryland, Mississippi, Missouri, Montana, Nebraska, New Jersey, New York, North Dakota, Tennessee, Virginia, and West Virginia. In Kentucky, although the northern long-eared bat does not have a State listing status, it is considered protected from take under Kentucky State law; however, since greater than 95 percent of hibernacula in Kentucky are privately owned, cave closures are not often possible to enforce (Hemberger 2011, unpublished data).

Wind energy development regulation varies by State within the northern long-eared bat's and eastern small-footed bat's ranges. For example, in Virginia, although there are not currently any wind energy developments in the State, new legislation requires mitigation for bats with the objective of reducing fatalities. As part of the regulation, operators are required to ''measure the efficacy'' of mitigation (Reynolds 2011 unpublished data). In Vermont, all wind projects are required to conduct bat mortality surveys, and at least 2 of the 3 currently permitted projects in the State include application of operational adjustments (curtailment) to reduce bat fatalities (Smith 2011, unpublished data).

Summary of Inadequacy of Existing Regulatory Mechanisms

No existing regulatory mechanisms have been designed to protect the species against WNS, the primary threat to the northern long-eared bat. Therefore, despite regulatory mechanisms that are currently in place for the northern long-eared bat, the species is still at risk, primarily due to WNS, as discussed under *Factor C.*

Factor E. Other Natural or Manmade Factors Affecting Its Continued Existence

Wind Energy Development

In general, bats are killed in significant numbers by utility-scale (greater than or equal to 0.66 megawatt (MW)) wind turbines along forested ridge tops in the eastern United States (Johnson 2005, p. 46; Arnett *et al.* 2008, p. 63). The majority of bats killed include migratory foliage-roosting species: the hoary bat (*Lasiurus cinereus*) and eastern red bat (*Lasiurus borealis*); migratory tree and cavity-roosting silver-haired bats (*Lasionycteris noctivagans*); and tri-colored bats (Arnett *et al.* 2008, p. 64).

Three effects may explain proximate causes of bat fatalities at wind turbines: (1) Bats collide with turbine towers, (2) bats collide with moving blades, or (3) bats suffer internal injuries (barotrauma) after being exposed to rapid pressure changes near the trailing edges and tips of moving blades (Cryan and Barclay 2009, p. 1331). It appears that barotrauma may be responsible for some deaths observed at wind-energy development sites. For example, nearly half of the 1,033 bat carcasses discovered over a 2-year study by Klug and Baerwald (2010, p. 15) had no fatal external injuries, and over 90 percent of those necropsied had internal injuries consistent with barotrauma (Baerwald *et al.* 2008, pp. 695–696). However, another study found that bone fractures from direct collision with turbine blades contributed to 74 percent of bat deaths, and therefore suggest that skeletal damage from direct collision with turbine blades is a major cause of fatalities for bats killed by wind turbines (Grodsky *et al.* 2011, p. 920). The authors suggest that these injuries can lead to an underestimation of bat mortality at wind energy facilities due to delayed lethal effects (Grodsky *et al.* 2011, p. 924). Lastly, the authors also note that the surface and core pressure drops behind the spinning turbine blades are high enough (equivalent to sound levels that are 10,000 times higher in energy density than the threshold of pain in humans (Cmiel *et al.* 2004)) to cause significant ear damage to bats flying near wind turbines (Grodsky *et al.* 2011, p. 924). Bats crippled by ear damage would have a difficult time navigating and foraging, since both of these functions depend on the bats' ability to echolocate (Grodsky *et al.* 2011, p. 924).

Wind projects have been constructed in areas within a large portion of the ranges of eastern small-footed bats and northern long-eared bats, suggesting these species may be exposed to the risk of turbine-related mortality. However, as of 2011, only two eastern small-footed bat and 13 northern long-eared bat fatalities were recorded from North American wind-energy facilities, representing less than 0.1 percent and 0.2 percent of the total bat mortality, respectively (American Wind Energy Association 2011, p. 18). Because eastern small-footed bats fly slowly and close to the ground (Davis *et al.* 1965, p. 683), they may be less susceptible to mortality caused by the operation of wind turbines.

The threat level posed by wind development to northern long-eared and eastern small-footed bats throughout their ranges varies. For example, in Illinois, wind energy development is viewed as a large threat to northern long-eared bats, especially during migration. Although the species is not considered a long-distance migrant, even limited migration distances between summer and winter habitats pose a risk to the northern long-eared bat in Illinois, due to the increasingly large line of wind farms across most of the central portion of the State (Kath 2012, pers. comm.). In 2012, 7 to 10 wind farms were in operation, and at least as many are planned. Further, northern long-eared bats have been found in pre-construction surveys for many of the wind farms (both planned and operational) (Kath 2012, pers. comm.). In Minnesota, wind energy development is moving at a rapid pace, and is one of the reasons State wildlife agency officials are concerned about the species' status in the State (Baker 2011, pers. comm.). In many States, such as Maryland, New Hampshire, South Carolina, and Vermont, wind energy projects have just recently been completed or are in the process of being installed; therefore, the level of mortality to northern long-eared bats and eastern small-footed bats has yet to be seen (Brunkhurst 2012, pers. comm.; Bunch 2011,unpublished data; Feller 2011, unpublished data; Smith 2011, unpublished data). Vermont currently has three permitted wind energy facilities in the State (the first of which is currently under construction), from which State officials see limited potential that northern long-eared bat fatalities will occur (Smith 2011, unpublished data), likely due to the current low population of the species in the State. We conclude that there may be adverse effects posed by wind energy development to northern long-eared bats and eastern small-footed bats; however, there is no evidence suggesting effects from wind energy development in itself have led to population declines in either species.

Climate Change

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms ''climate'' and ''climate change'' are defined by the Intergovernmental Panel on Climate Change (IPCC). The term ''climate'' refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2007a, p. 78). The term ''climate change'' thus refers to a change in the mean or variability of one or more measures of climate (*e.g.,* temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2007a, p. 78).

Scientific measurements spanning several decades demonstrate that changes in climate are occurring, and that the rate of change has been faster since the 1950s. Examples include warming of the global climate system, and substantial increases in precipitation in some regions of the world and decreases in other regions. (For these and other examples, see IPCC 2007a, p. 30; Solomon *et al.* 2007, pp. 35–54, 82–85). Results of scientific analyses presented by the IPCC show that most of the observed increase in global average temperature since the mid–20th century cannot be explained by natural variability in climate, and is ''very likely'' (defined by the IPCC as 90 percent or higher probability) due to the observed increase in greenhouse gas (GHG) concentrations in the atmosphere as a result of human activities, particularly carbon dioxide emissions from use of fossil fuels (IPCC 2007a, pp. 5–6 and figures SPM.3 and SPM.4; Solomon *et al.* 2007, pp. 21–35). Further confirmation of the role of GHGs comes from analyses by Huber and Knutti (2011, p. 4), who concluded it is extremely likely that approximately 75 percent of global warming since 1950 has been caused by human activities.

Scientists use a variety of climate models, which include consideration of natural processes and variability, as well as various scenarios of potential levels and timing of GHG emissions, to evaluate the causes of changes already observed and to project future changes in temperature and other climate conditions (*e.g.,* Meehl *et al.* 2007, entire; Ganguly *et al.* 2009, pp. 11555, 15558; Prinn *et al.* 2011, pp. 527, 529). All combinations of models and emissions scenarios yield very similar projections of increases in the most common measure of climate change, average global surface temperature (commonly known as global warming), until about 2030. Although projections of the magnitude and rate of warming differ after about 2030, the overall trajectory of all the projections is one of increased global warming through the end of this century, even for the projections based on scenarios that assume that GHG emissions will stabilize or decline. Thus, there is strong scientific support for projections that warming will continue through the 21st century, and that the magnitude and rate of change will be influenced substantially by the extent of GHG emissions (IPCC 2007a, pp. 44–45; Meehl *et al.* 2007, pp. 760–764 and 797–811; Ganguly *et al.* 2009, pp. 15555–15558; Prinn *et al.* 2011, pp. 527, 529). (See IPCC 2007b, p. 8, for a summary of other global projections of climate-related changes, such as frequency of heat waves and changes in precipitation. Also see IPCC 2011 (entire) for a summary of observations and projections of extreme climate events.)

Various changes in climate may have direct or indirect effects on species. These effects may be positive, neutral, or negative, and they may change over time, depending on the species and other relevant considerations, such as interactions of climate with other variables (*e.g.,* habitat fragmentation) (IPCC 2007, pp. 8–14, 18–19). Identifying likely effects often involves aspects of climate change vulnerability analysis. Vulnerability refers to the degree to which a species (or system) is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the type, magnitude, and rate of climate change and variation to which a species is exposed, its sensitivity, and its adaptive capacity (IPCC 2007a, p. 89; see also Glick *et al.* 2011, pp. 19–22). There is no single method for conducting such analyses that applies to all situations (Glick *et al.* 2011, p. 3). We use our expert judgment and appropriate analytical approaches to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

As is the case with all stressors that we assess, even if we conclude that a species is currently affected or is likely to be affected in a negative way by one or more climate-related effects, it does not necessarily follow that the species meets the definition of an ''endangered species'' or a ''threatened species'' under the Act. If a species is listed as endangered or threatened, knowledge regarding the vulnerability of the species to, and known or anticipated impacts from, climate-associated changes in environmental conditions can be used to help devise appropriate strategies for its recovery.

The unique natural history traits of bats and their susceptibility to local temperature, humidity, and precipitation patterns make them an early warning system for effects of climate change in regional ecosystems (Adams and Hayes 2008, p. 1120). Climate change is expected to alter seasonal ambient temperatures and precipitation patterns across regions (Adams and Hayes 2008, p. 1115). The ability of successful reproductive effort in female insectivorous bats is related directly to roost temperatures and water availability (Adams and Hayes 2008, p. 1116). Adams and Hayes (2008, p. 1120) predict an overall decline in bat populations in the western United States from reduced regional water storage caused by climate warming. In comparison, the northeast United States is projected to see a steady increase in annual winter precipitation, although a much greater proportion is expected to fall as rain rather than as snow. Overall, little change in summer rainfall is expected, although projections are highly variable (Frumhoff *et al.* 2007, p. 8). Based on this model, water availability should not be a limiting factor to bats in the northeast United States.

Climate change may result in warmer winters, which could lead to a reduced period of hibernation, increased winter activity, and reduced reliance on the relatively stable temperatures of underground hibernation sites (Jones *et al.* 2009, p. 99). Hibernation sites chosen by eastern small-footed bats (*e.g.,* under rocks) may be even more susceptible to temperature fluctuations, which may lead to energy depletion that reduces winter survival (Rodenhouse *et al.* 2009, p. 251). An earlier spring would presumably result in a shorter hibernation period and the earlier appearance of foraging bats (Jones *et al.* 2009, p. 99). An earlier emergence from hibernation may have no detrimental effect on population size if sufficient food is available (Jones *et al.* 2009, p. 99); however, predicting future insect population dynamics and distributions is complex (Bale *et al.* 2002, p. 6). Alterations in precipitation, stream flow, and soil moisture could influence insect populations in such a way as to potentially alter food availability for bats (Rodenhouse *et al.* 2009, p. 250).

Warmer winter temperatures may also disrupt bat reproductive physiology. Both eastern small-footed bats and northern long-eared bats breed in the fall, and spermatozoa are stored in the uterus of hibernating females until spring ovulation. If bats experience warm conditions they may arouse from hibernation prematurely, ovulate, and become pregnant (Jones *et al.* 2009, p. 99). Given this dependence on external temperatures, climate change is likely to affect the timing of reproductive cycles (Jones *et al.* 2009, p. 99), but whether these effects would be to the detriment of the species is largely unknown. A shorter hibernation period and warmer winter temperatures may lead to less exposure and slower spread of WNS or persistence of the fungus, which would likely benefit both species. However, the rapid rate at which WNS is affecting the species is on a much quicker time scale than are the changes associated with climate change. Thus, longer-term effects of climate change are unlikely to have an impact on the short-term effects of WNS. Although we do have information that suggests that climate change may impact both the northern long-eared bat and eastern small-footed bat and bats in general, we do not have any evidence suggesting that climate change in itself has led to population declines in either species.

Contaminants

Effects to bats from contaminant exposure have likely occurred and gone, for the most part, unnoticed among bat populations (Clark and Shore 2001, p. 204). Contaminants of concern to insectivorous bats like the eastern small-footed and northern long-eared bats include organochlorine pesticides, organophosphate, carbamate and neonicotinoid insecticides, polychlorinated biphenyls and polybrominated diphenyl ethers (PBDEs), pyrethroid insecticides, and inorganic contaminants such as mercury (Clark and Shore 2001, pp. 159–214).

Organochlorine pesticides (*e.g.,* DDT, chlordane) persist in the environment due to lipophilic (fat-loving) properties, and therefore readily accumulate within the fat tissue of bats. Because insectivorous bats have high metabolic rates, associated with flight and small size, their food intake increases the amount of organochlorines available for concentration in the fat (Clark and Shore 2001, p. 166). Because bats are long-lived, the potential for bioaccumulation is great, and effects on reproduction and populations have been documented (Clark and Shore 2001, pp. 181–190). In maternity colonies, young bats appear to be at the greatest risk of mortality. This is because organochlorines become concentrated in the fat of the mother's milk and these chemicals continually and rapidly accumulate in the young as they nurse (Clark 1988, pp. 410–411).

In addition to indirect effects of contaminants on bats via prey consumption, documented cases of population-level effects involve direct application of pesticides to bats or their roosts. For example, when a mixture of DDT and chlordane was applied to little brown bats and their roost site, mortality from exposure was observed (Kunz *et al.* 1977, p. 478). Most organochlorine pesticides have been banned in the United States and have largely been replaced by organophosphate insecticides, which are generally short-lived in the environment and do not accumulate in food chains; however, risk of exposure is still possible from direct exposure from spraying or ingesting insects that have recently been sprayed but have not died, or both (Clark 1988, p. 411). Organophospahate and carbamate insecticides are acutely toxic to mammals. Also, some organophosphates may be stored in fat tissue and contribute to ''organophosphate-induced delayed neuropathy'' in humans (USEPA 2013, p. 44).

Bats are less sensitive to organophosphate insecticides than birds in regards to acute toxicity, but many bats lose their motor coordination from direct application and are unlikely to survive in the wild in an incapacitated state lasting over 24 hours (Plumb and Budde 2011, unpublished data). Bats may be exposed to organophosphate and carbamate insecticides in regions where methyl parathion is applied in cotton fields and where malathion is used for mosquito control (Plumb and Budde 2011, unpublished data). The organophosphate, chlorpyrifos, has high fat solubility and is commonly used on crops such as corn, soybeans (van Beelen 2000, p. 34 of Appendix 2; *http://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=2009&map=CHLORPYRIFOS&hilo=L*).

The neonicotinoids have been found to cause oxidative stress, neurological damage and possible liver damage in rats and immune suppression in mice (*http://www.sciencedirect.com/science/article/pii/S0048357512001617* Badgujar *et al.* 2013, p. 408; Duzguner 2012, p. 58; Kimura-Kuroda *et al.* 2011, p. 381), Due to information indicating that there is a link between neonicotinoids used in agriculture and a decline in bee numbers, the European Union proposed a two year ban on the use of the neonocotinoids, thiamethoxam, imidacloprid and clothianidin on crops attractive to honeybees, beginning in December of 2013 (*http://www.lawbc.com/regulatory-developments/entry/proposal-for-restriction-of-neonicotinoid-products-in-the-eu/*).

The more recently developed ''third generation'' of pyrethroids have acute oral toxicities rivaling the toxicity of organophosphate, carbamate and organochlorine pesticides. These pyrethroids include esfenvalerate, deltamethrin, bifenthrin, tefluthrin, flucythrinate, cyhalothrin and fenpropathrin (Mueller-Beilschmidt 1990, p. 32). Pyrethroids are increasingly used in the United States, and some of these compounds have very high fat solubility (*e.g.,* bifenthrin, cypermethrin) (van Beelen 2000, p. 34 of Appendix 2).

Like the organochlorine pesticides, PCBs and PBDEs are highly lipophilic and therefore readily accumulate in insectivorous bats. Outside of laboratory experiments, there is no conclusive evidence that bats have been killed by PCBs, although effects on reproduction have been observed (Clark and Shore 2001, pp. 192–194).

In New Hampshire, to limit the amount of plant material growing on the rock slope of the Surry Mountain Reservoir, the U.S. Army Corps of Engineers spray the rock slope with herbicide; this site is an eastern small-footed bat summer roosting site (Veilleux and Reynolds 2006, p. 331). It is unknown whether the direct application of herbicide on the roost area reduces the roost quality or causes mortality of adult bats, young bats, or both.

Eastern small-footed bats and northern long-eared bats forage on emergent insects and can be characterized as occasionally foraging over water (Yates and Evers 2006, p. 5), and therefore are at risk of exposure to bioaccumulation of inorganic contaminants (*e.g.,* cadmium, lead, mercury) from contaminated water bodies. Bats tend to accumulate inorganic contaminants due to their diet and slow means of elimination of these compounds (Plumb and Budde 2011, unpublished data). In Virginia, for example, the North Fork Holston River is a water body that was highly contaminated by a waterborne point source of mercury through contamination by a chlor-alkali plant. Based on findings from a pilot study for bats in 2005 (Yates and Evers 2006), there is sufficient information to conclude that bats from near-downstream areas of the North Fork Holston River have potentially harmful body burdens of mercury, although the effect on bats is unknown. Fur samples taken from eastern small-footed bats have also yielded detectable amounts of mercury and zinc (Hickey *et al.* 2001, p. 703). Hickey *et al.* (2001, p. 705) suggest that the concentrations of mercury reported may be sufficient to cause sublethal biological effects to bats. Divoll *et al.* (*in prep*) found that eastern small-footed bats and northern long-eared bats showed consistently higher mercury levels than little brown bats or eastern red bats sampled in Maine, which may be correlated with gleaning behavior and the consumption of spiders by these two bat species. Eastern small-footed bats exhibited the highest mercury levels of all species. Bats recaptured during the study 1 or 2 years after their original capture maintained similar levels of mercury in fur year-to-year. Biologists suggest that individual bats accumulate body burdens of mercury that cannot be reduced once elevated to a certain threshold.

Exposure to holding ponds containing flow-back and produced water associated with hydraulic fracturing operations may also expose bats to toxins, radioactive material, and other contaminants (Hein 2012, p. 8). Cadmium, mercury, and lead are contaminants reported in hydraulic fracturing operations. Whether bats drink directly from holding ponds or contaminants are introduced from these operations into aquatic ecosystems, bats will presumably accumulate these substances and potentially suffer adverse effects (Hein 2012, p. 9). In summary, the best available data indicate that contaminant exposure can pose an adverse effect to individual northern long-eared and eastern small-footed bats, although it is not an immediate and significant risk in itself at a population level.

Prescribed Burning

Eastern forest-dwelling bat species, such as the eastern small-footed and northern long-eared bats, likely evolved with fire management of mixed-oak ecosystems (Perry 2012, p. 182). A recent review of prescribed fire and its effects on bats (U.S. Forest Service 2012, p. 182) generally found that fire had beneficial effects on bat habitat. Fire may create snags for roosting and creates more open forests conducive to foraging on flying insects (Perry 2012, pp. 177–179), although gleaners such as northern long-eared bats may readily use cluttered understories for foraging (Owen *et al.* 2003, p. 355). Cavity and bark roosting bats, such as the eastern small-footed and northern long-eared, use previously burned areas for both foraging and roosting (Johnson *et al.* 2009, p. 239; Johnson *et al.* 2010, p. 118). In Kentucky, the abundance of prey items for northern long-eared bats increased after burning (Lacki *et al.* 2009, p. 1170), and more roosts were found in post-burn areas (Lacki *et al.* 2009, p. 1169). Burning may create more suitable snags for roosting through exfoliation of bark (Johnson *et al.* 2009, p. 240), mimicking trees in the appropriate decay stage for roosting bats. In contrast, a prescribed burn in Kentucky caused a roost tree used by a radio-tagged female northern long-eared bat to prematurely fall after its base was weakened by smoldering combustion (Dickinson *et al.* 2009, p. 56). Low-intensity burns may not kill taller trees directly but may create snags of smaller trees and larger trees may be injured, resulting in vulnerability (of the tree) to pathogens that cause hollowing of the trunk, which provides roosting habitat (Perry 2012, p. 177). Prescribed burning also opens the tree canopy, providing more canopy light penetration (Boyles and Aubrey 2006, p. 112; Johnson *et al.* 2009, p. 240), which may facilitate faster development of juvenile bats (Sedgeley 2001, p. 434). Although Johnson *et al.* (2009, p. 240) found the amount of roost switching did not differ between burned and unburned areas, the rate of switching in burned areas of every 1.35 days was greater than that found in other studies of every 2–3 days (Foster and Kurta 1999, p. 665; Owen *et al.* 2002, p. 2; Carter and Feldhamer 2005, p. 261; Timpone *et al.* 2010, p. 119).

Direct effects of fire on bats likely differ among species and seasons (Perry 2012, p. 172). Northern long-eared bats have been seen flushing from tree roosts shortly after ignition of prescribed fire during the growing season (Dickinson *et al.* 2009, p. 60). Fires of reduced intensity that proceed slowly allow sufficient time for roosting bats to arouse from sleep or torpor and escape the fire (Dickinson *et al.* 2010, p. 2200), although extra arousals from fire smoke could cause increased energy loss (Dickinson *et al.* 2009, p. 52). During prescribed burns, bats are potentially exposed to heat and gases; the roosting behavior of these two species, however, may reduce their vulnerability to toxic gases. When trees are dormant, the bats are roosting in caves or mines (hibernacula can be protected from toxic gases through appropriate burn plans), and during the growing season, northern long-eared bats roost in tree cavities or under bark above the understory, above the area with the highest concentration of gases in a low-intensity prescribed burn (Dickinson *et al.* 2010, pp. 2196, 2200). Carbon monoxide levels did not reach critical thresholds that could harm bats in low-intensity burns at the typical roosting height for the eastern small-footed and northern long-eared bats (Dickinson *et al.* 2010, p. 2196); thus heat effects from prescribed fire are of greater concern than gas effects on bats. Direct heat could cause injury to the thin tissue of bat ears and is more likely to occur than exposure to toxic gas levels during prescribed burns (Dickinson *et al.* 2010, p. 2196). In addition, fires of reduced intensity with shorter flame height could lessen the effect of heat to bats roosting higher in trees (Dickinson *et al.* 2010, p. 2196).

Winter, early spring, and late fall generally contain less intense fire conditions than during other seasons and coincide with time periods when bats are less affected by prescribed fire due to low activity in forested areas. Furthermore, no young are present during these times, which reduces the likelihood of heat injury and exposure of vulnerable young to fire (Dickinson *et al.* 2010, p. 2200). Prescribed fire objectives, such as fires with high intensity and rapid ignition in order to meet vegetation goals, must be balanced with the exposure of bats to the effects of fire (Dickinson *et al.* 2010, p. 2201). Currently, the Service and U.S. Forest Service strongly recommend not burning in the central hardwoods from mid- to late April through summer to avoid periods when bats are active in forests (Dickinson *et al.* 2010, p. 2200).

Bats that occur in forests are likely equipped with evolutionary characteristics that allow them to exist in environments with prescribed fire. Periodic burning can benefit habitat through snag creation and forest canopy gap creation, but frequency and timing need to be considered to avoid direct and indirect adverse effects to bats when using prescribed burns as a management tool. We conclude that there may be adverse effects posed by prescribed burning to individual northern long-eared bats and eastern small-footed bats; however, there is no evidence suggesting effects from prescribed burning itself have led to population declines in either species.

Conservation Efforts To Reduce Other Natural or Manmade Factors Affecting Its Continued Existence

In the Midwest, rapid wind development is a concern with regards to the effect to bats (Baker 2011, pers. comm.; Kath 2012, pers. comm.). Due to the known impact from wind energy development, in particular to listed (and species currently being evaluated to determine if listing is warranted) bird and bat species in the Midwest, the Service, State natural resource agencies, and wind energy industry representatives are developing the Midwest Wind Energy Multi-Species Habitat Conservation Plan (MSHCP). The planning area includes the Midwest Region of the Service, which includes all or portions of the following States: Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. The MSHCP would allow permit holders to proceed with wind energy development, which may result in ''incidental'' taking of a listed species under section 10 of the Act, through issuance of an incidental take permit (77 FR 52754; August 30, 2012). Currently, both the northern long-eared bat and eastern small-footed bat are being considered for inclusion as covered species under the MSHCP. The MSHCP will address protection of covered species through avoidance, minimization of take, and mitigation to offset effect of ''take'' (*e.g.,* habitat preservation, habitat restoration, habitat enhancement) to help ameliorate the effect of wind development (77 FR 52754; August 30, 2012). In some cases, the U.S. Forest Service has agreed to limit or restrict burning in the central hardwoods from mid- to late April through summer to avoid periods when bats are active in forests (Dickinson *et al.* 2010, p. 2200).

Summary of Factor E

We have identified a number of factors (*e.g.,* wind energy development, climate change, contaminants, prescribed burning) that may have direct or indirect effects on eastern small-footed bats and northern long-eared bats. Although such activities occur, there is no evidence that these activities alone have significant effects on either species, because their effects are often localized and not widespread throughout the species' ranges. However, these factors may have a cumulative effect on the northern long-eared bat when added to white-nose syndrome, because the disease had led to dramatic population declines in that species (discussed under *Factor C*).

Cumulative Effects From Factors A Through E

None of the factors discussed above under Factors A, B, C, or E, alone or in combination, is affecting the eastern small-footed bat at a population level. Conversely, WNS (Factor C) alone has led to dramatic and rapid population-level effects on the northern long-eared bat. White-nose syndrome is the most significant threat to the northern long-eared bat, and the species would likely not be imperiled were it not for this disease. However, although the effects on the northern long-eared bat from Factors A, B, and E individually or in combination do not have significant effects on the species, when combined with the significant population reductions due to white-nose syndrome (Factor C), the resulting cumulative effect may further adversely impact the species.

Finding

Eastern Small-Footed Bat

As required by the Act, we considered the five factors in assessing whether the eastern small-footed bat is endangered or threatened throughout all of its range. We examined the best scientific and commercial information available regarding the past, present, and future threats faced by the eastern small-footed bat. We reviewed the petition, information available in our files, and other available published and unpublished information, and we consulted with recognized bat experts and other Federal and State agencies. Threats previously identified for the eastern small-footed bat include modification or destruction of winter and summer habitat, disturbance of hibernating bats from commercial and/or recreational activities in caves and mines, disease, wind energy development, climate change, and contaminants. The primary threat previously identified was WNS. While other species of hibernating bats have experienced mass mortality due to WNS, there is no indication of a population-level decline in eastern small-footed bat based on winter survey data. A review of pre-WNS and post-WNS hibernacula count data over multiple years finds that post-WNS counts were within the normal observed range at the majority of sites analyzed. Several life-history traits may reduce the susceptibility of this bat to WNS, which include their comparatively late arrival and early departure from hibernacula, departure from hibernacula during mild winter periods, solitary roosting habits, and selection of drier microhabitats (*e.g.,* cave and mine entrances). We will continue to closely monitor the spread of WNS and its effects on eastern small-footed bats. As for the other above-mentioned threats, although there is risk of exposure and individual mortality in isolated incidences, no declines in eastern small-footed bat populations have been documented.

Our review of the best available scientific and commercial information indicates that the eastern small-footed bat is not in danger of extinction (endangered) nor likely to become endangered within the foreseeable future (threatened), throughout all of its range.

Distinct Vertebrate Population Segment

After assessing whether the species is endangered or threatened throughout its range, we next consider whether a distinct vertebrate population segment (DPS) of the eastern small-footed bat meets the definition of an endangered or threatened species.

Under the Service's Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act (61 FR 4722;

February 7, 1996 (DPS Policy)), three elements are considered in the decision concerning the establishment and classification of a possible DPS. These are applied similarly for additions to or removal from the Federal List of Endangered and Threatened Wildlife. These elements include:

(1) The discreteness of a population in relation to the remainder of the species to which it belongs;

(2) The significance of the population segment to the species to which it belongs; and

(3) The population segment's conservation status in relation to the Act's standards for listing, delisting, or reclassification (i.e., is the population segment endangered or threatened).

Discreteness

Under the DPS policy, a population segment of a vertebrate taxon may be considered discrete if it satisfies either one of the following conditions:

(1) It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation; or

(2) It is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

There are no characteristics of the eastern small-footed bat's taxonomy, distribution or abundance, habitat, or biology (see the *Species Information* section, above) that suggest the species may be segmented into discrete populations. Throughout its range, the eastern small-footed bat has similar morphology and, as far as we know, genetics; uses similar roosting and foraging habitat; and exhibits similar roosting, foraging, and reproductive behavior. Therefore, the best available information indicates there is no evidence of markedly separated eastern small-footed bat populations.

There are no characteristics of the eastern small-footed bat's management that suggest the species may be segmented into discrete populations. The eastern small-footed bat occurs in the Canadian provinces of Ontario and Quebec, as well as in the United States. However, the species is not listed under Canada's Species At Risk Act. In addition, we have no information to suggest that the species, its habitat, or the potential threats evaluated above in the five factor analysis are managed differently in the Canadian versus U.S. portions of the eastern small-footed bat's range. Therefore, the best available information indicates that there is no evidence that the eastern small-footed bat is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

We determine, based on a review of the best available information, that no population of the eastern small-footed bat meets the discreteness conditions of the 1996 DPS policy. Therefore, no eastern small-footed bat population qualifies as a DPS under our policy, and no population is a listable entity under the Act.

The DPS policy is clear that significance is analyzed only when a population segment has been identified as discrete. Since we found that no population segment meets the discreteness element and, therefore, does not qualify as a DPS under the Service's DPS policy, we will not conduct an evaluation of significance.

Significant Portion of the Range

Under the Act and our implementing regulations, a species may warrant listing if it is endangered or threatened throughout all or a significant portion of its range. The Act defines ''endangered species'' as any species which is ''in danger of extinction throughout all or a significant portion of its range,'' and ''threatened species'' as any species which is ''likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The definition of ''species'' is also relevant to this discussion. The Act defines ''species'' as follows: ''The term 'species' includes any subspecies of fish or wildlife or plants, and any distinct population segment [DPS] of any species of vertebrate fish or wildlife which interbreeds when mature.'' The phrase ''significant portion of its range'' (SPR) is not defined by the statute, and we have never addressed in our regulations: (1) The consequences of a determination that a species is either endangered or likely to become so throughout a significant portion of its range, but not throughout all of its range; or (2) what qualifies a portion of a range as ''significant.''

Two recent district court decisions have addressed whether the SPR language allows the Service to list or protect less than all members of a defined ''species'': *Defenders of Wildlife* v. *Salazar,* 729 F. Supp. 2d 1207 (D. Mont. 2010), concerning the Service's delisting of the Northern Rocky Mountain gray wolf (74 FR 15123; April 2, 2009); and *WildEarth Guardians* v. *Salazar,* 2010 U.S. Dist. LEXIS 105253 (D. Ariz. September 30, 2010), concerning the Service's 2008 finding on a petition to list the Gunnison's prairie dog (73 FR 6660; February 5, 2008). The Service had asserted in both of these determinations that it had authority, in effect, to protect only some members of a ''species,'' as defined by the Act (i.e., species, subspecies, or DPS), under the Act. Both courts ruled that the determinations were arbitrary and capricious on the grounds that this approach violated the plain and unambiguous language of the Act. The courts concluded that reading the SPR language to allow protecting only a portion of a species' range is inconsistent with the Act's definition of ''species.'' The courts concluded that once a determination is made that a species (i.e., species, subspecies, or DPS) meets the definition of ''endangered species'' or ''threatened species,'' it must be placed on the list in its entirety and the Act's protections applied consistently to all members of that species (subject to modification of protections through special rules under sections 4(d) and 10(j) of the Act).

Consistent with that interpretation, and for the purposes of this finding, we interpret the phrase ''significant portion of its range'' in the Act's definitions of ''endangered species'' and ''threatened species'' to provide an independent basis for listing; thus there are two situations (or factual bases) under which a species would qualify for listing: A species may be endangered or threatened throughout all of its range; or a species may be endangered or threatened in only a significant portion of its range. If a species is in danger of extinction throughout a significant portion of its range, the species is an ''endangered species.'' The same analysis applies to ''threatened species.'' Based on this interpretation and supported by existing case law, the consequence of finding that a species is endangered or threatened in only a significant portion of its range is that the entire species shall be listed as endangered or threatened, respectively, and the Act's protections shall be applied across the species' entire range.

We conclude, for the purposes of this finding, that interpreting the significant portion of its range phrase as providing an independent basis for listing is the best interpretation of the Act because it is consistent with the purposes and the plain meaning of the key definitions of the Act; it does not conflict with established past agency practice (i.e., prior to the 2007 Solicitor's Opinion), as no consistent, long-term agency practice has been established; and it is consistent with the judicial opinions that have most closely examined this issue. Having concluded that the phrase ''significant portion of its range'' provides an independent basis for listing and protecting the entire species, we next turn to the meaning of ''significant'' to determine the threshold for when such an independent basis for listing exists.

Although there are potentially many ways to determine whether a portion of a species' range is ''significant,'' we conclude, for the purposes of this finding, that the significance of the portion of the range should be determined based on its biological contribution to the conservation of the species. For this reason, we describe the threshold for ''significant'' in terms of an increase in the risk of extinction for the species. We conclude that a biologically based definition of ''significant'' best conforms to the purposes of the Act, is consistent with judicial interpretations, and best ensures species' conservation. Thus, for the purposes of this finding, and as explained further below, a portion of the range of a species is ''significant'' if its contribution to the viability of the species is so important that without that portion, the species would be in danger of extinction.

We evaluate biological significance based on the principles of conservation biology using the concepts of redundancy, resiliency, and representation. Resiliency describes the characteristics of a species and its habitat that allow it to recover from periodic disturbance. Redundancy (having multiple populations distributed across the landscape) may be needed to provide a margin of safety for the species to withstand catastrophic events. Representation (the range of variation found in a species) ensures that the species' adaptive capabilities are conserved. Redundancy, resiliency, and representation are not independent of each other, and some characteristic of a species or area may contribute to all three. For example, distribution across a wide variety of habitat types is an indicator of representation, but it may also indicate a broad geographic distribution contributing to redundancy (decreasing the chance that any one event affects the entire species), and the likelihood that some habitat types are less susceptible to certain threats, contributing to resiliency (the ability of the species to recover from disturbance). None of these concepts is intended to be mutually exclusive, and a portion of a species' range may be determined to be ''significant'' due to its contributions under any one or more of these concepts.

For the purposes of this finding, we determine if a portion's biological contribution is so important that the portion qualifies as ''significant'' by asking whether without that portion, the representation, redundancy, or resiliency of the species would be so impaired that the species would have an increased vulnerability to threats to the point that the overall species would be in danger of extinction (i.e., would be ''endangered''). Conversely, we would not consider the portion of the range at issue to be ''significant'' if there is sufficient resiliency, redundancy, and representation elsewhere in the species' range that the species would not be in danger of extinction throughout its range if the population in that portion of the range in question became extirpated (extinct locally).

We recognize that this definition of ''significant'' (a portion of the range of a species is ''significant'' if its contribution to the viability of the species is so important that without that portion, the species would be in danger of extinction) establishes a threshold that is relatively high. On the one hand, given that the consequences of finding a species to be endangered or threatened in a significant portion of its range would be listing the species throughout its entire range, it is important to use a threshold for ''significant'' that is robust. It would not be meaningful or appropriate to establish a very low threshold whereby a portion of the range can be considered ''significant'' even if only a negligible increase in extinction risk would result from its loss. Because nearly any portion of a species' range can be said to contribute some increment to a species' viability, use of such a low threshold would require us to impose restrictions and expend conservation resources disproportionately to conservation benefit: Listing would be rangewide, even if only a portion of the range of minor conservation importance to the species is imperiled. On the other hand, it would be inappropriate to establish a threshold for ''significant'' that is too high. This would be the case if the standard were, for example, that a portion of the range can be considered ''significant'' only if threats in that portion result in the entire species' being currently endangered or threatened. Such a high bar would not give the significant portion of its range phrase independent meaning, as the Ninth Circuit held in *Defenders of Wildlife* v. *Norton,* 258 F.3d 1136 (9th Cir. 2001).

The definition of ''significant'' used in this finding carefully balances these concerns. By setting a relatively high threshold, we minimize the degree to which restrictions will be imposed or resources expended that do not contribute substantially to species conservation. But we have not set the threshold so high that the phrase ''in a significant portion of its range'' loses independent meaning. Specifically, we have not set the threshold as high as it was under the interpretation presented by the Service in the *Defenders* litigation. Under that interpretation, the portion of the range would have to be so important that current imperilment there would mean that the species would be currently imperiled everywhere. Under the definition of ''significant'' used in this finding, the portion of the range need not rise to such an exceptionally high level of biological significance. (We recognize that if the species is imperiled in a portion that rises to that level of biological significance, then we should conclude that the species is in fact imperiled throughout all of its range, and that we would not need to rely on the significant portion of its range language for such a listing.) Rather, under this interpretation we ask whether the species would be endangered everywhere without that portion, i.e., if that portion were completely extirpated. In other words, the portion of the range need not be so important that even the species being in danger of extinction in that portion would be sufficient to cause the species in the remainder of the range to be endangered; rather, the complete extirpation (in a hypothetical future) of the species in that portion would be required to cause the species in the remainder of the range to be endangered.

The range of a species can theoretically be divided into portions in an infinite number of ways. However, there is no purpose to analyzing portions of the range that have no reasonable potential to be significant or to analyzing portions of the range in which there is no reasonable potential for the species to be endangered or threatened. To identify only those portions that warrant further consideration, we determine whether there is substantial information indicating that: (1) The portions may be ''significant,'' and (2) the species may be in danger of extinction there or likely to become so within the foreseeable future. Depending on the biology of the species, its range, and the threats it faces, it might be more efficient for us to address the significance question first or the status question first. Thus, if we determine that a portion of the range is not ''significant,'' we do not need to determine whether the species is endangered or threatened there; if we determine that the species is not endangered or threatened in a portion of its range, we do not need to determine if that portion is ''significant.'' In practice, a key part of the determination that a species is in danger of extinction in a significant portion of its range is whether the threats are geographically concentrated in some way. If the threats to the species are essentially uniform throughout its range, no portion is likely to warrant further consideration. Moreover, if any concentration of threats to the species occurs only in portions of the species' range that clearly would not meet the biologically based definition of ''significant,'' such portions will not warrant further consideration.

We evaluated the current range of the eastern small-footed bat to determine if there is any apparent geographic concentration of potential threats for the species. We examined potential habitat threats from modification of cave and mine openings, mine reclamation, vandalism, wind energy development, and timber harvesting (Factor A); disturbance from cave recreation and research-related activities (Factor B); WNS and predation (Factor C); the inadequacy of existing regulatory mechanisms (Factor D); and collisions from wind energy development projects, climate change, contaminants, and prescribed burning (Factor E). We found no concentration of threats that suggests that the eastern small-footed bat may be in danger of extinction in a portion of its range. We found no portions of its range where potential threats are significantly concentrated or substantially greater than in other portions of its range. Therefore, we find that factors affecting the eastern small-footed bat are essentially uniform throughout its range, indicating no portion of the range warrants further consideration of possible endangered or threatened status under the Act. There is no available information indicating that there has been a range contraction for the species, and therefore we find that lost historical range does not constitute a significant portion of the range for the eastern small-footed bat. Our review of the best available scientific and commercial information indicates that the eastern small-footed bat is not in danger of extinction (endangered) nor likely to become endangered within the foreseeable future (threatened), throughout all of its range or in a significant portion of its range. Therefore, we find that listing the eastern small-footed bat as an endangered or threatened species under the Act is not warranted at this time.

We request that you submit any new information concerning the status of, or threats to, the eastern small-footed bat to our Pennsylvania Field Office, 315 South Allen Street, Suite 322, State College, PA 16801, whenever it becomes available. New information will help us monitor the eastern small-footed bat and encourage its conservation. If an emergency situation develops for the eastern small-footed bat, we will act to provide immediate protection.

Northern Long-Eared Bat

As required by the Act, we considered the five factors in assessing whether the northern long-eared bat is an endangered or threatened species, as cited in the petition, throughout all of its range. We examined the best scientific and commercial information available regarding the past, present, and future threats faced by the northern long-eared bat. We reviewed the petition, information available in our files, and other available published and unpublished information, and we consulted with recognized bat and disease experts and other Federal and State agencies.

This status review identifies that the primary threat to the northern long-eared bat is attributable to WNS (Factor C), a disease caused by the fungus *Geomyces destructans* that is known to kill bats. The disease has led to dramatic and rapid population declines in northern long-eared bats of up to 99 percent from pre-WNS levels in some areas. White-nose syndrome has spread rapidly throughout the East and is currently spreading through the Midwest. We have no information to indicate that there are areas within the species' range that will not be impacted by the disease or that similar rates of decline (to what has been observed in the East, where the disease has been present for at most 8 years) will not occur throughout the species' range. Other sources of mortality to the species include wind-energy development, habitat modification, destruction and disturbance (*e.g.,* vandalism to hibernacula, roost tree removal), effects of climate change, and contaminants. Although no significant decline due to these factors has been observed, they may have cumulative effects to the species in addition to WNS.

On the basis of the best scientific and commercial information available, we find that the petitioned action to list the northern long-eared bat as an endangered or threatened species is warranted. A determination on the status of the species as an endangered or threatened species is presented below in the proposed listing determination.

Proposed Determination for Northern Long-Eared Bat

Section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, we may list a species based on (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination.

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the northern long-eared bat. There are several factors that affect the northern long-eared bat; however, we have found that no other threat is as severe and immediate to the species persistence as WNS (Factor C). Predominantly due to the emergence of WNS, the northern long-eared bat has experienced a severe and rapid decline in the Northeast, estimated at approximately 99 percent (from hibernacula data) since the disease was first discovered there in 2007. Summer survey data in the Northeast have confirmed rates of decline observed in northern long-eared bat hibernacula data post-WNS, with rates of decline ranging from 93 to 98 percent. This disease is considered the prevailing threat to the species, as there is currently no known cure. As mentioned under Factor C, although at the current time the disease has not spread throughout the species' entire range (WNS is currently found in 22 of 39 States where the northern long-eared bat occurs), it continues to spread, and we have no reason not to expect that where it spreads, it will have the same impact to the affected species (Coleman 2013, pers. comm.). Although there is some uncertainty as far as when the disease will spread throughout the northern long-eared bat's range, all models that have attempted to project the spread of WNS (presented in Factor C) were in agreement that WNS will indeed spread across the United States. In addition, human transmission could introduce the spread of the fungus to new locations that are far removed from the current known locations (Coleman 2013, pers. comm.). This threat is ongoing, is expected to increase in the future, and is significant because it continues to extirpate northern long-eared bat populations as it spreads and is expected to continue to spread throughout the species' range. Other threats to the northern long-eared bat include wind-energy development, winter and summer habitat modification, destruction and disturbance (*e.g.,* vandalism to hibernacula, roost tree removal), climate change, and contaminants. Although these threats (prior to WNS) have not in and of themselves had significant impacts at the species level, they may increase the overall impacts to the species when considered cumulatively with WNS.

The Act defines an endangered species as any species that is ''in danger of extinction throughout all or a significant portion of its range'' and a threatened species as any species ''that is likely to become endangered throughout all or a significant portion of its range within the foreseeable future.'' We find that the northern long-eared bat is presently in danger of extinction throughout its entire range based on the severity and immediacy of threats currently affecting the species. The overall range has been significantly impacted because a large portion of populations in the eastern part of the range have been extirpated due to WNS. White-nose syndrome is currently or is expected in the near future to impact the remaining populations. In addition other factors are acting in combination with WNS to reduce the overall viability of the species. The risk of extinction is high because the species is considered less common to rare in the areas not yet, but anticipated to soon be, affected by WNS, and significant rates of decline have been observed over the last 6 years in the core of the species' range, which is currently affected by WNS; these rates of decline are especially high in the eastern part of the species' range, where rates of decline have been as high as 99 percent in hibernating populations of the species. Therefore, on the basis of the best available scientific and commercial information, we propose listing the northern long-eared bat as endangered in accordance with sections 3(6) and 4(a)(1) of the Act. We find that a threatened species status is not appropriate for the northern long-eared bat because the threat of WNS has significant effects where it has occurred and is expected to spread rangewide in a short timeframe.

Under the Act and our implementing regulations, a species may warrant listing if it is endangered or threatened throughout all or a significant portion of its range. The threats to the survival of the species occur throughout the species' range and are not restricted to any particular significant portion of that range. Accordingly, our assessment and proposed determination applies to the species throughout its entire range.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness, and conservation by Federal, State, Tribal, and local agencies; private organizations; and individuals. The Act encourages cooperation with the States and requires that recovery actions be carried out for all listed species. The protection required by Federal agencies and the prohibitions against certain activities are discussed, in part, below.

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Subsection 4(f) of the Act requires the Service to develop and implement recovery plans for the conservation of endangered and threatened species. The recovery planning process involves the identification of actions that are necessary to halt or reverse the species' decline by addressing the threats to its survival and recovery. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

Recovery planning includes the development of a recovery outline shortly after a species is listed and preparation of a draft and final recovery plan. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. Revisions of the plan may be done to address continuing or new threats to the species, as new substantive information becomes available. The recovery plan identifies site-specific management actions that set a trigger for review of the five factors that control whether a species remains endangered or may be downlisted or delisted, and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks. Recovery teams (composed of species experts, Federal and State agencies, nongovernmental organizations, and stakeholders) are often established to develop recovery plans. When completed, the recovery outline, draft recovery plan, and the final recovery plan will be available on our Web site (*http://www.fws.gov/endangered*), or from our Green Bay, Wisconsin, Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribal, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat protection, habitat restoration (*e.g.,* restoration of native vegetation) and management, research, captive propagation and reintroduction, and outreach and education. The recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. To achieve recovery of these species requires cooperative conservation efforts on private, State, and Tribal lands.

If this species is listed, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost-share grants for non-Federal landowners, the academic community, and nongovernmental organizations. In addition, under section 6 of the Act, the State(s) of Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Vermont, Virginia, West Virginia, Wisconsin, and Wyoming, and the District of Columbia, would be eligible for Federal funds to implement management actions that promote the protection or recovery of the northern long-eared bat. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants*.

Although the northern long-eared bat is only proposed for listing under the Act at this time, please let us know if you are interested in participating in recovery efforts for this species. Additionally, we invite you to submit any new information on this species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as an endangered or threatened species and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any action that is likely to jeopardize the continued existence of a species proposed for listing or result in destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into consultation with the Service.

Federal agency actions within the species' habitat that may require conference or consultation or both as described in the preceding paragraph include management and any other landscape-altering activities on Federal lands administered by the U.S. Fish and Wildlife Service, U.S. Forest Service, NPS, and other Federal agencies; issuance of section 404 Clean Water Act (33 U.S.C. 1251 *et seq.*) permits by the U.S. Army Corps of Engineers; and construction and maintenance of roads or highways by the Federal Highway Administration.

The Act and its implementing regulations set forth a series of general prohibitions and exceptions that apply to all endangered and threatened wildlife. The prohibitions of section 9(a)(2) of the Act, codified at 50 CFR 17.21 for endangered wildlife, in part, make it illegal for any person subject to the jurisdiction of the United States to take (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these), import, export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. Under the Lacey Act (18 U.S.C. 42–43; 16 U.S.C. 3371–3378), it is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

We may issue permits to carry out otherwise prohibited activities involving endangered and threatened wildlife species under certain circumstances. Regulations governing permits are codified at 50 CFR 17.22 for endangered species, and at § 17.32 for threatened species. With regard to endangered wildlife, a permit must be issued for the following purposes: For scientific purposes, to enhance the propagation or survival of the species, and for incidental take in connection with otherwise lawful activities.

It is our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), to identify to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of a proposed listing on proposed and ongoing activities within the range of species proposed for listing. The following activities could potentially result in a violation of section 9 of the Act; this list is not comprehensive:

(1) Unauthorized collecting, handling, possessing, selling, delivering, carrying, or transporting of the species, including import or export across State lines and international boundaries, except for properly documented antique specimens of these taxa at least 100 years old, as defined by section 10(h)(1) of the Act.

(2) Incidental take of the species without authorization pursuant to section 7 or section 10(a)(1)(B) of the Act.

(3) Disturbance or destruction of known hibernacula due to commercial or recreational activities during known periods of hibernation.

(4) Unauthorized destruction or modification of summer habitat (including unauthorized grading, leveling, burning, herbicide spraying, or other destruction or modification of habitat) in ways that kills or injures individuals by significantly impairing the species' essential breeding, foraging, sheltering, or other essential life functions.

(5) Unauthorized removal or destruction of trees and other natural and manmade structures being utilized as roosts by the northern long-eared bat that results in take of the species.

(6) Unauthorized release of biological control agents that attack any life stage of this taxon.

(7) Unauthorized removal or exclusion from buildings or artificial structures being used as roost sites by the species, resulting in take of the species.

(8) Unauthorized building and operation of wind energy facilities within areas used by the species, which results in take of the species.

(9) Unauthorized discharge of chemicals, fill, or other materials into sinkholes which may lead to contamination of known northern long-eared bat hibernacula.

Questions regarding whether specific activities would constitute a violation of section 9 of the Act should be directed to the Green Bay, Wisconsin Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Critical Habitat for Northern Long-Eared Bat

Background

Critical habitat is defined in section 3 of the Act as:

(1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features

(a) Essential to the conservation of the species, and

(b) Which may require special management considerations or protection; and

(2) Specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Conservation, as defined under section 3 of the Act, means to use and the use of all methods and procedures that are necessary to bring an endangered or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking.

Critical habitat receives protection under section 7 of the Act through the requirement that Federal agencies ensure, in consultation with the Service, that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat. The designation of critical habitat does not affect land ownership or establish a refuge, wilderness, reserve, preserve, or other conservation area. Such designation does not allow the government or public to access private lands. Such designation does not require implementation of restoration, recovery, or enhancement measures by non-Federal landowners. Where a landowner requests Federal agency funding or authorization for an action that may affect a listed species or critical habitat, the consultation requirements of section 7(a)(2) of the Act would apply, but even in the event of a destruction or adverse modification finding, the obligation of the Federal action agency and the landowner is not to restore or recover the species, but to implement reasonable and prudent alternatives to avoid destruction or adverse modification of critical habitat.

Under the first prong of the Act's definition of critical habitat, areas within the geographical area occupied by the species at the time it was listed are included in a critical habitat designation if they contain physical or biological features (1) which are essential to the conservation of the species and (2) which may require special management considerations or protection. For these areas, critical habitat designations identify, to the extent known using the best scientific and commercial data available, those physical or biological features that are essential to the conservation of the species (such as space, food, cover, and protected habitat). In identifying those physical and biological features within an area, we focus on the principal biological or physical constituent elements (primary constituent elements such as roost sites, nesting grounds, seasonal wetlands, water quality, tide, soil type) that are essential to the conservation of the species. Primary constituent elements are those specific elements of the physical or biological features that provide for a species' life-history processes and are essential to the conservation of the species.

Under the second prong of the Act's definition of critical habitat, we can designate critical habitat in areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. For example, an area currently occupied by the species but that was not occupied at the time of listing may be essential to the conservation of the species and may be included in the critical habitat designation. We designate critical habitat in areas outside the geographical area occupied by a species only when a designation limited to its range would be inadequate to ensure the conservation of the species.

Section 4 of the Act requires that we designate critical habitat on the basis of the best scientific data available. Further, our Policy on Information Standards Under the Endangered Species Act (published in the **Federal Register** on July 1, 1994 (59 FR 34271)), the Information Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Pub. L. 106–554; H.R. 5658)), and our associated Information Quality Guidelines, provide criteria, establish procedures, and provide guidance to ensure that our decisions are based on the best scientific data available. They require our biologists, to the extent consistent with the Act and with the use of the best scientific data available, to use primary and original sources of information as the basis for recommendations to designate critical habitat.

When we are determining which areas should be designated as critical habitat, our primary source of information is generally the information developed during the listing process for the species. Additional information sources may include the recovery plan for the species, articles in peer-reviewed journals, conservation plans developed by States and counties, scientific status surveys and studies, biological assessments, other unpublished materials, or experts' opinions or personal knowledge.

Habitat is dynamic, and species may move from one area to another over time. We recognize that critical habitat designated at a particular point in time may not include all of the habitat areas that we may later determine are necessary for the recovery of the species. For these reasons, a critical habitat designation does not signal that habitat outside the designated area is unimportant or may not be needed for recovery of the species. Areas that are important to the conservation of listed species, both inside and outside the critical habitat designation, continue to be subject to: (1) Conservation actions implemented under section 7(a)(1) of the Act, (2) regulatory protections afforded by the requirement in section 7(a)(2) of the Act for Federal agencies to ensure their actions are not likely to jeopardize the continued existence of any endangered or threatened species, and (3) section 9 of the Act's prohibitions on taking any individual of the species, including taking caused by actions that affect habitat. Federally funded or permitted projects affecting listed species outside their designated critical habitat areas may still result in jeopardy findings in some cases. These protections and conservation tools will continue to contribute to recovery of this species. Similarly, critical habitat designations made on the basis of the best available information at the time of designation will not control the direction and substance of future recovery plans, habitat conservation plans (HCPs), or other species conservation planning efforts if new information available at the time of these planning efforts calls for a different outcome.

Prudency Determination

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12), require that, to the maximum extent prudent and determinable, the Secretary designate critical habitat at the time the species is determined to be endangered or threatened. Our regulations (50 CFR 424.12(a)(1)) state that the designation of critical habitat is not prudent when one or both of the following situations exist: (1) The species is threatened by taking or other human activity, and identification of critical habitat can be expected to increase the degree of threat to the species, or (2) such designation of critical habitat would not be beneficial to the species.

There is currently no imminent threat of take attributed to collection or vandalism under Factor B for the northern long-eared bat, and identification and mapping of critical habitat is not expected to initiate any such threat. In the absence of finding that the designation of critical habitat would increase threats to a species, if there are any benefits to a critical habitat designation, then a prudent finding is warranted. The potential benefits of designation include: (1) Triggering consultation under section 7 of the Act, in new areas for actions in which there may be a Federal nexus where it would not otherwise occur because, for example, it is or has become unoccupied or the occupancy is in question; (2) focusing conservation activities on the most essential features and areas; (3) providing educational benefits to State or county governments or private entities; and (4) preventing people from causing inadvertent harm to the species. Therefore, because we have determined that the designation of critical habitat will not likely increase the degree of threat to the species and may provide some measure of benefit, we find that designation of critical habitat is prudent for the northern long-eared bat.

Critical Habitat Determinability

Having determined that designation is prudent, under section 4(a)(3) of the Act we must find whether critical habitat for the species is determinable. Our regulations at 50 CFR 424.12(a)(2) state that critical habitat is not determinable when one or both of the following situations exist: (i) Information sufficient to perform required analyses of the impacts of the designation is lacking, or (ii) The biological needs of the species are not sufficiently well known to permit identification of an area as critical habitat.

We reviewed the available information pertaining to the biological needs of the species and habitat characteristics where this species is located. Since information regarding the biological needs of the species is not sufficiently well known to permit identification of areas as critical habitat, we conclude that the designation of critical habitat is not determinable for the northern long-eared bat at this time.

There are many uncertainties in designating hibernacula as critical habitat for the northern long-eared bat. First, we are not able to establish which of the large number of known hibernacula the species is known to inhabit are essential to the conservation of the species. This is due to the species typically being found in small numbers (often fewer than 10 individuals per hibernaculum). Also, those hibernacula with historically greater numbers (greater than 100) are often now infected with WNS, where the northern long-eared bat has been extirpated or close to extirpated. In addition, we lack sufficient information to define the physical and biological features or primary constituent elements with enough specificity; we are not able to determine how habitats affected by WNS (where populations previously thrived and are now extirpated) may contribute to the recovery of the species or whether those areas may still contain essential physical and biological features. Finally, for several States (*e.g.,* Alabama, Iowa, Kansas, Montana, Nebraska, North Dakota, Oklahoma) within the species' range it is unknown if hibernacula occur within parts of the State, due to either the lack of survey effort or (especially the case in the western part of the range) the species being sparsely populated over a large landscape, making locating potential hibernacula challenging. Therefore, we currently lack the information necessary to propose critical habitat for the species.

There are also uncertainties with potential designation of summer habitat, specifically maternity colony habitat. Although research has given us indication of some key summer roost requirements, the northern long-eared bat appears to be somewhat opportunistic in roost selection, selecting varying roost tree species and types of roosts throughout the range. Thus, it is not clear whether certain summer habitats are essential for the recovery of the species, or whether summer habitat is not a limiting factor for the species. Although research has shown some consistency in female summer roost habitat (*e.g.,* selection of mix of live trees and snags as roosts, roosting in cavities, roosting beneath bark, and roosting in trees associated with closed canopy), the species and diameter of the tree (when tree roost is used) selected by northern long-eared bats for roosts vary widely depending on availability. Therefore, we are currently unable to determine whether specific summer habitat features are essential to the conservation of the species, and find that critical habitat is not determinable for the northern long-eared bat at this time. We will seek more information regarding the specific winter and summer habitat features and requirements for the northern long-eared bat and make a determination on critical habitat no later than 1 year following any final listing.

Peer Review

In accordance with our joint policy published in the **Federal Register** on July 1, 1994 (59 FR 34270), we will seek the expert opinions of at least three appropriate and independent specialists regarding this proposed rule. The purpose of peer review is to ensure that our listing determination for this species is based on scientifically sound data, assumptions, and analyses. We will invite these peer reviewers to comment during the public comment period.

We will consider all comments and information we receive during the comment period on this proposed rule during preparation of a final rulemaking. Accordingly, the final decision may differ from this proposal.

Public Hearings

The Act provides for one or more public hearings on this proposal, if requested. Requests must be received within 45 days after the date of publication of this proposal in the **Federal Register**. Such requests must be sent to the address shown in the **FOR FURTHER INFORMATION CONTACT** section. We will schedule public hearing on this proposal, if any are requested, and announce the dates, times, and places of those hearings, as well as how to obtain reasonable accommodations, in the **Federal Register** and local newspapers at least 15 days before the hearing.

Persons needing reasonable accommodations to attend and participate in a public hearing should contact the Green Bay, Wisconsin, Field Office at 920–866–1717, as soon as possible. To allow sufficient time to process requests, please call no later than 1week before the hearing date. Information regarding this proposed rule is available in alternative formats upon request.

Required Determinations

Clarity of the Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in the **ADDRESSES** section. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*), need not be prepared in connection with listing a species as an endangered or threatened species under the Endangered Species Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244).

References Cited

A complete list of references cited in this rulemaking is available on the Internet at *http://www.regulations.gov* and upon request from the Green Bay, Wisconsin, Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this proposed rule are the staff members of the Green Bay, Wisconsin, Field Office and the State College, Pennsylvania, Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—[AMENDED]

■ 1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 1531–1544; 4201–4245, unless otherwise noted.

■ 2. Amend § 17.11(h) by adding an entry for ''Bat, northern long-eared'' in alphabetical order under MAMMALS to the List of Endangered and Threatened Wildlife to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
MAMMALS							
*	*	*	*	*	*		*
Bat, northern long-eared.	*Myotis septentrionalis*.	U.S.A. (AL, AR, CT, DE, DC, FL, GA, IL, IN, IA, KS, KY, LA, ME, MD, MA, MI, MN, MS, MO, MT, NE, NH, NJ, NY, NC, ND, OH, OK, PA, RI, SC, SD, TN, VT, VA, WV, WI, WY); Canada (AB, BC, LB, MB, NB, NF, NS, NT, ON, PE, QC, SK, YT).	Entire	E		NA	NA
*	*	*	*	*	*		*

Dated: September 10, 2013.

Stephen Guertin,

Acting Director, U.S. Fish and Wildlife Service.

[FR Doc. 2013–23753 Filed 10–1–13; 8:45 am]

BILLING CODE 4310–55–P