Little Brown Myotis

Myotis lucifugus

REGULATORY STATUS

USFWS: Petitioned for Listing
USFS R2: No special status
UWFS R4: No special status
Wyoming BLM: No special status
State of Wyoming: Nongame Wildlife

CONSERVATION RANKS

USFWS: No special status
WGFD: NSS3 (Bb), Tier II
WYNDD: G3, S5
Wyoming Contribution: LOW
IUCN: Least Concern

STATUS AND RANK COMMENTS

In 2011, a status review was submitted to the U.S. Fish and Wildlife Service (USFWS) suggesting that Little Brown Myotis (*Myotis lucifugus*) be listed as Endangered on an emergency basis because of massive population declines in the northeastern U.S. from White-nose Syndrome (WNS) [1]. As of 2016, the USFWS had not yet completed this assessment or issued any decision on whether Threatened or Endangered status was warranted.

NATURAL HISTORY

Taxonomy:

There are five recognized subspecies of Little Brown Myotis: *M. l. alascensis*, *M. l. carissima*, *M. l. lucifugus*, *M. l. pernox*, and *M. l. relictus* [2, 3]. In Wyoming, *M. l. carissima* is the only known subspecies[3]. These sub-specific designations have been questioned as recently as 2008 because of the overlapping ranges of subspecies and evidence of subspecies-level hybridization from mitochondrial and nuclear DNA analyses [4].

Description:

Little Brown Myotis is, with few exceptions, identifiable in the field [5]. The species is a small vespertilionid bat, but medium in size among *Myotis* species [5]. Pelage is variable in color. Generally, the dorsal side is glossy and sooty brown to pale golden brown, while the ventral side is a lighter yellow or olive brown [3, 5, 6]. In early summer, juveniles can be distinguished from adults by noticeably darker pelage and lower mass [3]. These differences become less apparent by late summer [3], although the growth plate in the phalanges of juveniles are visible throughout the first summer [7, 8]. Little Brown Myotis has a moderately sloped forehead and pointed ears of moderate length (14–16 mm) with a short, blunt tragus [3]. Little Brown Myotis is similar in appearance to other co-occurring *Myotis* species. In Wyoming, these include Long-legged Myotis (*M. volans*), Northern Long-eared Myotis (*M. septentrionalis*), and Yuma Myotis (*M. yumanensis*). Little Brown Myotis can be distinguished from Long-legged Myotis by lack of a

keeled calcar and can be distinguished from Northern Long-eared Myotis by its short, blunt tragus. Although it can be difficult to distinguish from Yuma Myotis in the field, Little Brown Myotis has hair that extends past the toes of the hind feet, a more gradually sloped forehead, and echolocates at a distinctly lower frequency [3, 5, 6].

Distribution & Range:
Little Brown Myotis is widely distributed across the United States and Canada. Wyoming falls within the center of its distribution and comprises a relatively small proportion of the species global range. There are no known range contractions, but WNS has greatly reduced numbers of Little Brown Myotis in the northeastern United States [9].

Habitat:
Little Brown Myotis is generally associated with woodland habitats, but is considered a generalist species since it has been documented in many habitat types. In Wyoming, this species has been documented in coniferous forests, riparian areas, woodlots, shelterbelts, and urban areas [7]. Little Brown Myotis requires 3 roost types: day roosts, night roosts, and hibernacula [3]. Roost use varies by season. In spring and summer, reproductive females form maternity colonies at roost sites with warm microclimates [3]. Day roosts are varied and include buildings, trees, rock piles, wood piles, and caves. Non-reproductive bats roost singly or in small groups at sites with cooler microclimates [3]. Various structures are used as night roosts. In Wyoming, caves, abandoned mines, buildings, rock shelters, and railroad tunnels have been identified as night roost sites [7]. At night, large numbers of Little Brown Myotis pack tightly into a confined space following an initial feeding bout that begins at dusk [3]. In late summer and fall, individuals migrate up to several hundred km to winter hibernacula, using a variety of roost sites along the way [3]. Hibernacula are used in winter and are usually caves or abandoned mines with high humidity and temperatures above 0° C [1, 3]. Little Brown Myotis is common throughout Wyoming where suitable habitat is present [7]. Yellowstone National Park and Devils Tower National Monument are known to support relatively large numbers of Little Brown Myotis [10, 11].

Phenology:
Mating generally occurs in the fall at swarming sites in the vicinity of hibernacula shortly before hibernation but hibernating bats have also been observed copulating [3, 6]. Fertilization occurs in the spring when females emerge from hibernation [3]. A single altricial pup is born in early summer after a 50 to 60 day gestation period [3]. In the Rocky Mountain region, most pups are born in May and June [6]. Young are volant at around 22 days after birth [1]. Duration and timing of hibernation varies with latitude [3]. Across the species range, hibernation begins in mid-August at northern latitudes and early November at more southern latitudes [12]. Emergence from hibernation ranges from mid-March at southern latitudes to mid-May at northern latitudes [3, 12].

Diet:
Little Brown Myotis feeds on small aerial insects that emerge from aquatic habitats [6]. The species consumes a diverse array of insects of the orders Diptera, Lepidoptera, Coleoptera, Trichoptera, Ephemeroptera, and Neuroptera, among others [1, 6, 13]. Diet composition generally relates to the relative abundance of insect orders available at foraging areas, suggesting that the species is a dietary generalist [1, 13].

CONSERVATION CONCERNS

Abundance:
Continental: WIDESPREAD
Wyoming: COMMON
There are no estimates of abundance of Little Brown Myotis range-wide or in Wyoming. However, Little Brown Myotis is frequently reported as one of the most common bat species across its range[1]. In Wyoming, Little Brown Myotis was the most frequently documented bat species in several studies across the state [10, 11, 14-18].

Population Trends:
Historic: UNKNOWN
Recent: STABLE
Historic population trends of Little Brown Myotis in Wyoming are unknown. Little Brown Myotis numbers were thought be stable or slightly increasing range-wide up to 2006 [1, 9]. Since then, the species has undergone large declines in the eastern United States where it is affected by WNS [9, 19]. Between 2006 and 2012, it is estimated that between 5.7 and 6.7 million bats died from WNS infection, many of which were Little Brown Myotis [19]. Regional extirpations are projected by 2026 in the northeastern United States [9]. While no estimates of population trends are available for the species in Wyoming, WNS is currently not present in the state and it is likely that population trends are stable [9].

Intrinsic Vulnerability:
HIGH VULNERABILITY
Little Brown Myotis has low fecundity, giving birth to one pup per year [3]. Because the species congregates in large numbers at hibernacula and other roost sites, regional populations are susceptible to single catastrophic events at these sites [3, 7, 9]. Congregating at hibernacula also makes this species highly susceptible to large declines from WNS, a disease to which Little Brown Myotis is extremely susceptible.

Extrinsic Stressors:
MODERATELY STRESSED
Little Brown Myotis faces numerous extrinsic stressors in Wyoming. Wind-energy development has and will continue to increase in Wyoming, and post-construction mortality surveys indicate that Little Brown Myotis is killed by wind turbines in Wyoming and other states [20, 21]. Little Brown Myotis may also be negatively affected by climate change [22, 23]. In northern Colorado, long-term monitoring of bat species, including Little Brown Myotis, indicated that the number of reproductive (i.e., pregnant, lactating, or post-lactating) females declined significantly, $\leq 64\%$, under drought conditions that mimicked drought conditions predicted by climate change models [24]. Given the geographic proximity and habitat similarities between this study location and Wyoming, it likely that similar patterns could occur in Wyoming. Disturbance from visitors to caves and abandoned mines used as hibernacula represents a significant threat to cave-roosting bats and bat habitat [7]. Even a small number of short duration disturbances lead to significant increases in arousal events and subsequent energy expenditures that may lead to increased mortality of Little Brown Myotis [25, 26]. Timber harvest might also affect the species by reducing the density of suitable spring, summer, and fall roost sites [7], although it is unknown to what degree this may affect Little Brown Myotis in Wyoming. Similar to other insectivorous organisms, Little Brown Myotis is affected by pesticide use. Effects come from both reduced food availability and acute and chronic toxicity from the pesticides themselves [3, 7]. Perhaps the

greatest threat to the Little Brown Myotis is WNS, unintentionally introduced to the United States in 2006. Little Brown Myotis is highly susceptible to WNS and has undergone large population declines in the northeastern United States from the disease [9]. The pathogenic fungus *Pseudogymnoascus destructans* (formerly *Geomyces destructans*) that causes WNS has not been detected in Wyoming as of 2015 [27]. It is unknown what effect WNS would have on Little Brown Myotis in Wyoming, but, given their sensitivity to the disease, population declines are likely should WNS be introduced into Wyoming. Research from other geographic areas suggests that bats may experience non-lethal effects from exposure to environmental contaminants, including but not limited to reduced reproduction and increased susceptibility to WNS [28]

KEY ACTIVITIES IN WYOMING

In recent years, bats have received increasing research attention across North America and in Wyoming. Across the state, pre-construction bat inventories are being conducted at wind energy development sites. To address concerns regarding potential WNS infection of bats in Wyoming, the Wyoming Game and Fish Department (WGFD) in cooperation with the Wyoming Bat Working Group authored "A strategic plan for white-nose syndrome in Wyoming" in 2011. This document presents a plan of action to minimize impacts of WNS if it is detected in states adjacent to or in Wyoming [29]. To facilitate early detection of the disease, WGFD requires researchers to evaluate all bats captured during research activities for signs of WNS infection using the Reichard Wing-Damage Index [30]. Beginning in 2012, WGFD personnel placed temperature and humidity loggers in a number of known or suspected hibernacula across Wyoming to determine if climatic conditions at these sites are favorable for growth of *P. destructans*. Personnel have also begun collecting swabs of hibernating bats and hibernacula substrates in an effort to assist with early detection of *P. destructans*. While placing loggers, surveyors also searched for hibernating bats and detected Little Brown Myotis at two sites [31, 32]. WGFD conducts periodic surveys at known hibernacula throughout the state, including 10 Little Brown Myotis hibernacula. Several studies have been completed or are underway that have increased our understanding of bat species, including Little Brown Myotis, in the state. Both WGFD and the Wyoming Natural Diversity Database (WYNDD) have conducted numerous bat inventories across the state including a statewide forest bat inventory from 2008 to 2011 [14-17, 33, 34], a statewide inventory of cliffs, caves, and rock outcroppings from 2012 to 2015 [35, 36], an inventory of bats at Devils Tower National Monument from 2010 to 2011, a bat monitoring effort in southern Wyoming from 2011 to 2013 [37-39], and bat surveys in northeastern Wyoming in 2014 and 2015 [18]. Little Brown Myotis was the most frequently captured and recorded bat species during the majority of these investigations [10, 14, 15, 18, 34-36]. While Little Brown Myotis was frequently detected during all years across southern Wyoming, it was not the most commonly documented species from either acoustic monitoring or mist-net surveys, suggesting the species may be less abundant than other bat species in arid areas across the state [37-39]. In 2011, 2013, 2014, and 2015 WYNDD conducted multi-taxa inventories, which included bat surveys, within the Ferris Mountain Wilderness Study Area (WSA), Gardner Mountain WSA, Fortification Creek WSA, and North Fork WSA. Several bat species were detected within these four WSAs including Little Brown Myotis [40-42]. Also in 2014, WYNDD, the Bureau of Land Management, the USFWS, and the BioDiversity Research Institute conducted pilot work to investigate the potential for environmental contaminant accumulation in bats that feed and obtain water from produced water evaporation pits associated with oil and natural gas extraction in northeast Wyoming. Results are pending, and it is unknown if this work will continue in the

future. In 2015, WYNDD developed a bat monitoring plan and initiated survey activities at Bighorn Canyon National Recreation Area (BICA). The primary objective of this monitoring plan is to develop a baseline activity level or other index of abundance for Little Brown Myotis that can be used to detect changes in populations within BICA through time. In addition to research activities, many conservation organizations and federal and state agencies, including WGFD, have developed outreach and education materials to inform the general public of the importance bats and concerns regarding the persistence of bats in the future.

ECOLOGICAL INFORMATION NEEDS

Understanding habitat use and management practices that benefit the species are needed in the face of large population declines in parts of the species' range. Relatively few Little Brown Myotis hibernacula are known in Wyoming. These sites represent a critical habitat component for the species and a vitally important piece of information to better monitor and understand potential impacts and spread of WNS should it reach Wyoming. Robust estimates of abundance and population trends of the species in Wyoming do not exist, but would be valuable in the face of pending stressors such as WNS and wind energy development. While WNS has not been documented in Wyoming to date, continued monitoring for WNS across the state is necessary so that potential mitigation measures can be enacted in a timely manner. Current geographic and morphometric based sub-specific designations have been questioned. Application of molecular techniques would clarify taxonomic uncertainties of Little Brown Myotis [4].

MANAGEMENT IN WYOMING

This section authored solely by WGFD; Nichole L. Bjornlie. Very little is known about the wintering locations of Little Brown Myotis in Wyoming. Although WNS has not been detected in the state, the slow westward progression of the fungus necessitates the need for these data before it reaches Wyoming. Consequently, priorities will focus on locating and monitoring hibernacula as well as other roost locations (e.g., maternity roosts) to monitor populations and recommend and assist with bat-friendly closures of important caves and mines. In 2016, WGFD will begin a project in collaboration with the state of Nebraska to evaluate occurrence, abundance, and reproductive status of bats in eastern Wyoming, which represents an important zone of overlap between eastern and western bat species. Mist-net surveys will continue to implement WNS protocols and assessment in an effort to assist with early detection should the disease reach the state. Habitat assessments will be incorporated with survey efforts to better understand what influences species presence and distribution at a finer scale. In addition to inventory projects, WGFD, in collaboration with the Wyoming Bat Working Group and other state-wide partners, will implement the North American Bat Monitoring Program that will use acoustic monitoring to assist with state and region-wide assessment of bat trends. Additional priorities will include updating and revising the Conservation Plan for Bats in Wyoming and the Strategic Plan for WNS in Wyoming. Finally, outreach and collaboration with private landowners will remain a priority to ensure conservation of bats and bat habitat.

CONTRIBUTORS

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Conservation System Research and Science Program and the Bureau of Land Management Buffalo Field Office by the Wyoming Natural Diversity Database, Laramie, Wyoming.

Figure 1: Adult Little Brown Myotis. (Photo courtesy of Douglas A. Keinath)

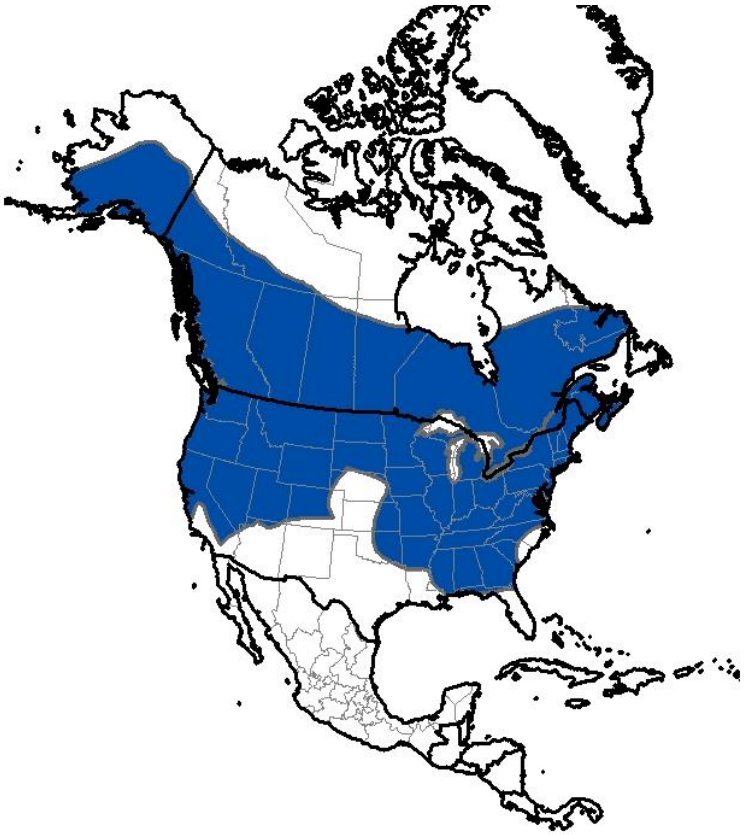

Figure 2: North American range of *Myotis lucifugus*. (Map from: Patterson, B. D., et al. (2007) Digital Distribution Maps of the Mammals of the Western Hemisphere, version 3.0, NatureServe, Arlington, Virginia.)

Figure 3: Forest clearing used by Little Brown Myotis in the Bear Lodge Mountains, Wyoming. The poles are supporting a mist net used to capture bats foraging over the water. (Photo courtesy of WGFD)

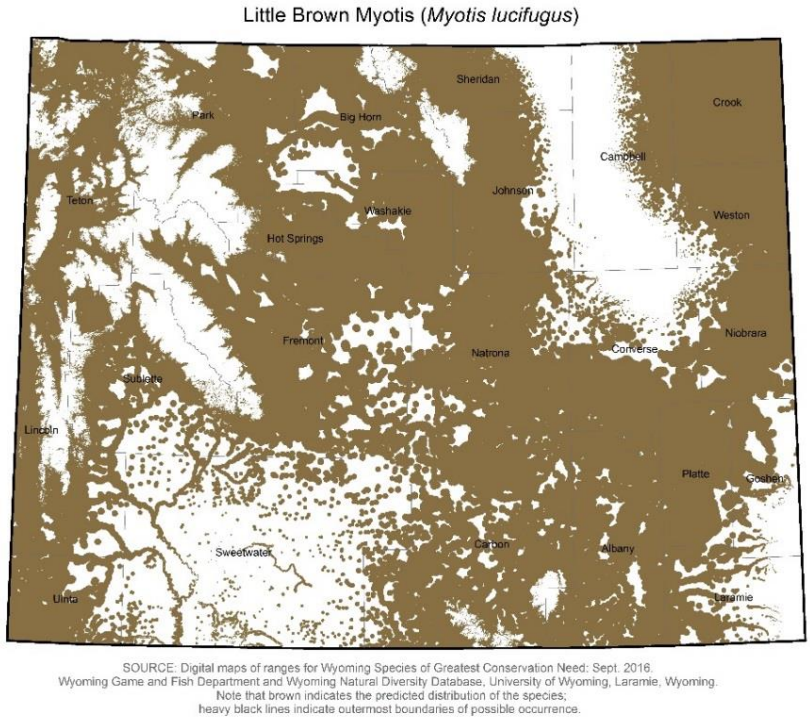

Figure 4: Range and predicted distribution of *Myotis lucifugus* in Wyoming.