



Bats

OVERVIEW

Bats probably first appeared in their current form 65-100 million years ago (Altringham 1996). The oldest known bat fossil was found in southwest Wyoming around 1933 and dates to the major diversification of species that occurred about 50 million years ago (Jepson 1966). Of the approximately 1,100 bat species now known worldwide, at least 12 are present in the three units of the Greater Yellowstone Network (GRYN): Bighorn Canyon National Recreation Area (NRA), Grand Teton National Park (NP) with John D. Rockefeller Memorial Parkway, and Yellowstone NP. As listed below, a 13th species may also be present in Bighorn Canyon NRA, while 8 to 10 occur in Grand Teton NP and 9 or 10 in Yellowstone NP (Keinath 2005b).



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Long-eared myotis, *Myotis evotis*.

Presence and Abundance of Bat Species

Each species was identified by capture, and/or audio monitoring during an inventory conducted in 2003 and 2004, mostly from late June to late August (fig. 1) (Keinath

2005b). All of the species are insectivores belonging to the Vespertilionidae family. They are relatively small bats, with wingspans from 8–16 inches (20–41 cm). The species vary in abundance from common and widespread (e.g., the little brown bat) to low in abundance and localized (e.g., the fringe-tailed bat). Bats occur at elevations up to approximately 8,000 feet (2,400 m), though the pallid bat (*Antrozous pallidus*), hoary bat, and silver-haired bat (*Lasionycteris noctivagans*) have only been documented below 6,000 feet (1,800 m) (Hendricks et al. 2004).

	Bighorn Canyon	Grand Teton	Yellowstone
Little brown bat <i>Myotis lucifugus</i>	Very high	Very high	Very high
Big brown bat <i>Eptesicus fuscus</i>	High	Medium	Medium
Long-legged myotis <i>Myotis volans</i>	Medium	Medium	Medium
Silver-haired bat <i>Lasionycteris noctivagans</i>	Low	Medium/High	Medium/High
Long-eared myotis <i>Myotis evotis</i>	Medium	Medium	Low
Townsend's big-eared bat <i>Corynorhinus townsendii</i>	Low/Medium	Low	Low
Hoary bat <i>Lasiurus cinereus</i>	Low	Medium	Low
Fringed-tailed myotis <i>Myotis thysanodes</i>	Low	Low	Low
Yuma myotis <i>Myotis yumanensis</i>	Medium	Possible	Low
Western small-footed myotis <i>Myotis ciliolabrum</i>	Medium	Possible	Unlikely
Pallid bat <i>Antrozous pallidus</i>	Low	Unlikely	Possible
Spotted bat <i>Euderma maculatum</i>	Medium	Unlikely	Unlikely
California myotis <i>Myotis californicus</i>	Possible	Unlikely	Unlikely

Figure 1. Presence and abundance of bat species in Bighorn Canyon National Recreation Area, Grand Teton National Park, and Yellowstone National Park

Distribution and Abundance

In Bighorn Canyon National Recreation Area

Compared to nearby areas in Wyoming, Montana and Idaho, Bighorn Canyon NRA and the adjacent lands (primarily owned by the Bureau of Land Management and the state of Wyoming) are relatively arid, warm, and low in elevation, and they contain abundant cliff, cave, and tree roosting habitat relatively proximate to large expanses of still water that bats use for foraging insects. Bighorn Canyon NRA therefore supports an abundance of bats and at least 12 different species. All of these species, plus the call of what may have been a California myotis, were

recorded in the Layout Creek area of the Ewing-Snell Ranch during the GRYN inventory (Keinath 2005b). More than half of the 19,424-acre Yellowtail Wildlife Habitat Management Area lies at the southern end of Bighorn Canyon NRA, where an apparent abundance of insects and the surrounding roosting habitat in caves, cliffs, and abandoned buildings and mines have accommodated an abundance of bats (Keinath 2005b). The Wyoming Game and Fish Department (WGFD) has established an abandoned building there as a bat house, and other buildings in the area are probably also used by bats (Keinath 2001).

In Grand Teton National Park

A survey of historic structures in Grand Teton NP documented big brown bats, Townsend's big-eared bats, and six maternity colonies of little brown bats (Bogan and Geluso 1999). Bats were found roosting in buildings that had the warmest night-time temperatures and offered spaces no more than 2 inches (5 cm) wide, including the Jenny Lake Visitor Center, park housing, and buildings at Moran Junction and Signal Mountain.

In August 2004 as part of the GRYN inventory, evidence of bat use was found in 11 of the 28 structures at Bar B-C Ranch and 11 of the 13 structures at White Grass Ranch (Keinath 2005a). White Grass Ranch had long-term use by five bat species: Townsend's big-eared bat, big brown bats, long-eared myotis, little brown bats, and long-legged myotis. Ranch buildings were used for day roosting, night roosting, and maternity colonies. More exposed locations were used for shelter, feeding, and rest during the night (Keinath 2005b). The GRYN inventory also documented a diversity of bats and bat habitats at Blacktail Butte, the Blacktail ponds, and the Moose-Wilson Road beaver ponds, and White Grass Ranch in that southern part of the park, and in the Two Oceans Lake area in the northern part of the park and at Glade Creek in John D. Rockefeller National Memorial Parkway.

In Yellowstone National Park

Half of the bridge and bridge-like structures surveyed along the Norris-Madison Junction road corridor in 1999 had evidence of bat use (Hendricks 2000). Of the 15 colonies documented in structures (all little brown bats), 13 were in sites with spaces approximately 2 inches (5 cm) wide or smaller. Maternity colonies were generally observed in structures with small roosting spaces and the warmest minimum temperatures (Bogan and Geluso 1999).

In the Mammoth Hot Springs area, thermally heated caves are used by maternity colonies of the little brown bat and Townsend's big-eared bat. The inactive caves and sinkholes provide non-maternity day roosts and possibly hibernacula. The mature, open forests near shrubland

provide foraging and roosting habitat for tree-roosting species. The extent of bat use of thermal features is not well known, but little foraging activity was observed around them in 2000 (Hendricks 2000). There have been some reports of bats roosting at ground level in thermally heated stumps. A maternity colony was documented in 2004 in a ground-level boulder in Gibbon Geyser basin. Use of several sink-holes was documented in the Mammoth area (Keinath 2005b).

Physical Description

Bat size and shape of wings, echolocation, and the ability to control metabolism and body temperature have evolved as adaptations to exploit habitat and catch prey, and they allow multiple species to coexist without competition by partitioning their habitat. Most bats capture insects in mid-air. On the inner side of the bat's ankle is a cartilaginous spur (the calcar) that helps support the wing membrane. Bats with long, narrow wings (e.g., the hoary bat) are fast but less maneuverable fliers that typically forage in open areas. Bats with short, broad wings (e.g., Townsend's big-eared bat) are slower but more agile and typically forage in forested areas or along the edge of vegetation. A few GRYN bats, such as long-eared myotis, pallid bat, and Townsend's big-eared bat can glean insects off the surface of vegetation, and have wing shapes that enable them to hover and carry larger prey. Of these species the long-eared myotis is able to access more areas because of its smaller size (Adams 2003; Altringham 1996).

The ability to use echoes from the animal's own vocalizations for navigation and foraging is probably most highly developed in bats. Although they usually echolocate using a range of frequencies, most are too high to hear with the unaided human ear. Audio equipment can be used to determine the level of bat activity at a site and identify some bat species. High frequency calls are less likely to alert predators and are best for locating prey, although some moths have developed "ears" on their abdomens capable of detecting such calls. The spotted bat (*Euderma maculatum*) has adapted by using lower frequency calls that are inaudible to the moth but audible to humans. Species such as the spotted bat that have low frequency calls typically have long ears that enable them to hear themselves. Most bats also use lower frequency calls (often audible to humans) to communicate with each other. Also, contrary to the expression "blind as a bat," bats typically have excellent vision that can be used for hunting (Adams 2003; Altringham 1996).

Bats make efficient use of the energy obtained through foraging by regulating their body temperature (thermoregulation). To conserve energy, bats can lower their metabolic rate and body temperature (torpor), but they are then unable to carry out normal activities. Most bat



species in Greater Yellowstone undergo hibernation, a form of torpor that may continue for months and is typically a seasonal response to a prolonged fall in temperature or reduction in food supply (Adams 2003; Altringham 1996).

At rest, bats roost head down, which makes them less vulnerable to predators and facilitates flight. A bat can remain upside down for months because of cavities in its cranium that pool blood and other fluids away from the brain and an arrangement of ligaments and leg muscles that enables them to hang passively from their perch while sleeping (Adams 2003).

Ecology

Habitat

Roosts provide bats with protection from weather and predators, and the type of roosting structure available affects foraging and mating strategies, seasonal movements, morphology, physiology, and population distribution (Altringham 1996). Bats in Greater Yellowstone use both natural habitats and man-made structures including bridges and abandoned mines for roosting and other activities. Of the 130 highway structures surveyed in the summer of 2003 in an area of south-central Montana that is northeast of Yellowstone NP and northwest of Bighorn Canyon NRA, bats were using 60% for roosting (Hendricks et al. 2005).

Bighorn Canyon has greater abundance and diversity of bats than most other areas of Greater Yellowstone because it is relatively warm, low in elevation, has an abundance of cliff and cave roosting habitat and tree roosting habitat in the form of extensive cottonwood riparian areas, and the roosting habitat is relatively close to large expanses of still water for drinking and abundant insect life. Grand Teton and Yellowstone NPs, have much open water and probably an abundance of tree roosts, but they are generally higher and cooler. They therefore have suitable habitat for bat species that have generalist feeding habits and either generalist roost requirements (e.g., little brown bat, big-brown bat) or roost in snags (e.g., silver-haired bat, long-legged myotis). The presence of other bats in these parks is probably restricted by the limited location of suitable roosts and/or the distribution of moths and beetles on which more specialized bats forage.

Most western bat species probably migrate short distances from their summer roosts to their winter hibernacula. However, some species migrate long distances to areas where temperature and insect populations remain high enough for continued activity. Species that undergo long-distance seasonal migrations usually do not hibernate (Adams 2003). In Greater Yellowstone, the hoary bat and silver-haired bat likely migrate south for the winter (Keinath 2005).

Life Cycle

Bats develop and reproduce slowly, which is unusual given their small body size. They are sexually active once a year and typically mate in the fall. In bats that hibernate, fertilization is delayed until the female emerges from hibernation. For most Greater Yellowstone bats, hibernation ends around mid-April and the females give birth in mid-June (Keinath 2005b). The timing of fetus development and gestation can be affected by temperature (Altringham 1996). Most bats give birth to one young (pup) a year, although four of the species mentioned here have two or more pups at a time (Barclay and Harder 2003). These bat species typically begin flying in 2–6 weeks, are weaned around 5–10 weeks, and become sexually mature in 1–2 years, although some may be mature in as little as three months.

The bat's flying ability and nocturnal activity reduce the risk of predation, and few predators specialize in bats. Predators of bats are generally opportunistic and include owls, falcons, hawks, snakes, and raccoons (Barclay and Harder 2003). Of the bats that survive their first year, 40–80% survive 7–8 years; many bats live 10–30 years (Altringham 1996).

Species Accounts

Pallid Bat (*Antrozous pallidus*)

Physical description. Pallid bats have wingspans reaching 15–16 inches (37–41 cm) and weights of 0.7–1.2 ounces (20–35 g). The body and head are pale brown, though the underside can be pale brown to white. They have large eyes, prominent separate ears that are clearly visible during flight, a pig-like snout, and wart-like glands that produce musky odor (Adams 2003; Hester and Grenier 2005).

Distribution. Pallid bats are most common in lower elevation rocky deserts, dry canyons, and shrub-steppe



Pallid bat, *Antrozous pallidus*.

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grasslands, particularly in the southwestern U.S. Surveys in Wyoming in the 1990s found the species in only five roosting sites (Priday and Luce 1999). Bighorn Canyon NRA is considered to have some of the best roosting sites in Wyoming because of its warm, arid climate and abundant cliffs. The Bighorn Canyon NRA population is considered permanent and a major contribution to the persistence of pallid bats in Wyoming. The Mammoth Hot Springs area of Yellowstone NP appears to be suitable habitat for pallid bats, though a population would likely be small. Several possible pallid bat calls were recorded in the area during the 2004 inventory, but none of the bats were captured. No pallid bats were documented in Grand Teton NP (Keinath 2005b).

Habitat. The pallid bat is generally found in low desert shrublands, juniper woodlands, grasslands, and occasionally nearby cottonwood-riparian zones, though most commonly in areas with rocky outcroppings. Bats have been observed in Wyoming as high as 7,000 feet (2,100 m) (Clark and Stromberg 1987). Summer roosts are typically rocky crevices and buildings, though rock piles, tree cavities, caves, and abandoned mines are used to a lesser extent (Hester and Grenier 2005; Keinath 2005b). Pallid bats are highly selective of roost sites to minimize daily energy use. Suitable roosting sites typically provide protection from precipitation, predators, and direct sunlight, and have unobstructed entrances at least 5 feet (1.5 m) above the ground. Sites are warm with stable daytime temperatures close to 86°F (30°C). Night roosts, which are typically near but separate from day roosts, are often rock shelters, bridges, open buildings, porches, shallow caves, and abandoned mines. Roost fidelity is highly variable; females change roosts frequently. Pallid bats have not been found hibernating in Wyoming (Hester and Grenier 2005).

Foraging. The pallid bat forages for insects primarily by walking on the ground, but this characteristic makes it particularly vulnerable to predation and possibly insecticides. Pallid bats emerge about one hour after sunset for the first of two foraging rounds. They are slow fliers with low maneuverability, but also forage in flight within about 10 feet (3 m) of the ground and glean insects from the surface of vegetation. The pallid bat primarily feeds on flightless insects 0.8–2.8 inches (2–7 cm) long including scorpions, crickets, centipedes, millipedes, grasshoppers, beetles, spiders, and large moths. The species is also known to feed on other large insects such as cicadas and katydids from vegetation and occasionally eats small vertebrates, including lizards and rodents. The bat's kidneys are adapted to concentrate urine so the species rarely needs to drink water (Clark and Stromberg 1987).

Roosting. Pallid bats typically roost in colonies of 12–100 individuals in all seasons. Roosting in groups helps conserve energy in cool climates, and pallid bats exhibit a complex rallying behavior to locate roost-mates. Maternity

roosts are the largest colonies, but disband from August to October after offspring are independent.

Reproduction. Mating occurs in October through December, though fertilization is delayed until spring. Young are born after 8–9 weeks, between late May and early July, depending on local climate. Yearling females give birth to a single pup, and typically to two pups a year thereafter. Pups may fly 4–5 weeks after birth and are usually independent of the mother by about 6–8 weeks (Adams 2003; Hester and Grenier 2005).

Townsend's Big-eared Bat (*Corynorhinus townsendii*)

Physical description. Townsend's big-eared bats weigh 0.3–0.4 ounces (8–14 g) and have a 12–13 inch wingspan (30–34 cm). They have long, gray-brown fur; the dorsal hair is slate gray with pale cinnamon to blackish brown tops. The species is distinguished by very long, wide ears that join across forehead and are directed forward during flight. During hibernation, fleshy outer part of the ear (the pinnae,) curl against the head and resemble ram horns. Glands are present on the muzzle on each side of the nostrils (Adams 2003; Hester and Grenier 2005; Kunz and Martin 1982).

Distribution. Townsend's big-eared bats occur throughout western North America from southwestern Canada to central Mexico and in isolated populations as far east as West Virginia. According to a revision of geographic ranges of subspecies by Piaggio and Perkins (2005), the subspecies in the western U.S. is considered *C.t. townsendii*. These bats are present in Idaho, southern and western Montana, and are year-round residents in isolated locations throughout Wyoming, though populations are concentrated in the southeastern and north central portions of the state (Adams 2003; Hester and Grenier 2005; Priday and Luce 1999). Populations are small and localized due to restrictive roost requirements, particularly for maternity colonies (Adams 2003; Hester and Grenier 2005). Several maternity colonies have been documented near Bighorn Canyon NRA (Hendricks et al. 2004; Worthington 1991) and smaller maternity colonies likely occur in Bighorn Canyon and the surrounding BLM and Crow Indian Reservation land, as the geology of the area is ideal for the formation of suitable roost caves. An isolated, but regularly breeding population of Townsend's big-eared bats has been present in the Mammoth Hot Springs area of Yellowstone NP. The thermal cave known as Devil's Kitchen is the only documented maternity colony in the park, but other features in the area have similar potential. The cooler caves of the upper terraces are likely the summer home of bachelor males. Bachelor males have also been documented in two abandoned buildings at White Grass Ranch in Grand Teton NP, but no females have been observed. A Bar B-C Ranch building is used as a day roost (Keinath 2005b).

Habitat. Townsend's big-eared bats are found at



elevations of 3,675–8,300 feet (1,120–2,530 m) in Wyoming (Clark and Stromberg 1987; Hester and Grenier 2005; Keinath 2005b). Although they are present in many habitats, their distribution is limited by the availability of caves or abandoned mines, which they require for all roosting. Each life stage has different microclimate needs (temperature is the most critical factor), so populations require multiple roosting sites. Maternity roosts are usually along the walls just inside the entrance of spacious caves or abandoned mines or in relatively warm ceiling pockets. The roost must be consistently warm throughout the breeding season, but is generally cooler than temperatures required by other species. Dimensions, light quality, and airflow are other roosting site selection factors. Townsend's big-eared bats will occasionally roost in other cavern-like structures, including buildings or large tree cavities (Hester and Grenier 2005; Keinath 2005b; Kunz and Martin 1982).

Males and non-reproductive females use a wider variety of roosts than maternity colonies during the summer. Sites include caves, buildings, bridges, abandoned mines, and tree cavities. Night roosts are primarily used for rest after feeding and usually occur in more open settings with large entrances and deep passages. Small night-roosting groups form in open buildings, rock shelters, and culverts. The species refer hibernacula with stable temperatures preferably below 50°F (10°C), moderate airflow, high humidity, and multiple north-facing entrances, but does not migrate long distances. In Wyoming and other parts of the west, hibernacula may contain single bats or groups of several dozen individuals (Priday and Luce 1999). Year-to-year roost fidelity is high, though some bats may use multiple roosts during the year in search of optimal temperatures (Hester and Grenier 2005; Keinath 2005b; Kunz and Martin 1982).

Foraging. Townsend's big-eared bat is a slow but agile flier, specializing in moths it captures in flight. The species emerges about 45 minutes after sunset to forage primarily on moths averaging 0.2 inches (6 mm) long. Townsend's big-eared bat may also opportunistically consume lacewings, beetles, flies, and wasps. Foraging occurs along forest and woodland edges as well as in forests, riparian corridors, and in open areas near wooded habitat. After an initial feeding, the bats use night roosts often shared with other bat species and return to day roosts just before sunrise, possibly after a second round of feeding.

Reproduction. Mating occurs between October and February, but fertilization is delayed until spring. Females are reproductively active in their first fall; males are not. Females form maternity colonies in mid-March that range from a few dozen to several hundred individuals in caves and sometimes buildings. Males typically roost alone. Females give birth to a single pup between May and July after a 56–100 day gestation period, depending on temperatures and the amount of torpor experienced. Offspring can fly at about three weeks and are independent



Big brown bat, *Eptesicus fuscus*.

at six weeks. Maternity colonies generally break up in August. Townsend's big-eared bat is known to live up to 16 years (Adams 2003; Hester and Grenier 2005; Keinath 2005b; Kunz and Martin 1982).

Big Brown Bat (*Eptesicus fuscus*)

Physical description. The big brown bat weighs 0.5–0.7 ounces (14–21 g) and has a 13–16 inch (32–40 cm) wingspan. Its body is brown with darker dorsal fur and black, rounded ears. Wings and membranes are hairless and dark brown to black and the calcar is keeled. The tail vertebrae are mostly enclosed by the tail membrane; about 0.1 inches (3 mm) extends beyond the membrane. Ear length is less than 0.8 inches (21 mm), and forearm length is greater than 1.5 inches (40 mm) (Adams 2003; Hester and Grenier 2005; Kurta and Baker 1990).

Distribution. Big brown bats are distributed throughout most of North America, from southern Canada through Central America into South America, including several of the Caribbean islands. They are widely distributed throughout the Rocky Mountain West and are year-round residents in most of Wyoming. The big brown bat is also a common resident in Montana, where maternity colonies can be found throughout the state (Adams 2003; Hester and Grenier 2005; Worthington 1991). In arid and western North America, the big brown bat is generally limited to forested highlands, and is more abundant in deciduous than coniferous forests (Kurta and Baker 1990). Big brown bats are more abundant in Bighorn Canyon NRA than in Grand Teton or Yellowstone NPs. Possible big brown bat calls were frequently detected in Yellowstone NP and Grand Teton NP during the 2004 inventory, but they may have



been calls of other species (Keinath 2005b).

Habitat. The big brown bat occurs in a wide variety of habitats and is better adapted to human activity than are most bat species. In addition to occurring in cottonwood riparian woodlands, sagebrush steppe, juniper woodlands, conifer forests, and aspen woodlands, big brown bats also occur around man-made structures and in urban areas. Big brown bats are generalist foragers and will feed over water, meadows, pastures, and tree canopies in rural and urban environments. The species is known for their tendency to roost in buildings, but also in rock crevices, caves, abandoned mines, bridges, and tree cavities (Hester and Grenier 2005; Keinath 2005b; Kurta and Baker 1990).

Foraging. Big brown bats forage throughout the night, but most activity occurs within two hours after sunset. In Greater Yellowstone, big brown bats tend to emerge earlier than other bats and are often seen flying at, or even slightly before, sunset. The species is easily recognizable by its size and strong, direct flying style (Adams 2003; Hester and Grenier 2005; Kurta and Baker 1990). Foraging sites occur on average 0.6–1.2 miles (1–2 km) from the roost. Big brown bats feed 20–33 feet (6–10 m) above ground, primarily on beetles, but also on other flying insects including moths, ants, mosquitoes, mayflies, and crickets.

Roosting. Summer roosts are commonly in buildings, barns, bridges, and other man-made structures (Adams 2003; Hester and Grenier 2005; Kurta and Baker 1990). Night roosts are commonly used in open buildings, abandoned mines, bridges, porches, breezeways, and open garages. Big brown bats hibernate alone or in groups of less than 20 in buildings, caves, and abandoned mines. The species frequently hibernates in temperatures below freezing and is often found in cracks or crevices beneath rocks in the hibernaculum floor. Winter and summer roosts are generally less than 50 miles (80 km) apart. Females form maternity colonies (12 to several hundred bats) after fertilization occurs; males form summer colonies of a few individuals or roost alone. Females often return to the same maternity roost year after year.

Life cycle. In the Rocky Mountain West, females give birth after a 60-day gestation period to a single pup; in the Eastern U.S., twins are typical. Pups learn to fly between 3–4 weeks (Clark and Stromberg 1987). Maternity colonies break up in August and September, followed by reunions with mates and short migrations to hibernacula (Adams 2003). The species is known to live at least 19 years. Predators include hawks, owls, weasels, housecats and bullfrogs (Kurta and Baker 1990).

Physical description. The spotted bat has long, wide pink ears and three prominent white spots, one on each shoulder and one on the rump. Its dorsal fur is black and ventral hair is white. It weighs 0.6–0.7 ounces (16–20 g) and has a 12–15 inch (30–38 cm) wingspan (Adams 2003).

Distribution. The spotted bat occurs in North American between southern British Columbia and southern Mexico,

primarily in rough, rocky semiarid desert regions. Despite widespread distribution, the species is not common and usually occurs in low numbers due to its restrictive roosting requirements and forage specialization of high-flying moths. The spotted bat's ability to concentrate urine suggest it may have evolved in an arid environment (Adams 2003; Hester and Grenier 2005). Distribution in Wyoming is relatively unknown, though it may occur in isolated patches throughout the state in suitable habitat (Hester and Grenier 2005). Bighorn Canyon NRA and Tensleep Canyon to the south, may be the most important locations in Wyoming for the spotted bat (Keinath 2005b). Neither Grand Teton and Yellowstone national parks has suitable habitat for the species (Keinath 2005b).

Habitat. The spotted bat uses a variety of habitats from desert shrub to coniferous forests but is most often observed in low deserts, basins, and juniper woodlands, and is usually associated with rocky cliffs, canyons, and prominent rock features near permanent water sources. Day roosts are in rock crevices of high cliffs. The spotted bat may occasionally roost in buildings, caves, or abandoned mines, but reproductive females have only been documented in cliff roosts. The species probably hibernates alone or in small clusters through most of the winter, although populations in the northern end of its range may migrate to more suitable hibernacula (Adams 2003; Clark and Stromberg 1987; Hester and Grenier 2005; Keinath 2005b).

Foraging. The spotted bat emerges about an hour after dark to forage, returning to its day roost just before sunrise. The bat typically forages while in a continuous circular or elliptical flight pattern 33–50 feet (10–15 m) above ground, and at or above treetops. The bat appears to use the same foraging areas nightly, even reaching travel points at routine times. Spotted bats primarily eat moths 0.2–0.4 inches long (5–11 mm), but probably also eat other insects. Moths with abdominal ears are unable to hear the low-frequency calls of the spotted bat, which are audible to the human ear. Spotted bats usually forage alone and may defend their foraging territory from other spotted bats (Adams 2003; Hester and Grenier 2005).

Silver-Haired Bat (*Lasionictus noctivagans*)

Physical description. The silver-haired bat is a dark brown to black bat with silver-white tipped fur; its ventral fur is paler. The silver-white tips may be absent on older bats or appear yellowish. The species weighs 0.3–0.4 ounces (8–11 g) and has an 11–13 inch (27–33 cm) wingspan. Its ears are short, rounded, and hairless; its wings are black and hairless. The tail membrane is furred dorsally to the tip (Adams 2003; Hester and Grenier 2005; Kunz 1982).

Distribution. The silver-haired bat occurs throughout most of North America from southeastern Alaska to and northeastern Mexico, across southern Canada and most of





Silver-haired bat, *Lasionycteris noctivagans*.

the U.S. from New Mexico to Georgia. It winters mostly in the southern third of the continent, but also in areas of relatively mild coastal climate as far north as Alaska and New York (Adams 2003). The bat is probably most abundant throughout Idaho, Montana, and Wyoming during the summer months (Hester and Grenier 2005). Silver-haired bats are found throughout Greater Yellowstone, and are fairly common in Yellowstone NP, but appear to occur more regularly in Grand Teton NP. The only evidence of it in Bighorn Canyon NRA are a few questionable bat calls (Hester and Grenier 2005; Keinath 2005b).

Habitat. The silver-haired bat is most commonly associated with montane forests near lakes, ponds, and other open bodies of water where it forages. Since they usually roost in dead trees, they are often found in stands of late-successional forest. The silver-haired bat generally roosts alone in trees, though it may form small colonies, including small maternity colonies, in the summer. Day roosts are generally on the south side of a tree under loose bark or in cracks or crevices. Silver-haired bats have also been documented in woodpecker holes, bird nests, and man-made structures including open sheds, garages, and outbuildings. The bats reuse roosts from year to year and often use multiple roosts in a limited area during the summer.

Roosting. Small colonies of reproductive females normally roost in cavities of trees and snags. Maternity roost trees are generally large in diameter, taller than surrounding trees, and surrounded by sparse and short understory vegetation. Males and non-reproductive females generally roost alone. The silver-haired bat migrates through grassland, lower elevation, and more xeric habitats where roost trees are often more scarce, so it is less selective of roosts during migration. During migration it can be found roosting alone in narrow tree trunk crevices and has been found in buildings, caves, woodpiles, railroad ties, and fence posts. Hibernacula are typically in trees, mines, caves, rock crevices, and buildings (Adams 2003; Hester and Grenier 2005; Keinath 2005b; Kunz 1982).

Foraging. In Greater Yellowstone, the silver-haired bat emerges to forage 2–4 hours after sunset, which is later than in other parts of the country. A relatively slow but agile flier, the silver-haired bat forages close to the ground

(<8 feet [2.4 m]), but occasionally as high as 40 feet (12 m), typically over ponds and in open forest near bodies of still water. It generally forages for a few hours, then rests and forages again 6–8 hours after sunset. This allows the silver-haired bat to be foraging when other bat species are not. Silver-haired bats feed opportunistically on swarming insects, moths, flies, leaf hoppers, midges, flying ants, mosquitoes, termites, beetles and other flying insects. Its diet may change with seasons and habitat types (Adams 2003; Hester and Grenier 2005; Keinath 2005b; Kunz 1982). The silver-haired bat probably begins to migrate to warmer climates in August. Bats have been observed migrating in small groups and probably return to Wyoming in March or April (Adams 2003; Keinath 2005b; Kunz 1982).

Reproduction. Both males and females are likely reproductive during their first summer. Reproductive females form small maternity colonies in the summer in hollow trees and reuse the roosts each year. Gestation typically requires 50–60 days and females give birth to two pups between June and mid-July (Adams 2003; Hester and Grenier 2005). Pups grow rapidly and are independent at 3–4 weeks (Clark and Stromberg 1987).

Hoary Bat (*Lasiurus cinereus*)

Physical description. The hoary bat is the largest of the bat species described here, weighing 0.9–1.1 ounces (25–30 g) with a 13–16 inch (33–40 cm) wingspan. It is heavily furred, dark brown or black to gray and has white tips on the hair, which give it a frosted appearance. The bat also has a distinctive yellow throat patch and white wrist and shoulder patches. Its ears are short and rounded, with black, furry edges, and the dorsal interfemoral membrane is heavily furred. The calcar is twice as long as the hind foot and narrowly keeled (Adams 2003; Hester and Grenier 2005; Shump and Shump 1982).

Distribution. Although it occurs in relatively low densities, the hoary bat is the most widespread bat species in North and South America, occurring from near the tree limit in Canada south to Argentina and Chile. Hoary bats have been documented in Hawaii and the Galapagos Islands, and there are records of migrants in Iceland and Bermuda. The hoary bat subspecies *L. c. cinereus* is widely distributed in the northern Rocky Mountains, but it is uncommon, most abundant in Grand Teton NP where the most suitable habitat is available. The species is present, but less common in Bighorn Canyon NRA and Yellowstone NP (Hester and Grenier 2005; Keinath 2005b). Hoary bats are active year-round and spend winters in southern California, the southeastern US, and probably most of Mexico (Shump and Shump 1982).

Habitat. Although hoary bats are known to roost in urban parks, their roosting sites are generally solitary on forest edges 10–16 feet (3–5 m) above ground at the end of deciduous and coniferous tree branches. Females with pups



Hoary bat, *Lasiurus cinereus*.

may roost higher than other adults (Hester and Grenier 2005; Keinath 2005b; Shump and Shump 1982).

Foraging. The hoary bat emerges 2–5 hours after sunset to forage primarily on moths, but also on beetles, flies, grasshoppers, termites, dragonflies, wasps, and other large insects. Species abundance appears to be related to the availability of these food sources even though hoary bats are opportunistic and their diet varies based on season and geography. Foraging occurs in open areas associated with forested habitat and along roads, forest, and open water edges. The species is known to forage near lights in urban and rural areas. Hoary bats are fast and less agile than smaller bats, so they pursue prey over relatively long distances (Keinath 2005b; Hester and Grenier 2005; Shump and Shump 1982). Females may migrate with their young and/or with male hoary bats, sometimes in large groups (Clark and Stromberg 1987; Shump and Shump 1982). (Clark and Stromberg 1987).

Reproduction. Males and females generally remain apart except during mating, which may occur in late summer, fall, or possibly winter, and may be associated with fall migration. Fertilization is delayed until spring. Gestation lasts approximately 90 days and females give birth sometime between mid-May and early July to 1–4 pups; the average is two. Pups are able to fly in about 33 days. Some females with pups will move between nearby roosts

(Keinath 2005b; Hester and Grenier 2005; Shump and Shump 1982).

Status. Hoary bats are widely distributed in Wyoming, but are listed as a species of potential concern (S4) for their low range occupation, low abundance, uncertain abundance trends, moderate biological vulnerability, and moderate external threats (Keinath et al. 2003). Hoary bats are also listed as species of special concern (NSS3) in Wyoming by the WGFD because of significant habitat loss. Population status and trends are unknown, though they are suspected to be stable. The species is sensitive to human disturbance (WGFD 2003). Hoary bats are a potential species of concern (S3S4) in Montana because limited data shows potential vulnerability (MNHP and MFWP 2007).

California Myotis (*Myotis californicus*)

Physical description. The is a very small pale to dark chestnut bat, weighing 0.1–0.2 ounces (3–5 g) with a 9–10 inch (23–26 cm) wingspan. Its nearly black ears and membrane contrast with a lighter body color, which is darker at the base of hairs than at the tips. The California myotis generally has slender features and small, weak hind feet. Although difficult to distinguish from the western small-footed myotis, which is present in Bighorn Canyon NRA and possibly in Grand Teton NP (Adams 2003; Hester and Grenier 2005; Keinath 2005b; Simpson 1993), it can be distinguished from other myotis species by its slender, prominently keeled calcar, steeply sloped forehead, and tail enclosed by membrane.

Distribution. The California myotis ranges from southern Alaska through western Canada and the Pacific Coast and south through most of Mexico (Simpson 1993). The species is common throughout its range and occurs in most of Idaho, western Montana, and portions of southwestern Wyoming. Wyoming, which is on the eastern edge of the species northern range, has no winter records of California myotis (Hester and Grenier 2005). Of the four subspecies, *M. c. californicus* has been reported in Greater Yellowstone (Adams 2003). The GRYN inventory captured a bat that may have been *M. c. californicus* in Bighorn Canyon NRA and recorded a possible call in Yellowstone NP (Keinath 2005b).

Habitat. The California myotis occurs in a variety of habitats, most commonly in arid regions such as deserts, grasslands, juniper woodlands, arid interior basins, but also forests and mountain regions. During the summer, the species roosts alone or in groups in rock crevices and cliffs, rock-walled canyons, hollow trees under loose barks and in crevices, and buildings near foraging habitat and water sources. The species will also roost in small desert shrubs and on the ground. California myotis prefer roosts in tall, large diameter trees in intermediate stages of decay in relatively open areas. Summer night roosts include open structures, desert shrubs, and trees. Hibernacula are in caves, mines, and buildings (Clark and Stromberg 1987;



Hester and Grenier 2005; Keinath 2005b; Simpson 1993).

Foraging. The California myotis emerges shortly after sunset to forage in tree canopies such as cottonwood and willow and high above the ground in open areas. The bat is a slow, erratic flier, but can fly close to surfaces in pursuit of prey. Foraging generally occurs <10 feet (3 m) above the ground on swarms of small flying insects, including flies, moths, beetles, and caddis flies (Hester and Grenier 2005; Keinath 2005b; Simpson 1993). California myotis roost alone or in small groups during the winter and may hibernate at high elevations and latitudes, but little is known about their winter activity.

Reproduction. Reproductive females form maternity colonies in narrow crevices during the summer; males and non-reproductive females generally roost alone. Females give birth to a single pup in May or June which is able to fly within about a month. California myotis are potentially reproductive for 15 years. The species shows little fidelity to maternity or other roosts. (Clark and Stromberg 1987; Hester and Grenier 2005; Simpson 1993).

Western Small-footed Myotis (*Myotis ciliolabrum*)

Physical description. The Western small-footed myotis was once considered a subspecies of the eastern small-footed myotis (*M. leibii*) (Hester and Grenier 2005). It can also be difficult to distinguish from the California myotis. It weighs 0.1–0.2 ounces (4–6 g) and has an 8–10 inch (20–25 cm) wingspan. Its membranes are black, contrasting with the light brown to yellow-brown dorsal fur and slightly lighter ventral hair. Its black or dark brown long ears reach or exceed the tip of its nose when laid forward. It has a broad, flat skull and its dark ears and facial coloring give it the appearance of wearing a mask that contrasts with its generally light fur. The species can also be distinguished by relatively small hind feet, distinctly keeled calcar, and a tail that extends beyond the

uropatagium membrane by 0.2 inches (4 mm).

Distribution. The western small-footed myotis is widely distributed, though not abundant across western North America from southwestern Canada through the western U.S. to central Mexico and as far east as northeastern Nebraska. The two recognized subspecies of *M. ciliolabrum* have geographically adjacent ranges: *M. c. ciliolabrum* is found in Wyoming and Montana, while *M. c. melanorhinus* is generally found further west and south (Holloway and Barclay 2001). The species appears to be relatively common throughout most of Wyoming between 3,000 and 8,000 feet (915 and 2,500 m), including some areas of the Yellowtail Wildlife Habitat Management Area, but not in other areas covered by the GRYN inventory. It was documented in Bighorn Canyon NRA cottonwood forest and a few possible small-footed myotis calls were recorded in Grand Teton NP, but neither Grand Teton nor Yellowstone NP has suitable habitat and it is unlikely that either supports a viable population (Hester and Grenier 2005; Keinath 2005b).

Habitat. The western small-footed myotis is common in low to mid-elevations in arid desert, badland, and semiarid areas. The species also occurs in a variety of other habitats including forest, juniper woodlands, sagebrush steppe, and shortgrass prairie. It forages along the edges of rocky bluffs and slopes in dry areas and prefers rocky areas including canyons, cliffs and bluffs, outcrops, and badlands. The western small-footed myotis is found in higher elevations and more mesic habitats in the southern portion of its range (Hester and Grenier 2005; Keinath 2005b).

Roosting. During the summer, the species typically roosts in rock shelters such as crevices, cliffs, overhangs, and under rocks. It is also known to roost in buildings, tunnels, abandoned swallow nests, under loose tree bark, and in holes in the ground. Night roosts include caves, abandoned mines, rock overhangs, bridges, and buildings. Maternity roosts are typically small, dry, shallow, and maintain a relatively stable, high temperature. Western small-footed myotis hibernates in small numbers or alone in rock crevices, in the ceilings of abandoned mines, and caves with stable temperatures. The species has been documented in abandoned mines year-round in Wyoming (Hester and Grenier 2005; Keinath 2005b). Western small-footed myotis generally hibernates alone or in groups of three or four in larger crevices. The species has been documented hibernating with Townsend's big-eared bat and big brown bat. Western small-footed myotis emerges from hibernation as early as March. (Hester and Grenier 2005; Keinath 2005b).

Foraging. Western small-footed myotis begins to forage shortly after sunset for soft-bodied, flying insects, although peak feeding activity may not occur until later. Foraging typically occurs along cliffs and rocky slopes and along forest edges. Western small-footed myotis is a slow, but maneuverable flier that forages in irregular circles from 3



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Western small-footed myotis, *Myotis ciliolabrum*.

feet (1 m) above ground to tree-top level. The species will forage 10–16 feet (3–5 m) over water, but can be displaced by California myotis, which usually hunt over and near water (Hester and Grenier 2005; Keinath 2005b).

Reproduction. Females may roost alone or form maternity colonies with up to about 30 bats. No maternity colonies have been confirmed in Wyoming. Males usually roost alone. Females generally give birth in July to a single pup, though twins have occurred. Pups are able to fly independently at about three weeks (Hester and Grenier 2005).

Long-eared Myotis (*Myotis evotis*)

Physical description. The long-eared myotis weighs 0.2–0.3 ounces (5–8 g) and has a 10–12 inch (25–30 cm) wingspan. Its ears are longer on average than those of other North American myotis and extend beyond the tip of the nose when laid forward. The ears, wings, and interfemoral membrane are blackish and contrast with the medium to light brown body fur, which is paler ventrally. The species can be distinguished from the fringed myotis because it lacks a conspicuous fringe of hairs on the interfemoral membrane. The long-eared myotis has larger, darker ears than the northern myotis when present in the same area (Adams 2003; Hester and Grenier 2005; Manning and Jones 1989).

Distribution. The long-eared myotis ranges throughout much of western North America from central British Columbia and southern Alberta through the Pacific Coast and Rocky Mountains to Baja California, northeastern Arizona, and northwestern New Mexico, as far east as western North Dakota (Manning and Jones 1989). The subspecies *M. e. evotis* occurs in the Rocky Mountain region and throughout Idaho, Montana, and Wyoming in suitable habitat. It is found in Wyoming at elevations from 5,000–9,800 feet (1,525–2,990 m) but is relatively uncommon compared to other bat species (Hester and Grenier 2005). The species occurs in low numbers throughout the GRYN park units (Keinath 2005b; Worthington 1991). Little is known about migration and hibernacula, though distances between summer roosts and winter hibernacula are probably short (Hester and Grenier 2005; Manning and Jones 1989).

Habitat. The long-eared myotis seems to be most abundant in forested areas near water and rocky outcrops or cliffs. When suitable roosts are available, the species may occur in semiarid shrublands, sagebrush grasslands, cottonwood riparian areas, basins, and agricultural areas. Summer daytime roosts are primarily snags and stumps of large-diameter trees in western coniferous forests. Other roosting sites include abandoned buildings, hollow trees under loose bark, rock crevices, caves, and abandoned mines. Little is known about the hibernation of long-eared myotis, but it probably occurs primarily in caves and abandoned mines (Hester and Grenier 2005; Keinath

2005b; Manning and Jones 1989).

Foraging. The long-eared myotis emerges at dusk, but forages at variable times throughout the night in forest habitat and over rivers, streams, ponds, and other open areas. A slow but maneuverable flier, the long-eared myotis uses echolocation and passive listening to catch flying insects near vegetation and over water and glean prey from the surfaces of vegetation, rocks, and the ground. Its diet is primarily moths, but it also feeds on small beetles, flies, lacewings, wasps, true bugs, and leaf hoppers. The long-eared myotis often gather in night roosts after feeding near their day roosts (Hester and Grenier 2005; Keinath 2005b; Manning and Jones 1989).

Reproduction. Females give birth to a single pup in June or July after a 60-day gestation period. The species generally forms small colonies, though males and non-reproductive females may roost alone nearby. Few maternity roosts have been documented in Wyoming (Hester and Grenier 2005; Keinath 2005b; Manning and Jones 1989).

Little Brown Bat (*Myotis lucifugus*)

Physical description. The little brown bat is easily confused with other myotis. It weighs 0.3–0.5 ounces (4–14 g) with a wingspan of 9–11 inches (23–28 cm). It has glossy fur that varies from grayish-brown to pale brown, and the underside of the wing has less fur. Its ears, wings, and interfemoral membrane are dark brown. Its ears do not extend beyond the nose when laid forward. The calcar is not keeled and hair extends beyond the toes on the hind feet (Adams 2003; Hester and Grenier 2005).

Distribution. The little brown bat occurs throughout most of forested North America, from Alaska east through most of central and southern Canada and through central Mexico. *M. l. carissima* is the subspecies that occurs in Greater Yellowstone. The species is a common year-round resident throughout Wyoming and occurs in almost all elevations below alpine zones (Hester and Grenier 2005). The little brown bat is probably the most common bat in Greater Yellowstone and occurred at a relatively high



Little brown bat, *Myotis lucifugus*.

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abundance at most survey sites in the 2004 inventory. Large roosting colonies occur in many buildings in Grand Teton NP and Yellowstone NP and in a few buildings in Bighorn Canyon NRA (Bogan and Geluso 1999; Keinath 2005b). Little brown bats may migrate hundreds of miles to hibernacula, though the species hibernates throughout its range and most migrations are shorter (Adams 2003; Hester and Grenier 2005).

Habitat. Little brown bats are common where suitable roosts are present, particularly conifer forest, streamside riparian areas, wooded areas, windbreaks, and urban areas, but do not occur as frequently in hot, arid, low areas. Though widespread in range, local distribution and abundance may be related to water and roost availability. The species generally occurs near open water, but uses a wide variety of natural and man-made roosts including buildings, tree cavities and loose bark, bridges, rock crevices, caves, and abandoned mines. Temperature and shelter appear to be important selection factors for roosts, especially maternity roosts, which are usually in very warm sites; males and non-reproductive females usually select cooler sites. Summer roosts usually have southern exposures. Man-made structures appear to be important to the viability of Greater Yellowstone populations. Night roosts are often in different locations of the same buildings that are used for day roosts. Most roosts are in confined spaces where a large number of bats congregate, which increases roost temperatures. Hibernacula are usually caves or abandoned mines with high humidity and temperatures above freezing. Night roosts, maternity roosts, and hibernacula often contain colonies of hundreds to thousands of bats; a night roost of 500 individuals and maternity roost of 1,500 individuals has been documented in Wyoming. Little brown bats return to physically stable roost sites year after year (Hester and Grenier 2005; Keinath 2005b).

Foraging. Little brown bats emerge at dusk to forage, usually over water but also in open woodlands and forest openings. The species is slow but maneuvers easily and forages within 3–7 feet (1–2 m) of water and vegetation and 7–16 feet (2–5 m) above ground. Diet is mainly small, soft-bodied insects including water boatmen, caddis flies, mayflies, midges, moths, flies, and mosquitoes. Since the little brown bat eats a wide range of food, it is probably more limited by roost availability than food sources. The bats rest in night roosts after feeding (Adams 2003; Clark and Stromberg 1987; Hester and Grenier 2005; Keinath 2005b).

Life cycle. Females give birth to a single pup between late May and mid-June after a gestation period of 50–60 days. Pups are able to fly and independent at three weeks of age. The little brown bat is known to live at least 34 years (Davis and Hitchcock 1965). Predators include carnivores, birds, mice, and snakes (Fenton and Barclay 1980).

Fringed Myotis (*Myotis thysanodes*)

Physical description. The fringed myotis weighs 0.2–0.3 ounces (5–7 g) and has a wingspan of 11–13 inches (28–33 cm). The fringed myotis is distinguishable from other long-eared bats by a conspicuous fringe of stiff hairs that extends 0.04–0.08 inches (1–2 mm) beyond the trailing edge of the tail membrane. The species is similar to the long-eared myotis, but is slightly larger and has slightly smaller ears in relation to its body size. Fur color varies from yellow-brown to dark olive-brown with little difference between dorsal and ventral surfaces. Fur color varies geographically and can be darker in northern populations (Adams 2003; Hester and Grenier 2005; Keinath 2005bb; O’Farrell and Studier 1980).

Distribution. The fringed myotis is found from southern British Columbia through southern Mexico and from the Pacific Coast to the Rocky Mountains. The subspecies that occurs in Greater Yellowstone, *M. t. thysanodes*, is the most widespread. Though relatively rare, the species can be locally abundant and probably occurs in suitable habitat throughout much of Wyoming (Hester and Grenier 2005; Keinath 2005b). Fringed myotis has been documented in all three GRYN park units of the GRYN, but in low numbers in Grand Teton and Yellowstone NPs (Keinath 2005b). Fringed myotis likely migrates short distances to hibernacula in lower elevations or more southern areas.

Habitat. Fringed myotis are found at elevations from 3,900–6,900 feet (1,200–2,100 m), most commonly in dry woodland habitats where open areas are mixed with mature forest. The species may also be present in xeric shrublands and forests, deserts, and grasslands if suitable roosting substrate is available. (Hester and Grenier 2005; Keinath 2005b, 2004b; O’Farrell and Studier 1980). During summer, day roosts are usually in crevices of cliffs or the cavities and loose bark of large, middle-aged snags in mature conifer forest, but also include caves, abandoned mines, buildings and bridges. Night roosts and hibernacula are in similar locations. Maternity roosts are typically warm. Fringed myotis may hibernate in small to large groups. Males and non-reproductive females may roost separately and at higher elevations. Individuals will periodically change sites within cave and building roosts and appear to return to physically stable roosts (Hester and Grenier 2005; Keinath 2005b, 2004b; O’Farrell and Studier 1980).

Foraging. The fringed myotis emerges at sunset to forage, though peak activity occurs between two and four hours later. The fringed myotis is a slow, but maneuverable flier and is able to catch prey in flight and glean it from vegetation. The species probably forages in interior forest or along forest edges. Diet consists primarily of beetles and moths, though it may opportunistically consume flies, lacewings, crickets, spiders, and other insects. Fringed myotis uses night roosts after feeding (Hester and Grenier



2005; Keinath 2005b, 2004b; O'Farrell and Studier 1980). Fringed myotis typically forages among vegetation near water and along forest edges or in forests or woodlands

Reproduction. After a gestation period of 50–60 days, females give birth from late June to early July to a single pup. Pups are able to fly 16–21 days after birth. (Hester and Grenier 2005; Keinath 2005b, 2004b; O'Farrell and Studier 1980).

Long-legged Myotis (*Myotis volans*)

Physical description. The long-legged myotis weighs 0.2–0.3 ounces (6–9 g) and has a 10–12 inch (25–30 cm) wingspan. Its fur is medium to dark brown and its ears, wings, interfemoral membrane are black. The species can be distinguished by the long, dense fur on the underwing that extends from the body to a line joining the elbow and the knee, short rounded ears that barely reach the nostril when laid forward, a keeled calcar, and small hindfeet (Adams 2003; Hester and Grenier 2005; Warner and Czaplewski 1984).

Distribution. Long-legged myotis occur throughout western North America from southern Alaska through western Canada as far east as the Rocky Mountains and south to Baja California and central Mexico. The subspecies *M. v. interior* is found in Greater Yellowstone (Adams 2003; Warner and Czaplewski 1984). The species occurs throughout Wyoming in suitable habitat during the summer, but little is known about its winter range (Hester and Grenier 2005). The 2004 inventory estimated the long-legged myotis to be common in Grand Teton NP, locally common in Yellowstone NP, and somewhat common in Bighorn Canyon NRA (Keinath 2005b). Little is known about the migration of long-legged myotis, but it probably migrates short distances to hibernacula (Adams 2003; Hester and Grenier 2005; Warner and Czaplewski 1984).

Habitat. The long-legged myotis occurs primarily at elevations of 5,000–11,000 feet (1,500–3,300 m) in Wyoming, but can be found at lower elevations during cooler weather. All three park units in the GRYN have suitable habitat (Adams 2003; Hester and Grenier 2005; Keinath 2005b; Warner and Czaplewski 1984). During the summer, the long-legged myotis roosts in tall, large-diameter snags with loose bark, rock crevices, caves, buildings, and abandoned mines near open forest areas and long-term water sources. Maternity roosts are in similar locations, but are not known in caves or abandoned mines (Priday and Luce 1999). Hibernacula are not known in Wyoming, though the species has been documented hibernating in caves and abandoned mines elsewhere (Adams 2003; Hester and Grenier 2005; Keinath 2005b; Warner and Czaplewski 1984).

Foraging. The long-legged myotis emerges shortly after sunset to begin foraging and is active throughout the night, with peak activity occurring 3–4 hours after sunset. The species forages over open areas and riparian vegetation,

and through, above, and under the forest canopy. Long-legged myotis are fast, direct fliers that can pursue prey over relatively long distances. Their diet consists primarily of moths, but also includes soft-bodied insects such as flies, termites, lacewings, true bugs, wasps, leafhoppers, and small beetles. Night roosts are used after feeding (Adams 2003; Hester and Grenier 2005; Keinath 2005b; Warner and Czaplewski 1984).

Mating occurs as early as August but fertilization is delayed until spring. After a 50–60 day gestation period, females give birth to a single pup in June or July. The species is known to live to 21 years (Warner and Czaplewski 1984).

Yuma Myotis (*Myotis yumanensis*)

Physical description. The Yuma myotis weighs 0.1–0.2 ounces (4–6 g) and has a 9–10 inch (23–25 cm) wingspan. It is pale to medium brown with light brown ears and wings; Arizona and Mexican populations are darker. The interfemoral membrane has light fur to the knee. The Yuma myotis can be differentiated from other myotis species by its dull fur, relatively steep forehead, and pale ears and wings, and from the little brown bat by its echolocation call (Adams 2003; Hester and Grenier 2005).

Distribution. The Yuma myotis is present in western North American from southern British Columbia along the Pacific Coast, sporadically through the Rocky Mountains, and south into central Mexico. The subspecies *M. y. yumanensis* occurs in the Rocky Mountain region. The species can be locally abundant in large colonies but may be absent from apparently suitable habitat. It is possible that occurrences of Yuma myotis in Greater Yellowstone are isolated from the main range of the species, which is to the north and south of Wyoming and west in Idaho (Adams 2003; Clark and Stromberg 1987; Hester and Grenier 2005). The most suitable habitat for the species in the GRYN survey was found in Bighorn Canyon NRA, where Yuma myotis appeared uncommonly but regularly. A maternity roost was documented in Yellowtail Wildlife Habitat Management Area. Its presence is uncertain in Grand Teton NP and low, possibly localized or accidental, in Yellowstone NP. Prior to the 2004 inventory, the species had only been documented once in Wyoming, in the southwestern part of the state (Keinath 2005b; Priday and Luce 1999). The Yuma myotis probably hibernates in caves and abandoned mines, though little is known of its winter habits.

Habitat. The Yuma myotis occurs at low to mid-elevations in deserts, woodlands, grasslands, sagebrush steppe, and riparian areas. The species generally occurs near long-term water sources and often treeless areas where it forages. Summer day roosts are usually close to open water in buildings, trees, caves, abandoned mines, bridges, or cliff crevices. Maternity roosts occur in buildings, caves, abandoned mines, bridges, and occasionally in abandoned



cliff-swallow nests. Night roosts have been documented in buildings, bridges, and other man-made structures. (Adams 2003; Hester and Grenier 2005; Keinath 2005b).

Foraging. The Yuma myotis emerges in darkness when prey is abundant to forage primarily over open bodies of water and in open habitats. The species feeds a few centimeters above the water and can forage close to other surfaces and among vegetation. Its diet includes beetles and soft-bodied insects such as caddis flies, termites, moths, mayflies, moths and small beetles.

Reproduction. Starting as yearlings, females give birth from late May to July to a single pup. Maternity colonies can grow to several thousand bats even though males usually roost alone in the summer (Adams 2003; Hester and Grenier 2005; Keinath 2005b).

Status and Threats in the Greater Yellowstone Area

Status

As listed in the table below, four of the bat species discussed in this report except the California myotis have been designated “species of concern” by the states of Montana (MFWP 2007) and/or Wyoming (Keinath et al. 2003). This designation is based on standardized criteria established by NatureServe (Regan et al. 2004) that are used to rank species from S1 (at high risk of extirpation in the state because of extremely limited and/or rapidly declining numbers, range and/or habitat) to S4 (uncommon but apparently secure). The Wyoming Game and Fish Department also uses a “Native Species Status” ranking to identify conservation priorities (WGFD 2005). This designation classifies native non-game mammal species in Wyoming from NSS1 to NSS5 based on extent of habitat loss, population trend, distribution, and sensitivity to human disturbance. All of the bat species discussed in this report except the California myotis have a Wyoming Native Species Status of at least NSS4 (fig. 2).

To avoid federal agency actions that could increase the likelihood of a species becoming listed under the Endangered Species Act, some of these species have also been identified as “sensitive” in Wyoming and Montana by the Bureau of Land Management and the U.S. Forest Service.

Threats

Suitable roosts are one of the most limiting features in the environment for bats, so they are particularly threatened by the disturbance or elimination of roost structures. Availability of roost sites can determine population sizes and distributions and some species typically return to the same roosts year after year. Caves provide important

roosting sites for bats in Greater Yellowstone. Federal agencies are required by the Federal Cave Resources Protection Act of 1988 to protect significant caves and their biota on federal land from harm. Loss of old-growth forests and tall, large-diameter decaying trees may reduce roosting habitat for several species, particularly the silver-haired bat, fringed myotis, and long-legged myotis, all of which may rely on older forests and tree snags for roost trees (Hester and Grenier 2005; Kunz 1982; Keinath 2005b).

Some bats in Greater Yellowstone take advantage of man-made roosting sites including abandoned mines, historic and modern buildings, bridges, and other structures. These roosting sites can cause public safety issues related to human-bat interactions as well as expose bats to human disturbance. Bats are particularly vulnerable during hibernation when disturbances can cause them to wake up and use fat stores intended to sustain them through the winter, which can cause starvation. Abandoned mines have replaced or supplemented caves as key year-round bat habitat in many regions of the US. “Bat-friendly” gates can restrict human access while allowing open access to bats. Human disturbance of abandoned buildings in Grand Teton and Yellowstone national parks may impact populations of

	Montana	Wyoming
Little brown bat <i>Myotis lucifugus</i>	—	NSS3
Big brown bat <i>Eptesicus fuscus</i>	—	NSS3
Long-legged myotis <i>Myotis volans</i>	—	NSS2
Silver-haired bat <i>Lasionycteris noctivagans</i>	—	NSS4
Long-eared myotis <i>Myotis evotis</i>	—	NSS2
Townsend's big-eared bat <i>Corynorhinus townsendii</i>	S2	S2, NSS2
Hoary bat <i>Lasiurus cinereus</i>	—	NSS4
Fringed-tailed myotis <i>Myotis thysanodes</i>	S3	S2, NSS2
Yuma myotis <i>Myotis yumanensis</i>	—	S1
Western small-footed myotis <i>Myotis ciliolabrum</i>	—	NSS3
Pallid bat <i>Antrozous pallidus</i>	—	S1, NSS2
Spotted bat <i>Euderma maculatum</i>	S2	S3, NSS2

Figure 2. Native species status of bats in Montana and Wyoming.



Townsend's big-eared bat (Hendricks and Carlson 2001; Keinath 2005b). Protection from human disturbance can reduce declines in bat populations.

Loss of foraging habitat can include conversion of wildland to cultivated land, which bats of the *Vespertilionidae* family appear to avoid (Racey and Entwistle 2003). Use of pesticides and other environmental contaminants may also impact bat populations by direct exposure, changed food supply, and internal accumulation (Hester and Grenier 2005). Accidental impalement of bats on barbed wire fences has also been reported (Shump and Shump 1982).

Management

Research. Except for a few colonial species that roost in large, conspicuous groups, bat roosts are often difficult to find and even more difficult to reach. The nocturnal activity of bats makes them difficult to observe in the wild, except for brief glimpses as they fly through lighted areas or against a moonlit sky. And since they spend virtually all of their active hours flying and have very keen senses, they are challenging to catch (Keinath 2007).

Prior to the GRYN inventory completed in 2005 (Keinath et al. 2005b), the primary reports that included information about bats in Greater Yellowstone were a 1984 Bighorn Canyon NRA vertebrate inventory, surveys of bats using highway structures in southern Montana and Yellowstone NP (Anderson et al. 1987; Hendricks 2000; Hendricks et al. 2004; Worthington 1991), Pryor Mountain surveys in the early 1990s, and a study of bat roosts and historic structures on National Park Service lands in the Rocky Mountains (Bogan and Geluso 1999). The historic structures at White Grass Ranch in Grand Teton NP was surveyed in 2004 prior to renovations for use as the Western Center for Historic Preservations (Keinath 2005a).

Management policy. As native species in each of the GRYN units, bats receive the same protection as other wildlife on land managed by the National Park Service: human interference is avoided except when necessary to protect human health or property, or as part of an authorized research project. Bats do not have this protection while using human-made structures in the park for roosting. However, given the large number of park buildings used by bats, the age of many of the buildings, and the small size of opening needed by these bat species to gain access, it is not feasible from an expense or maintenance standpoint to exclude bats from all buildings, especially since efforts to exclude bats from one building may simply cause them to begin using another. Decisions on whether to remove or attempt to exclude bats from a building are therefore made on a case by case basis.

Rabies. Although rabies in bats is rare, as is the frequency of rabies transmission from bats to humans, the

problem has gained more attention as vaccination of dogs has nearly eliminated that source of rabies in the United States. There were only 19 human cases of indigenously acquired rabies in the United States from 2000 to 2006, but 18 of the cases were fatal and 17 were caused by bats—though four of the victims were people who had received organ transplants from someone who died from a rabid bat bite (Blanton et al. 2007). Unless they are in a state of torpor during roosting, healthy bats will usually avoid contact with people, but rabid bats may be clumsy, disoriented, and unable to fly, increasingly the likelihood of contact. Rabies is transmitted by a bite or a scratch, or by infected saliva that comes into contact with an open wound or mucous membrane. Although most of the bats found in Greater Yellowstone are so small that it is difficult for them to break the skin with a bite, bat-transmitted rabies has been diagnosed in people who were unaware that they had been bitten, possibly because they were asleep at the time.



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