

Western Bat Working Group

Species Accounts

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Leptonycteris curasoae
LESSER LONG-NOSED BAT

2005 Update by: Angela McIntire
Original Account by: Michael Herder

I. **DISTRIBUTION:** *Leptonycteris curasoae*, a member of the Family Phyllostomidae (New World leaf-nosed bats), is recorded in southern Arizona from the Agua Dulce Mountains in the west, north to Phoenix and east to southwestern New Mexico, south through Mexico to El Salvador. This species inhabits of the Sonoran desert scrub, semi-desert grasslands and lower oak woodlands in the United S. In Mexico, the lesser long-nosed bat occurs in coastal desert-scrub, thorn-scrub, thorn forest, pine-oak woodlands, and ponderosa pine habitat (Figure 1).

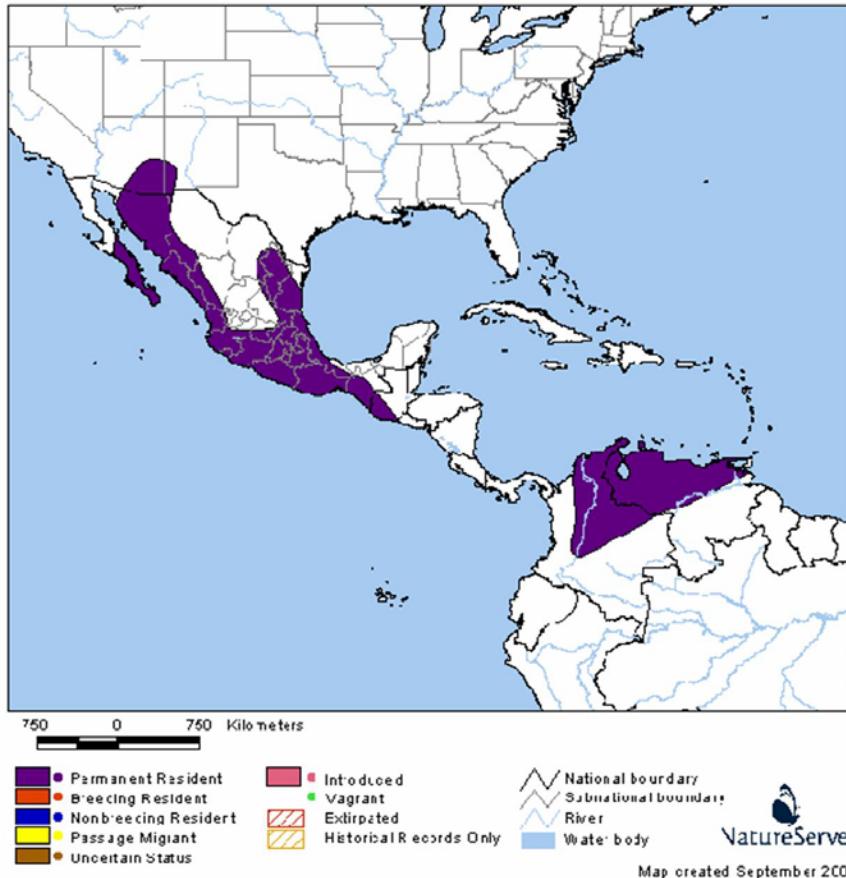


Figure 1. Range map (NatureServe).

- II. STATUS: Global Rank: G4; State Ranks: AZ - S2, NM - S1; Other Ranks: IUCN - VU; Mexico - Threatened; AGFD - Wildlife of Special Concern; USFS - Sensitive; Federally listed as endangered in 1988 due to long term population declines, reports of absence from historic roosts, decline in agave pollination, and concern for death of an ecosystem. Population decline information has been questioned due to improperly timed surveys and overestimates of historic populations. A 5-year review is underway in 2005 to ensure that the endangered classification is accurate.
- III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: The lesser long-nosed bat is a medium-sized bat with relatively large eyes and a forearm of 51-56 mm. It has reddish-brown fur and an elongated snout and nose leaf, no tail, and the interfemoral membrane is reduced to a narrow band along each hind leg. This species does not hibernate, and is one of few bat species that undergo long distance migrations. They migrate south in the fall to Mexico, where they breed and spend the winter. Migration corridors are not known exactly, but data have shown use of two corridors during spring migration, one coastal and the other inland. Lesser long-nosed bats may follow the sequential blooming of agave, saguaro, ocotillo, palo verde, prickly pear and organ pipe cactus during their migrations, feeding on nectar and pollen. The tongue is long and tipped with brush-like papillae to lap up nectar. Some authors suggest pollination success of *Agave palmeri* is dependent upon this and other nectar-feeding bats. This bat roosts in caves and mine tunnels. Males form separate, smaller colonies from females. Females may arrive in southwestern Arizona as early as the second week in April and form maternity colonies from early May to late June/early July. Maternity colonies number in the hundreds to thousands and in a few places in the tens of thousands. Females give birth to one young per year, which are volant by the end of June. In Arizona, following break up of maternity colonies by the end of July, some bats move east to transient roosts at the higher elevations of southern Arizona and southwestern New Mexico. Others found at these eastern roosts beginning in mid-July might come directly from Mexico. Efforts to conserve and learn more about the life history of this species include: annual surveys of important roosts in Arizona, New Mexico, and Mexico, including simultaneous efforts; surveys for new roost locations, migration corridor studies, foraging studies, public education and information efforts, improved population census techniques, roost characteristics study, and roost protection at some sites.
- IV. THREATS: Threats to the lesser long-nosed bat includes loss of foraging habitat by fire; roost site disturbance from recreational caving, illegal immigrant/smuggler activities near maternity roosts near the Arizona-Mexico border; destruction of forage plants by development, grazing, and human exploitation of agaves for food and alcohol production; possible reduction in numbers of forage plants resulting from depressed pollination; and direct mortality by humans.

- V. SURVEY METHODS: Netting/capture effectiveness depends on habitat type. Identification: Morphologically distinct. Roost Location: Roosts in mines and caves, and is highly colonial. Identification at Roost: Easy to detect and identify in roost except in areas of overlap with *Leptonycteris nivalis*. Passive acoustic detection: Difficult to detect acoustically where range overlaps with *Choeronycteris mexicana*. Active acoustic detection: Indistinguishable in flight from *Leptonycteris nivalis* and *Choeronycteris mexicana*, except possibly at very close range (e.g. hummingbird feeders).
- VI. GAPS IN KNOWLEDGE: Continue gathering information on population size and trends; information regarding the timing of seasonal movements, migration routes used, and plant species and phenology along such routes; genetics of sub-populations; interdependence of the species with individual plant species and communities; location of important roosting areas; characteristics of ideal roosts.
- VII. SELECTED LITERATURE:

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Leptonycteris nivalis
BIG LONG-NOSED BAT

Prepared by: Michael Herder

I. DISTRIBUTION: *Leptonycteris nivalis*, a member of the Family Phyllostomidae (leaf-nosed bats), is found in the southern Trans-Pecos in Texas and the southwestern corner of New Mexico, southward through central and eastern Mexico, mostly east of the 102 meridian and south at least to Guerrero and Guatemala. High-elevation pine-oak woodlands (5,000 ft. to snow line) and at lower elevations (1860 ft.) In agave and desert-scrub woodlands.

II. STATUS: Global Rank - G3. State Ranks: NM - S1; TX - S1. Federally listed as endangered in 1988 due to long-term population declines, apparent abandonment of historic roosts, and decline in agave pollination.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: An agile flyer capable of quick maneuvering and high speed flight. Roosts colonially in caves, deep caverns, mines, culverts, hollow trees, and unused buildings. Known to share roosts with *Corynorhinus townsendii*, and may use the same roost as *Myotis thysanodes* and *M. volans*, but at different times. Breeding season in Texas reportedly April, May and June, with lactating females found in June and July and volant young in late June. Adult males segregate geographically in summer and do not occupy the northern part of the range. Produces one young per year. Feeds on nectar, pollen, insects (accidental), and probably soft succulent cactus fruits during the non-flowering season. Feeds from flowers of various agaves (*Agave scabra*, *A. chisosensis*, *A. lechguilla*, and *A. schotti*), mescal (*A. spp.*), jimson weed (*Datura stramonium*) and wax mallow (*Malvaviscus spp.*). Feeds by thrusting its snout into the flower and licking the nectar with its long tongue. Emerges with its head covered with pollen. This species is an effective pollinator of many cacti, agave, and other species on which it feeds.

IV. THREATS: Loss of foraging habitat by fire; destruction of forage plants (human exploitation of agaves for food and alcohol production); reduction in numbers of forage plants resulting from depressed pollination success caused by *Leptonycteris* population declines; roost site disturbance (recreational caving), and direct mortality by humans.

V. GAPS IN KNOWLEDGE: Information is needed on population size and trends; the timing and destination of seasonal movements; interdependence of the species with

individual plant species and communities; location of important roosting areas; characteristics of ideal roosts.

VI. SELECTED LITERATURE:

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Macrotus californicus

CALIFORNIA LEAF-NOSED BAT

Prepared by: Patricia E. Brown

I. DISTRIBUTION: *Macrotus californicus* is the most northerly representative of the Phyllostomidae (a predominantly Neotropical family). It occurs in the Lower Sonoran life zone in the deserts of California, southern Nevada, Arizona and south into Baja California and Sonora, Mexico.

II. STATUS: Global Rank - G4. State Ranks: AZ - S3S4; CA - S2S3; NV - S?; UT - SP. It is included in Arizona Game and Fish Department's Wildlife of Special Concern in Arizona, and listed as a Mammal of Special Concern in California. It is a former Category 2 (C2) candidate.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *M. californicus* can be distinguished from all other western bat species by a combination of large ears (>25 mm), grey pelage and a distinct leaflike projection from tip of the nose. Its tail extends slightly beyond the tip of the interfemoral membrane. This species neither hibernates nor migrates, and it is incapable of lowering its body temperature to become torpid. It has a relatively narrow thermal-neutral zone, with the lower critical temperature near 34°C and the upper near 37°C. No special physiological adaptations occur in *Macrotus* for desert existence, and behavioral adaptations such as foraging methods and roost selection contribute to their successful exploitation of the temperate zone desert. Although longevity in this species does not approach the 30 or more years of temperate zone vespertilionid bats, banded *Macrotus* in California have been recaptured after 14 years.

Macrotus feeds primarily on moths and immobile diurnal insects such as butterflies and katydids which it locates by vision, even at low ambient light levels. The culled, inedible remains of these prey items can be found beneath night roosts. In total darkness,

Macrotus utilizes echolocation, an energetically more costly method of sensory localization. The strategy of gleaning larger prey from the substrate as compared to aerial insectivory appears to reduce the total time and energy necessary for foraging. Radio-telemetry studies of *Macrotus* in the California desert show that the bats forage almost exclusively among desert wash vegetation within 10 km of their roost. The bats emerge from their roosts 30 or more minutes after sunset, and fly near the ground or vegetation in slow, maneuverable flight. Shallow caves and short mine prospects are used by both sexes as night roosts between foraging bouts at all seasons, except for the coldest winter months.

To remain active yearlong in the temperate deserts of California, Arizona and Southern Nevada, *Macrotus* uses warm diurnal roosts in caves, mines and buildings with temperatures that often exceed 28°C. Depending on the season, they roost singly or in groups of up to several hundred individuals, hanging separately from the ceiling, rather than clustering. Often the bats hang from one foot, using the other to scratch or groom themselves. Most diurnal winter roosts are in warm mine tunnels at least 100 meters long. At this season, the large colonies of over 1000 bats may contain both males and females, although the sexes may also roost separately. The consistent feature of the areas in the mines used by the bats is warmth and high humidity with no circulating air currents. The temperature of the mines is usually warmer than the annual mean temperature, and the mines appear to be located in geothermally-heated rock formations. Except for the approximately two hour-nightly foraging period, in winter *Macrotus* inhabits a stable warm environment.

Females congregate in large (~100-200 bats) maternity colonies in the spring and summer, utilizing different mines or areas within a mine separate from those occupied in the winter. A few males are found in these colonies, although large roosts of only males also form. Apparently, the males in the maternity colonies try to maintain separate harem groups of females. The single young is born between mid-May and early July, following a gestation of almost 9 months. This species exhibits "delayed development" following ovulation, insemination and fertilization in September. In March, with increased temperatures and insect availability, embryonic development accelerates. Since the newborn bats are poikilothermic, the maternity colony is located fairly close to the entrance, where temperatures exceed 30°C and daytime outside temperatures can reach 50°C in the summer. This allows the bats to use shallow natural rock caves that would be too cold for a winter roost. In the fall, the males attempt to attract females with a courtship display consisting of wing-flapping and vocalizations. Aggression between males occurs at this time. The mines used as "lek" sites are usually in or near a mine that had been occupied by a maternity colony.

IV. THREATS: Human entry into mine or cave roosts and closure of mines for hazard abatement and renewed mining are the primary threats to *Macrotus*. Loss of desert riparian habitat (as in the development of golf courses and housing areas in the Coachella Valley) are also responsible for population declines.

V. GAPS IN KNOWLEDGE: Identifying mines used as roosts (maternity, winter and courtship) within the range of *Macrotus*, establishing the effectiveness of different bat gate designs, and determining the distance at which exploratory drilling and blasting in renewed mining activities causes impacts to roosting bats.

VI. SELECTED LITERATURE:

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Corynorhinis townsendii
TOWNSEND'S BIG-EARED BAT

2005 Update by: Antoinette Piaggio
Original account by: Rick Sherwin

I. DISTRIBUTION: Corynorhinus townsendii occurs throughout the west and is distributed from the southern portion of British Columbia south along the Pacific coast to central Mexico and east into the Great Plains, with isolated populations occurring in the central and eastern United States (Figure 1). It has been reported in a wide variety of habitat types ranging from sea level to 3,300 meters. Habitat associations include: coniferous forests, mixed meso-phytic forests, deserts, native prairies, riparian communities, active agricultural areas, and coastal habitat types.

Corynorhinus townsendii is a member of the Family Vespertilionidae and the tribe Plecotini. Systematic relationships within C. townsendii were revised by Handley (1959), who examined morphological variation within this species. His monograph suggested that there were five subspecies within C. townsendii; C. t. pallescens, C. t. australis, C. t. townsendii, C. t. ingens, and C. t. virginianus. More recently, a molecular phylogenetic examination of the genus Corynorhinus was completed based on control region and cytochrome b gene mitochondrial DNA (mtDNA) sequences, and sequences from a nuclear intron of the PEPCK gene (Piaggio & Perkins in press). The phylogenetic analyses supported Handley's (1959) five subspecific designations within C. townsendii. However, the geographic ranges of two of these subspecies, C. t. pallescens and C. t. townsendii inferred from the phylogeny did not agree wholly with Handley and a revision of the geographical ranges of these two subspecies was suggested:

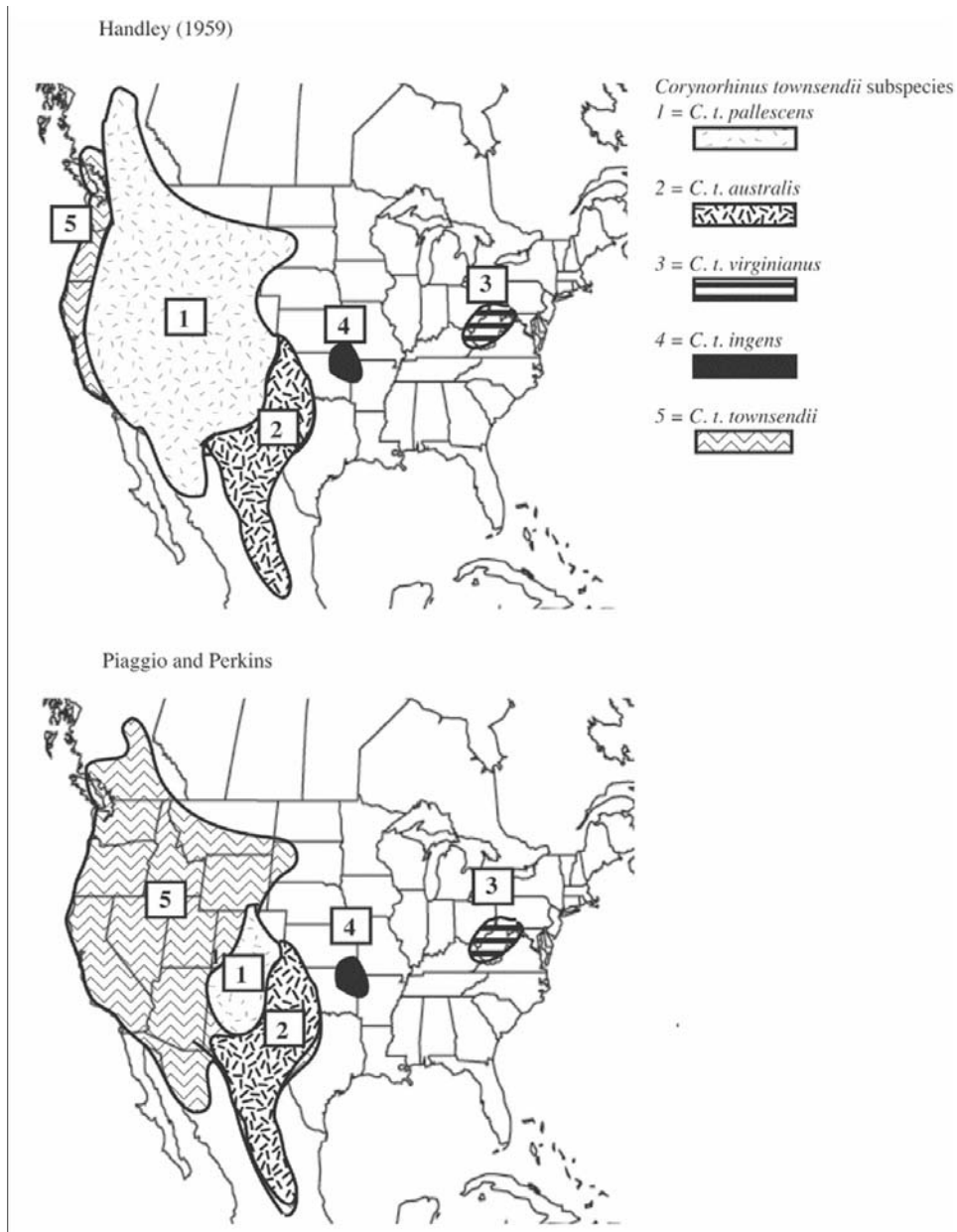


Figure 1. Approximate North American distribution of *C. townsendii* (Bat Conservation International: <http://www.batcon.org/discover/species/ctown.html>)

II. STATUS: Global Rank - G4T4 (This may need to be reviewed and revised along with state rankings). This species has been listed as vulnerable to extinction (VU) by the World Conservation Union's 2004 IUCN Red List of threatened species (www.redlist.org). Federally in the United States, the western subspecies, *C. t. townsendii* and *C. t. pallescens* were listed as former USFWS category 2 candidate for listing (USFWS 1989; USFWS 1994) under the Endangered Species Act (ESA). The two isolated subspecies in the central and eastern United States, *C. t. ingens* and *C. t. virginianus*, respectively are listed as endangered species (authorized under the ESA) and

managed as such by the USFWS (USFWS 1979). In the western United States the only current federal protection for this species is as a sensitive species by management agencies on their lands. The USFS lists this bat as a sensitive species in Region 2, Region 3, and Region 4. However, recently this sensitive species status has been removed from C. townsendii in USFS Region 6. C. townsendii is a BLM sensitive species in California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, and Wyoming. State Status Ranks are as follows: AZ - S3; CA - S3S4; CO - S2; ID - S2; KS-S2; KY-S2; MT - S2S3; ND - ?; NE - S1; NM - S3; NV - S3; OK - S3; OR - S2; SD - S2S3; TX - S4; UT - S4; WA - S2; WV - S2; WY - S2; BC - S2S3. Finally, this bat is listed as state Species of Special Concern by the following states: Arizona, California, Idaho, Montana, Oregon, Texas, and Utah.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: C. townsendii can be distinguished from all other vespertilionids by the presence of prominent, bilateral nose lumps and large “rabbit-like” ears. Distribution is strongly correlated with the availability of caves and cave-like roosting habitat, including abandoned mines. Population centers occur in areas dominated by exposed, cavity or caverniculous forming rock and/or historic mining districts. Its habit of roosting pendant-like on open surfaces makes it readily detectable, and it can be the species most readily observed, when present (commonly in low numbers) in caves and abandoned mines throughout its range. It has also been reported to utilize buildings, bridges, rock crevices and hollow trees as roost sites. Summer maternity colonies range in size from a few individuals to several hundred individuals. Maternity colonies form between March and June (based on local climactic factors), with a single pup born between May and July. Recent studies indicate that use of roost sites by C. townsendii is variable within seasons and among years, and multiple surveys may be required before use can be documented within an area. Although in some areas where roost availability is low there may be quite high roost fidelity (i.e. California Coastal regions). Males appear to remain solitary during the maternity period. Winter hibernating colonies are composed of mixed-sexed groups, which can range in size from a single individual to colonies of several hundred animals (or in some areas, particularly in the eastern U.S., several thousand). Mating generally takes place between October and February in both transitory migratory sites and hibernacula. C. townsendii is a moth specialist with over 90% of its diet composed of lepidopterans. Foraging associations include: edge habitats along streams, adjacent to and within a variety of wooded habitats. These bats often travel large distances while foraging, including movements of over 150 kilometers during a single evening (R. Sherwin pers. comm.). Evidence of large foraging distances and large home ranges has also been documented in California (E. D. Pierson pers. comm.). Seasonal movement patterns are not well understood, although there is some indication of local migration, perhaps along an altitudinal gradient and may be localized or require longer distance travel. Dispersal from natal ranges into others appears to primarily be mediated by males, while females remain philopatric.

IV. THREATS: The primary threat to C. townsendii is almost certainly related to disturbance and/or destruction of roost sites (e.g., recreational caving or mine exploration, mine reclamation, and renewed mining in historic districts). Surveys conducted in Oregon and California indicate that current and historic roost sites have

been negatively impacted by human visitation and renewed mining in recent years with most reported colonies exhibiting moderate to sizable reduction in numbers. Additional surveys in Utah indicate that several historic maternity sites have been abandoned, although it is not known if these colonies have relocated. This species is very sensitive to human disturbance events and may abandon roost sites after human visitation (Humphrey and Kunz 1976). In select sites in California and in other areas, depressed populations have recovered with the protection (i.e., gating) of roosts. In Colorado, gates have been shown to be successful at maintaining C. townsendii colonies at all types of roosts of, i.e., hibernacula, summer roosts, and maternity sites. All types of gates showed continued use by this species: ladder gates (11), full (2), culvert w/ladder (2), and culvert w/full gates (2), suggesting that big-eared bats apparently have a high degree of tolerance for flying through restricted openings. This appeared to be especially true at fall transition roosts and hibernacula. One ladder gate had continued bat use 12 years after gating. (Navo and Krabacher 2005). In large portions of its western range, dependence upon abandoned mines puts this species at risk if mine reclamation and renewed mining projects do not mitigate for roost loss, or do not conduct adequate biological surveys prior to mine closure. Further, like most other North American species of bat, the long term persistence of C. townsendii is threatened by both roosting and foraging habitat may be impacted by timber harvest practices and loss of riparian habitat. Although, there have not been any studies to confirm such impacts, pesticide spraying in forested and agricultural areas could affect the prey base (moths) of these bats. Threats to populations of these bats may also include the loss of genetic diversity and population connectivity due to reduced population sizes or available roost sites. In fact, populations of the endangered C. t. virginianus in WV, VA and KY have been identified through a population genetic examination to lack genetic diversity, lack population connectivity, and to exhibit significantly high levels of inbreeding. The only remaining genetic diversity in these populations is between populations, there is very little or no genetic diversity within colonies (Piaggio et al. in prep.). Further, population genetic investigations of colonies of C. t. townsendii in Colorado have found a colony with high levels of inbreeding, which needs to be investigated further (Piaggio et al. in prep.).

In general, the long term persistence of North American bat species is threatened by the loss of clean, open water; modification or destruction of roosting and foraging habitat; and, for hibernating species, disturbance or destruction of hibernacula. Chemicals in the environment that affect bats or their prey are also a threat. Because of low fecundity, high juvenile mortality, and long generational turnover, many bat populations may be vulnerable to human-induced pressures.

V. SURVEY METHODS: C. townsendii is quite effective at avoiding mist-nets. Morphologically these bats are similar to the Allen's Big-eared bat (Idionycteris phyllotis). Roost locations are most effectively found by searching for colonial roosts in mines and caves. However, roosts can be found in buildings in the coastal and northern portions of range. In some portions of its range, particularly Canada and some desert areas, roosts can be very difficult to locate. Because these bats hang pendulum-like they can be easy to locate and identify in a roost. These bats are difficult to detect with passive acoustic detection because they utilize low intensity calls ("whispering bat"),

however they are acoustically (passively and through recording devices) and visually distinctive in most settings.

VI. GAPS IN KNOWLEDGE: The daily and seasonal degree of movement of these bats and colonies of these bats is not settled and the dogma that these bats are sedentary, have high roost fidelity, and small home ranges may not be accurate. The identification of critical roosts and limiting factors in roost requirements is incomplete especially for hibernacula. Identification and protection of significant roost sites is still needed in most areas. Significant populations need to be monitored over time. More information is needed on foraging requirements, seasonal movement patterns, and population genetics (i.e. the degree of relatedness within and between different maternity roosts).

VII. SELECTED LITERATURE:

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Myotis velifer
CAVE MYOTIS

Prepared by: Kathy Peckham

I. DISTRIBUTION: *Myotis velifer*, a member of the Family Vespertilionidae, occurs from Kansas, Oklahoma and western Texas, to southern Nevada, and southeastern California (along the Colorado River only), south through Mexico to Honduras. At least some populations are migratory. Hibernacula have been discovered in Mexico, Arizona, and Kansas. Within the U.S. it is most widely distributed in Arizona. This species is found primarily at lower elevations (the Sonoran and Transition life zones) of the arid southwest, in areas dominated by creosote bush, palo verde, brittlebush, and cactus.

II. STATUS: Global Rank - G5. State Ranks: AZ - S3S4; CA - S1S2; CO - S?; NM - S4; NV - S?; TX - S4. Hayward (1961) claimed that *M. velifer* was very common in southern Arizona, with at least 500,000 individuals during the summer months. Current status is

not well known. The BRD Bat Population Database has about 50 observation records of colonies from 13 literature citations from peer-reviewed journals, but current status of these colonies is unknown. Very severe declines have been documented along the Colorado River in California.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *M. velifer* is a large *Myotis*, with a forearm of 37-47 mm. It can be distinguished from other large *Myotis* by the presence of a conspicuous bare patch on the back between the scapulae, and the absence of either a keel on the calcar or fringe on the interfemoral membrane. As implied by the vernacular name, caves are the main roosts for this southwestern species, although it also uses mines, and occasionally buildings and bridges. It is primarily a "crevice dweller," preferring "crevices, pockets, and holes in the ceilings of its underground retreats" (Stager 1939). This species is also known to roost in barn swallow nests. Colonies of 2,000 to more than 10,000 individuals have been reported. This bat is reported to fly less erratically and more strongly than other species of *Myotis*. It has been reported foraging over dense riparian vegetation and in drier desert washes. Dietary studies in Arizona, Kansas, and Mexico indicate that lepidopterans and coleopterans are typical prey. Known predators include rat snakes, hawks, barn owls, and raccoons. In southern Arizona this species has been found in the winter occupying wet mine tunnels above 6,000 feet, where roost temperatures are 8° to 11° C.

IV. THREATS: Potential threats include recreational caving, mine closures and subsequent roost destruction, and loss of foraging habitat in riparian zones.

V. GAPS IN KNOWLEDGE: We need information regarding status of historically identified colonies, trends in population numbers, more information on roosting and foraging requirements, basic life history information.

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Euderma maculatum
SPOTTED BAT

2005 Update by: Carol Chambers and Michael Herder
Original account by: Bob Luce

I. DISTRIBUTION: *Euderma maculatum*, a member of the Family Vespertilionidae, occurs throughout western North America, from British Columbia as far south as Jalisco, Mexico. In the United States, it is known from all the states west of and including Montana, Wyoming, Colorado, New Mexico and Texas. Although broadly distributed, this species is rarely common, but may be locally abundant in southern British Columbia, northern Arizona, Arizona/Utah border, and west Texas. Spotted bats have been found from below sea level to 2700 m elevation, occurring from arid, low desert habitats to high elevation conifer forests. Prominent rock features appear to be a necessary feature for roosting. Winter range and hibernacula are unknown for most its range, though the species has been captured year-round in the southern part of its range and is may be year-round in central Oregon with the exception of December and January.

II. STATUS: Global Rank: G4. IUCN Red List Category: LR – Lower risk. Natural Heritage State Ranks: AZ – S1S2; CA – S2S3; CO – S2; ID – S2; MT – S1; NM – S3; NV – S1S2; OR – S1; TX – S2; UT – S2S3; WA – S3; WY – S3. Canada Ranks: BC – S3S4. USFWS: No status. BLM and FS: Sensitive species in several states and regions.

III. The spotted bat has been listed as a species of concern because of limited information available, and uncertainty as to life history and population trends. States with specific ranking include: AZ – Wildlife of Special Concern Candidate; CA – Species of Special Concern; ID – Species of Concern; MT – S2; NM – Threatened; NV – Threatened; TX – State Threatened Species; UT – Wildlife Species of Concern; WA – State Monitor Species; WY – NSS2. Canada Ranks: BC – Special Concern Species.

IV. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: The spotted bat is easily identifiable because of its unique coloration: dorsal black fur with three white spots, white ventral surface, and long, pink ears (37-47 mm). Weight ranges from 13-20

g; wingspan is 34-38 cm. It is the only species in its genus. Genetically, *Euderma maculatum* is closely related to *Idionycteris phyllotis* (Allen's lappet-eared bat).

Spotted bats likely breed in late summer with females giving birth to a single pup in early summer (May or June). Postpartum females have been captured from June to late August. They appear to be solitary animals but occasionally roost or hibernate in small groups. Roost sites are cracks, crevices, and caves, usually high in fractured rock cliffs. In British Columbia and Arizona, bats showed high roost fidelity, using the same roosts nightly.

This species has been found in vegetation types that range from desert to sub-alpine meadows, including desert-scrub, pinyon-juniper woodland, ponderosa pine, mixed conifer forest, canyon bottoms, rims of cliffs, riparian areas, fields, and open pasture. During summer, bats may travel from roosts in desert-scrub to forage in high elevation meadows, returning to roosts within an hour of dawn. Males and females are capable of long distance (20 km in British Columbia, 80 km in Arizona) and rapid (50 kph) flight, thus foraging ranges can be large. Spotted bats avoided conspecifics when foraging in British Columbia, probably to reduce competition for food resources. In Arizona and Oregon, conspecifics did overlap when foraging. In British Columbia, bats foraged within 6-10 km of day roosts, maintaining exclusive foraging areas. In Arizona, spotted bats traveled up to 40 km from roosts, and night roosted for 1 to 3 hrs in or away from their day roost. Bats in Oregon and Arizona did not appear to be as predictable in their foraging locations as in British Columbia, but predictability of foraging may change over seasons. Early in summer, foraging patterns may be restricted to a few locations with abundant prey. As prey become more plentiful later in summer, spotted bats may be able to acquire food in shorter foraging periods across more locations.

When foraging, spotted bats fly alone from 2 to 50 m above ground, often within 10 m. They echolocate at a pitch (12 to 6 kHz) audible to humans but often not audible to prey until bats are too close (1 m) for prey to evade them. Spotted bats forage primarily on moths, but do not appear to select particular moth species. They likely feed on any moth they encounter that is appropriate handling size (8-12 mm in length), particularly Noctuids. In Arizona, they also fed on Lasiocampid and Geometrid moths. They avoided some moths such as those in the family Arctiidae (wooly bears), probably because the dense hairs of these moths make them distasteful.

Many new records of spotted bats have been added so this species may be more common than previously suspected. They are infrequently captured; spotted bat captures are often <0.5% of total bat captures in an area. They may be sensitive to light and noise, or fly high enough that tall net sets (e.g., 4.5 m) are needed to capture bats in some areas. In the southwest, spotted bats have been most often captured over water, but occasionally along dry canyon rims. It is probably easier to capture them because water is so limiting.

It is unknown whether spotted bats migrate or hibernate locally. At lower elevations, they do not appear to migrate, but in British Columbia, they are present at least May through August. In Arizona, spotted bats have been reported to be active year-round, although

activity during winter months is generally on warmer nights with favorable weather conditions. Specimens taken in September and October may indicate post-breeding wandering but could be elevational movement towards winter range.

IV. THREATS: Little is known about possible threats to spotted bats because of lack of knowledge of this species. Because the spotted bat roosts in remote locations, threats to roosts seem unlikely. However, recreational rock climbing may cause impacts in some areas. Dam construction that inundates high cliffs and canyons may remove roost locations. Urbanization in some areas (for example, mesas in the Sierra foothills in California, areas around Bend and Redmond, Oregon) may affect roosting habitat since spotted bats appear to roost in some of these areas. Collection of spotted bats by humans and use of pesticides that may bioaccumulate in bats or kill prey may also be threats. In Montana, coal bed methane development creates toxic ponds that may harm animals. Loss of foraging habitat (grazing of meadows and desert-scrub, conversion of desert wash vegetation, or conversion of native grasslands to cheatgrass or other invasive species) may reduce food availability. In the southwest, loss of accessible, open water that has been introduced in many areas for grazing livestock may impact bats because of the bats' high rates of evaporative water loss. As with most bat species, threats include habitat destruction or alteration, disturbance, sensitivity to pesticides and other pollutants, and overexploitation.

In general, the long term persistence of North American bat species is threatened by the loss of clean, open water; modification or destruction of roosting and foraging habitat; and, for hibernating species, disturbance or destruction of hibernacula. Chemicals in the environment that affect bats or their prey are also a threat. Because of low fecundity and long generational turnover, many bat populations may be vulnerable to human-induced pressures.

V. SURVEY METHODS: Netting can be effective where water is a limiting factor in xeric conditions, although netting is not effective in many portions of range. This species is easy to detect acoustically (with microphones sensitive to audible frequencies). Calls are audible to many people. Identification in hand is easy as the species is morphologically distinct. *Euderma maculatum* is difficult to distinguish in flight from *I. phyllotis*; but is otherwise distinctive. Cliff roosts are very difficult to locate and are generally inaccessible.

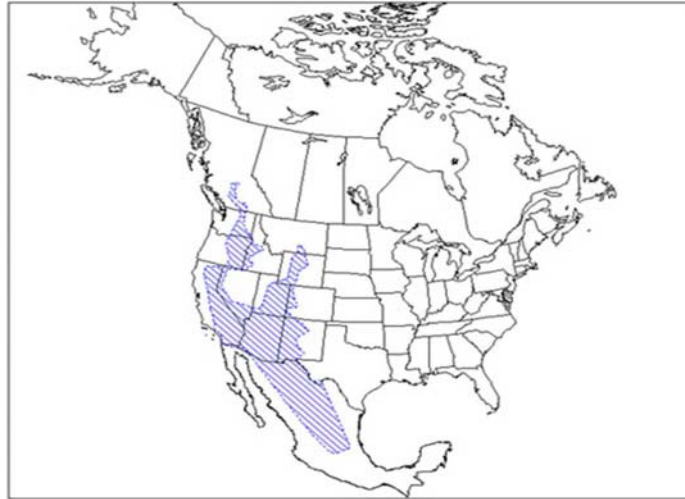
VI. GAPS IN KNOWLEDGE: More information is needed on life history, ecology, reproduction, habitat use, patterns of movement, distribution and abundance.

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Inferred geographic range map for spotted bat. Used with permission from Bat Conservation International (<http://www.batcon.org/>). This map is only an estimation of distribution and may not reflect up-to-date capture data.

Pipistrellus hesperus
WESTERN PIPISTRELLE

Prepared by: Patricia E. Brown

I. DISTRIBUTION: *Pipistrellus hesperus*, a member of the Family Vespertilionidae, occurs from the desert lowlands of the southwestern United States, with its range extending into southern Washington. In Mexico, it ranges throughout Baja California and on the mainland to Michoacan and Hidalgo. While most commonly associated with arid, desert landscapes, it also occurs in association with significant rock features in lower elevation mixed conifer forest in mountain ranges in California and up to fir-spruce forest in Arizona.

II. STATUS: Global Rank - G5. State Ranks: AZ - S5; CA - S5; CO - S4; ID - S3; NM - S5; NV - S?; OR - S4; TX - S5; UT - S4; WA - S4?.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *P. hesperus* is the smallest of all North American bats, and can be distinguished from the small *Myotis* species (*californicus* or *ciliolabrum*) by the club-shaped tragus compared to the pointed tragus of *Myotis*. All three of these small bats have a keeled calcar. In Texas, there is a

slight overlap in range with the eastern pipistrelle (*P. subflavus*) which is larger, with an unkeeled calcar and tricolored fur. Western pipistrelles are also commonly known as canyon bats due to their association with rocky canyons and outcrops (usually at elevations below 2,000 meters), where they roost in small crevices. Occupied crevices may also be in mines and caves. They have been observed at dusk flying over creosote bush scrub several miles from rocky areas, and it is postulated that they may roost under rocks or in rodent burrows. They emerge early in the evening, often before sunset, and may be active after sunrise. Near rocky canyons, their small fluttery forms can fill the sky in the fading desert light. They are often the first bats captured in an evening in mist nets set over isolated desert water holes or across mine entrances as they enter to night roost. Stomach content analysis suggest they feed on small swarming insects such as flying ants, mosquitoes, fruit flies, leafhoppers and ants. During cooler winter months, pipistrelles hibernate in rock crevices (sometimes in mines), although on warm winter days, they may emerge to forage during the day. It is reported that females give birth to twins in late May through June, and mothers with their young may roost alone or in groups of less than 20 individuals. The young are volant within a month.

IV. THREATS: Destruction of rocky areas due to renewed mining or other development activities (road construction, housing developments, water impoundments) can kill roosting bats and remove roosting habitat.

V. GAPS IN KNOWLEDGE: Since this bat is too tiny to carry a transmitter, no data exists on individual foraging areas or range. Although *P. hesperus* is a ubiquitous bat throughout the arid southwest, limited information is available on social structure, microhabitat roost requirements, roost fidelity, or longevity. Without more knowledge of natural history, it is difficult to assess potential threats to this species.

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Eumops perotis

WESTERN MASTIFF BAT

2005 Update by: Melissa S. Siders

Original account by: Elizabeth D. Pierson

I. DISTRIBUTION: *Eumops perotis*, a member of the Family Molossidae, has a disjunct distribution, with two subspecies confined to South America. The subspecies that occurs in North America, *E. p. californicus*, ranges from central Mexico across the southwestern United States (parts of California, southern Nevada, Arizona, southern New Mexico and western Texas). Recent surveys have extended the previously known range to the north in both Arizona (several localities near the Utah border) and California (to within a few miles of the Oregon border). Distribution in Nevada and Southern Utah is not well understood. Until recently, Nevada records were limited to a single record from Southern Nevada. A recent study in southern Nevada has acoustic records for *E. perotis* from June through October in 2004. The species has also been detected acoustically in southern Utah. Published information suggests that the species occurs only to 375 m in California, and 1,100 m in Texas. Recent surveys in California, however, have documented roosts up to 1,400 m, and foraging animals at > 2,700 m. Acoustic records of *E. perotis* in California document foraging or commuting at up to 3,050m in the southern Sierra Nevada. Recent surveys in northern Arizona have documented roosts at approx. 1,200 m, and foraging animals at >2,500 m. The distribution of *E. perotis* is likely geomorphically determined, with the species being present only where there are significant rock features offering suitable roosting habitat. It is found in a variety of habitats, from desert scrub to chaparral to oak woodland and into the ponderosa pine belt and high elevation meadows of mixed conifer forests (Figure 1).

II. STATUS: Global Rank - G5. National Rank – N3., State Ranks: AZ – S2S3; CA - S3?; NV – S2; TX - S3., former category 2 candidate species. A Species of Special Concern in California, where severe declines have been documented in the Los Angeles basin.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *E. perotis* can be distinguished from all other North American molossid (=free-tail) species based on size. With a forearm of 73-83 mm, it is North America's largest species. While it may overlap somewhat in size with the smaller *Eumops underwoodi*, the tragus is broad and square in *E. perotis*, and small and rounded in *E. underwoodi*.

E. perotis is primarily a cliff-dwelling species, where maternity colonies of 30 to several hundred (typically fewer than 100) roost generally under exfoliating rock slabs (e.g., granite, sandstone or columnar basalt). It has also been found in similar crevices in large boulders and buildings. Although maternity roosts for many bat species contain only adult females and their young, some *E. perotis* colonies contain adult males and females at all times of year. Roosts are generally high above the ground, usually allowing a clear

vertical drop of at least 3 m below the entrance for flight. *E. perotis* have been estimated to forage as much as 2000 ft above the ground; regularly forage at 100 to 200 ft over the substrate; and probably forage for considerable distances from roosting sites. *E. perotis* may forage in flocks. In California, it is most frequently encountered in broad open areas. Its foraging habitat includes dry desert washes, flood plains, chaparral, oak woodland, open ponderosa pine forest, grassland, and agricultural areas. In northern Arizona, it is also encountered in broad open areas, and captures are limited to larger bodies of water. Its foraging habitats are similar to those described for California, but it also includes high elevation meadows surrounded by mixed conifer forests. The diet consists primarily of moths (Lepidoptera), but also includes beetles, crickets and katydids. In Arizona, large Lepidoptera (up to 60 mm) pre-dominated for prey species, although a few small (about 8 mm) hymenopterous insects were consumed.

E. perotis does not have a late emergence, but may have been assumed to have late emergence due to long distances traveled from roost sites to capture locations over water. Studies in California and Arizona seem to indicate that they emerge from roosts just after dark.

Unlike vespertilionids which mate in the fall, North American molossid, including *E. perotis*, appear to mate in the late winter/early spring and give birth to a single young in the early to mid-summer. Available data suggest that, although most *E. perotis* young are born by early July, parturition dates vary extensively and births are not synchronous, even within colonies. Unlike some Molossid species (e.g., *Tadarida brasiliensis*) which undergo long distance seasonal migrations, *E. perotis* appears to move relatively short distances seasonally. It does not undergo prolonged hibernation, and appears to be periodically active all winter, and thus may seek winter refugia that are protected from prolonged freezing temperatures.

E. perotis emit an audible echolocation call, and aural detection is the best survey method. Acoustic monitoring is transforming our understanding of this species, especially foraging habitat and species distributions. These strong, fast fliers cover an extensive foraging area and can be detected flying throughout the night. The species appears to forage over open areas, and many individuals have been heard feeding over agricultural fields in the Imperial Valley and along the Lower Colorado River.

The species has been heard in open desert, at least 15 miles from the nearest possible roosting site (Vaughan, 1959). In Arizona, capture to roost distances were >30 km. Often multiple animals are detected together, and this species may travel or forage in groups. Western mastiff bats move relatively short distances seasonally. Although capable of lowering their body temperatures for short periods of time, they do not undergo prolonged hibernation, and may be periodically active throughout the winter. In California and Arizona, *E. perotis* have been detected at all seasons, although they may change roost sites.

IV. **THREATS:** Like most other North American species of bat, the long term persistence of *E. perotis* is threatened by: low fecundity, high juvenile mortality, long

generational turnover; loss of clean, open water; loss of riparian vegetation; pesticide application. Population trends for this species are difficult to assess in many areas because of an absence of historical roost records.

Additionally, *E. perotis* in particular, are threatened by urban expansion. When colonies are within or in close proximity to human dwellings, they are vulnerable to disturbance, vandalism and the hysteria which often surrounds bat colonies, causing extermination by pest control operators and public health departments. Two colonies in buildings in the Los Angeles area (Norco and Rancho Cucamonga) were eradicated recently in the name of public health.

Any construction activities (e.g., quarry operations, highway projects, water impoundments) that impact cliffs or boulders could also affect western mastiff bat roosts. Rock climbing may also disturb roosting bats, and is a rapidly-growing recreational activity in the range of *Eumops*. Communication with avid rock climbers suggest bat encounters do occur on climbs, and that hands or temporary climbing aids inserted into a roost crevice could cause abandonment of a site.

Since *E. perotis* forage over a large area, the huge amount of pesticide applications in areas such as the Imperial and Colorado River Valleys could have far-reaching effects. Non-chemical methods, such as the lepidopteron-attacking *E. perotis*, can reduce the prey base for western mastiff bat populations, which rely heavily on moths.

In general, the long term persistence of North American bat species is threatened by the loss of clean, open water; modification or destruction of roosting and foraging habitat; and, for hibernating species, disturbance or destruction of hibernacula. Chemicals in the environment that affect bats or their prey are also a threat. Because of low fecundity, high juvenile mortality, and long generational turnover, many bat populations may be vulnerable to human-induced pressures.

V. SURVEY METHODS: Morphologically distinct. Most roosts are in cliffs and are highly inaccessible; quite frequently in building roosts. *E. perotis* can sometimes be found by surveying for guano and listening for loud chatter along base of cliffs. Effectiveness of netting varies regionally. *E. perotis* have been netted where open flight paths are evident, or water is limiting. *E. perotis* forage at considerable heights and captured at drinking sites. *E. perotis* calls are diagnostic and in the audible range; easy to detect species acoustically (better with low frequency microphone). Flight is distinctive except in areas of overlap with *E. perotis*.

VI. GAPS IN KNOWLEDGE: More surveys are needed, using acoustic techniques, to delineate the range of this species. More information is needed on distribution of breeding colonies, seasonal movements, roosting and foraging requirements. Methods need to be developed for assessment and on going monitoring of population size.

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Figure 1. Range map (<http://www.batcon.org/discover/species/eperotis.html>).

Eumops unerwoodi

UNDERWOOD'S MASTIFF BAT

Prepared by: E.D. Pierson

I. DISTRIBUTION: *Eumops unerwoodi*, a member of the Family Molossidae, is known in the United States only from a few localities in Pima County, Arizona. This species' range extends from southern Arizona through western Mexico, as far south as Honduras. The subspecies found in Arizona, *E.u. sonoriensis*, is limited to Arizona and Sonora, Mexico. It is found in sonoran desert habitat in Arizona, and has been found in pine-oak forest at 1,495-1,800 m elevation in Mexico.

II. STATUS: Global Rank - G4. State Ranks: AZ - S1. Although this species can be predictably encountered at at least one locality in Arizona, its status and distribution are not well understood. A former category 2 candidate species.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *E. unerwoodi* can be distinguished from all other North American molossid (=free-tail) species based on size. With a forearm of 65-77 mm, it is smaller than *Eumops perotis* (forearm = 73-83 mm) and larger than *Nyctinomops macrotis* (forearm = 58-64 mm). *Eumops* species have a smooth upper lip, in contrast to a wrinkled upper lip in *Nyctinomops*. In *E. unerwoodi* the tragus is small and rounded, in *E. perotis* it is broad and square. While *E. unerwoodi* is presumed to roost primarily in rock crevices on cliff-faces, the only identified roost was in a large, hollow tree in Jalisco, Mexico. *E. unerwoodi* apparently gives birth to a single young in late June or July. No information is available on colony size. Based on limited samples, the diet of *E. unerwoodi* appears to be predominantly beetles (scarabs and long-horned) and short-horned grasshoppers, with some leafhoppers and moths. No information is available on seasonal movements.

IV. THREATS: No threats have been identified. Assuming that this species is primarily cliff-dwelling, it could be threatened by any activities that disturb or destroy cliff habitat (e.g., recreational climbing, water impoundments, highway construction, quarry operations). Grazing and pesticide applications in agricultural areas could impact foraging habitat.

V. GAPS IN KNOWLEDGE: More surveys are needed to delineate the range of this species in the southwestern U.S. More information is needed on distribution of breeding colonies, seasonal movements, roosting and foraging requirements. Methods need to be developed for assessment and on going monitoring of population size. Call features need to be described to determine whether this species can be distinguished from other large molossids acoustically.

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Nyctinomops femorosaccus **POCKETED FREE-TAILED BAT**

Prepared by : Kirk Navo

I. DISTRIBUTION: *Nyctinomops femorosaccus*, a member of the Family Molossidae, occurs in western North America, from southern California, central Arizona, southern New Mexico and western Texas, south into Mexico including Baja California. The species is thought to be non-migratory. The known altitudinal distribution is from near sea level to about 7,300 ft (2,250 meters). Breeding populations have recently been identified in southern California.

II. STATUS: Global Rank - G4. State Ranks: Arizona - S2/S3, California - S2/S3, New Mexico - S1, and Texas - S3. This species currently is not listed as Threatened or Endangered. It is a Species of Special Concern in California. There are no studies that elucidate the global population status of this species. Rankings should be re-evaluated as more information is available.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: Like all molossids (=free-tailed bats), *N. femorosaccus* has a free-tail which extends beyond the edge of the interfemoral membrane. With a forearm of 45-49 mm., it is smaller than all other North American molossid species except *Tadarida brasiliensis*. It is slightly larger than *T. brasiliensis* and, unlike *T. brasiliensis*, has its ears joined at the midline. The pocketed free-tailed bat is colonial and roosts primarily in crevices of rugged cliffs, high rocky outcrops and slopes. It has been found in a variety of plant associations, including desert shrub and pine-oak forests. The species may also roost in buildings, caves, and under roof tiles. The species forms maternity colonies, and females bear 1 young in late June or July.

Lactating females have been taken between 7 July and 8 August, and volant juveniles recorded on 7 August. *N. femorosaccus* forages mainly on large moths, but its diet includes small moths and beetles, with small amounts of a variety of other insects. Owls and snakes have been documented preying on this species. Little is known about population dynamics, seasonal movements, or ecology.

IV. THREATS: No known threats to the species have been identified to date. However, some of the general threats to bats could apply to *N. femorosaccus*. These could include impacts to foraging areas from grazing, riparian management, the use of pesticides, and in some places disturbance to roost sites.

V. GAPS IN KNOWLEDGE: Information is needed on *N. femorosaccus* regarding roosting ecology, foraging ecology, seasonal movements, and breeding colony distribution. Little appears to be known about the echolocation calls of this species, and documentation is needed for comparison with other molossid species. More information on the ecology of this species is required before threats can be more fully delineated.

VI. SELECTED LITERATURE:

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Nyctinomops macrotis **BIG FREE-TAILED BAT**

Prepared by: Kirk Navo

I. DISTRIBUTION: *Nyctinomops macrotis*, a member of the Family Molossidae, ranges from most of South America northward to include Mexico, Arizona, New Mexico, southern and western Texas, southern California and southeastern Nevada, southern Utah, and north to central Colorado. The species is migratory, and there are some extralimital records from British Columbia, Iowa, Kansas, and South Carolina. The known elevational range is from near sea level to about 8,500 ft (2,600 meters).

II. STATUS: Global Rank - G5. State Ranks: AZ - S2S3; CA - S2; CO - S1?; NM - S2; NV - S?; TX - S3; UT - S2. The Big-free-tailed bat was proposed as a federal candidate C2 species in 1994. This species is currently on the BLM's special status species list for Utah and Colorado. It is considered a Species of Special Concern by the states of California and Utah.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *N. macrotis* can be distinguished from other molossids (= free-tailed bats) based on size. With an adult

forearm of 58-64 mm it is larger than *T. brasiliensis* or *N. femorosaccus*, and smaller than either *Eumops* species. Also, it has vertical grooves or wrinkles on the upper lip, which are lacking in *Eumops*. *N. macrotis* appears to be mainly an inhabitant of rugged, rocky habitats in arid landscapes. It has been found in a variety of plant associations, including desert shrub, woodlands, and evergreen forests. It appears to be associated with lowlands, but has been documented at around 8,000 ft in New Mexico. This species is a seasonal migrant, and a powerful flyer. It roosts mainly in the crevices of rocks in cliff situations, although there is some documentation of roosting in buildings, caves, and tree cavities. The species forms maternity colonies, and females bear one young in late spring or early summer. Lactating females have been taken in July, August and September, and volant juveniles recorded on 8 and 27 August. Maternity roosts have been documented in rock crevices, with evidence of long term use of the crevices reported. It appears that the return to the roost site by this bat involves ritualized behavior, including a general reconnaissance of the site and several landing trials before entry. *N. macrotis* forages almost entirely on large moths, but some data exists to document occasional foraging on other insects, including grasshoppers, beetles, crickets, leafhoppers and flying ants. Owls appear to be the only documented predator of this species. *N. macrotis* has an audible echolocation call, which is characterized as loud and with a frequency range of 17-30 kHz. Surveys based on echolocation calls for this species may be possible, as captures appear to be uncommon (outside of Big Bend National Park, where the most animals in North America have been documented). Easterla, however, reports that the populations at the Park fluctuate greatly from year to year. Little is known about the species population dynamics and ecology.

IV. THREATS: No known threats to the species have been identified to date. However, some of the general threats to bats could apply to *N. macrotis*. These could include impacts to foraging areas from grazing, riparian management, the use of pesticides, and in some places disturbance to the roost site (e.g., blasting of cliffs or water impoundments).

V. GAPS IN KNOWLEDGE: Information is needed on *N. macrotis* regarding roosting ecology, seasonal movement patterns, and breeding colony distribution. Current evidence suggests that the species breeds farther north than previously thought, including southern Utah and Colorado. Vocalization recordings are needed to help train researchers and managers that may attempt to survey for the species based on audible call detections. Reference calls need to be established and geographically verified, and made available at a depository, and/or establish a site where recordings can be sent for verification. It will be important for bat biologists to be able to distinguish between the different audible bats in the southwest.

VI. SELECTED LITERATURE:

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Schmidly, D. J. 1991. The bats of Texas. University of Texas Press, Austin, TX. 189 pp.

Lasionycteris noctivagans

SILVER-HAIRED BAT

Prepared by: Mark Perkins

I. DISTRIBUTION: *Lasionycteris noctivagans*, a member of the Family Vespertilionidae, is found from southern Alaska, throughout southern Canada, and most of the United States into the San Carlos Mountains of northeastern Mexico. *L. noctivagans* is primarily a forest bat, associated primarily with north temperate zone conifer and mixed conifer/hardwood forests. It has been found in winter and during seasonal migrations in low elevation, more xeric habitats.

II. STATUS: Global Rank - G5. State Ranks: AZ - S3; CA - Sx; CO - S4B; ID - S5; MT - S4; NM - S5; NV - S?; OR - S4?; TX - S4; UT - S3S4; WA - S?; WY - S4; AL - S3; BC - S4.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *L. noctivagans* is a medium sized vespertilionid with black or dark brown hairs which are silver-tipped. The interfemoral membrane is partially furred. Its ears are short and rounded, with a blunt tragus. Females form small nursery colonies of up to 70 individuals. Maternity roosts appear to be almost exclusively in trees -- inside natural hollows and bird excavated cavities or under loose bark of large diameter snags. Roosting sites are generally at least 15 m above the ground. Both males and females change roosts frequently, and use multiple roosts within a limited area throughout the summer, indicating that clusters of large trees are necessary. Some records exist for roosts in other structures. Based on recent radio telemetry, these appear to be largely anomalies. This species has been found hibernating in hollow trees, under sloughing bark, in rock crevices, and occasionally under wood piles, in leaf litter, under foundations, and in buildings, mines and caves. *L. noctivagans* forages above the canopy, over open meadows, and in the riparian zone along water courses. Radiotracking has shown that it travels considerable distances from roost sites to foraging areas. Although the species is known to take a wide variety of insects, including chironomids, moths appear to be a major portion of dietary prey. This species appears to have gestation of 50-60 days, and give birth to twins in mid to late June. The young require >36 days to become volant. Seasonal records suggest considerable north south migration, with animals moving to warmer, more southern climates in the winter. The few overwintering *L. noctivagans* that have been found in

Oregon and Washington were juveniles from the previous summer. In some there appears to be summer segregation of the sexes (e.g., whereas both adult males and females are captured during the summer reproductive season in parts of northern California, males and females are geographically separated in most of Oregon).

IV. THREATS: The primary threat to *L. noctivagans* is likely to be loss of roosting habitat due to logging practices that fail to accommodate the roosting needs of this species (e.g., clusters of large snags). Loss of temporary roosts within migration corridors could also be important. Loss of foraging habitat in riparian areas, and reduction of prey base due to broadcast application of pesticides are other potential threats.

V. GAPS IN KNOWLEDGE: More information is needed distribution of breeding populations, on regional differences in roosting requirements, the timing and patterns of migration for each sex throughout the west, and the location of possibly important mating and migratory stopover sites. Information is also needed on what factors (e.g., temperature, local food availability) determine year to year variation in local distribution and abundance.

VI. SELECTED LITERATURE:

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Lasiurus blossevillii
WESTERN RED BAT

Prepared by: Betsy C. Bolster

I. **DISTRIBUTION:** *Lasiurus blossevillii*, a member of the Family Vespertilionidae, has a broad distribution reaching from southern British Columbia in Canada, through much of the western United States, through Mexico and Central America, to Argentina and Chile in South America.

II. **STATUS:** Global Rank - G5. State Ranks: AZ - S2; CA - S?; NM - S?; NV - S?; OR - S?; TX - S2; UT - S1; WA - S3; BC - S1?. *L. blossevillii* is proposed as a Mammal of Special Concern in California, is included in Arizona Game and Fish Department's Wildlife of Special Concern in Arizona, and is considered a Species of Special Concern due to declining populations and limited distribution in Utah..

III. **LIFE HISTORY:** *L. blossevillii* can be distinguished from all other western bat species except *Lasiurus borealis* (the eastern red bat) by its distinctive red coloration, and can be distinguished from *L. borealis* by its slightly smaller size and lack of frosted appearance. The only area where these two species are known to overlap is western Texas. *L. blossevillii* is typically solitary, roosting primarily in the foliage of trees or shrubs. Day roosts are commonly in edge habitats adjacent to streams or open fields, in orchards, and sometimes in urban areas. There may be an association with intact riparian habitat (particularly willows, cottonwoods, and sycamores). Roost sites are generally hidden from view from all directions except below; lack obstruction beneath, allowing the bat to drop downward for flight; lack lower perches that would allow visibility by predators; have dark ground cover to minimize solar reflection; have nearby vegetation to reduce wind and dust; and are generally located on the south or southwest side of a tree. *L. blossevillii* may also occasionally use caves, as both dead and live red bats, including a pregnant female, have been collected from Carlsbad Caverns in New Mexico. Red bats

generally begin to forage one to two hours after sunset. Although some may forage all night, most typically have an initial foraging period corresponding to the early period of nocturnal insect activity, and a minor secondary activity period corresponding to insects that become active several hours before sunrise. Red bats have been observed feeding around street lights and flood lights. Reported prey items include homopterans, coleopterans, hymenopterans, dipterans, and lepidopterans. Red bats mate in late summer or early fall. Females become pregnant in spring and have a pregnancy of 80-90 days. Females may have litters of up to five pups per year. This species is considered to be highly migratory. Although generally solitary, red bats appear to migrate in groups and forage in close association with one another in summer. The timing of migration and the summer ranges of males and females seem to be different. Winter behavior of this species is poorly understood. The eastern red bat has been found hibernating in leaf-litter. Arousal from hibernation on warm days to feed has been reported, as has periodic foraging during the winter in the San Francisco Bay area. Predators reported for *L. blossevillii* include birds (e.g., scrub jays, falcons, accipters, owls, roadrunners), opossums, and domestic cats.

IV. THREATS: Loss of riparian zones, primarily due to agricultural conversion and creation of water storage reservoirs has reduced both roosting and foraging habitat of red bats. The intensive use of pesticides in fruit orchards may constitute a threat to roosting bats and may significantly reduce the amount of insect prey available. Controlled burns may be another significant mortality factor for red bats that roosting in leaf litter during cool temperatures.

V. GAPS IN KNOWLEDGE: The following areas need more investigation to accurately determine the status of and conserve the red bat in the western U.S.: habitat requirements (esp. roost sites and foraging habitat), altitudinal distribution, migration patterns, effects of controlled burns, and effects of pesticide use in orchards.

VI. SELECTED LITERATURE:

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Lasiurus cinereus

HOARY BAT

Prepared by: Betsy C. Bolster

I. DISTRIBUTION: *Lasiurus cinereus*, a member of the Family Vespertilionidae, is the most widespread of all North American bats. This species ranges from near the limit of trees in Canada, southward at least to Guatemala, and from Brazil to Argentina and Chile in South America. *L. cinereus* is also found in Hawaii and the Galapagos Islands. Hoary bats are uncommon throughout most of the eastern U.S. and in the northern Rocky Mountains, but are more common in the prairie states and Pacific Northwest. They are highly associated with forested habitats in the west.

II. STATUS: Global Rank - G5. State Ranks: AZ - S3; CA - S5; CO - S5B; ID - S5; MT - S4; NM - S5; NV - S?; OR - S4?; TX - S4; UT - S3; WA - S?; WY - S4; AL - S2?; BC - S4.

III. LIFE HISTORY: *L. cinereus* can be distinguished from all other species by a combination of its large size (forearm of 46-58 mm), frosted fur, golden coloration around the face, rounded ears, blunt tragus and furred uroplagium. Hoary bats are solitary and roost primarily in foliage of both coniferous and deciduous trees, near the ends of branches, 3-12 m above the ground. Roosts are usually at the edge of a clearing. Some unusual roosting situations have been reported in caves, beneath a rock ledge, in a woodpecker hole, in a grey squirrel nest, under a driftwood plank, and clinging to the side of a building. Although thought to be highly migratory, wintering sites have not been well documented, and no specific migration routes have been discerned. Hoary bats are often found flying in waves of large groups during autumn migration, whereas spring migration is apparently less organized. This species tolerates a wide range of temperatures as illustrated by captures at air temperatures between 0 and 22°C. The ambient temperature at which individuals employ torpor also appears to be variable, as entry into torpor was observed in one study to vary from 5°C to 13°C. Hoary bats probably mate in the fall, followed by delayed implantation and birth in the following May through July. Females have from one to four pups annually, with two being the norm. Hoary bats usually emerge late in the evening to forage, although they occasionally have been observed flying during late winter afternoons or just before sunset. Evening emergence and capture times range from just over one hour after sunset to after midnight. The swift, direct flight of this species makes it identifiable on the wing from all other U.S. bats except molossids. Hoary bats reportedly have a strong preference for moths, but are also known to eat beetles, flies, grasshoppers, termites, dragonflies, and wasps. Reported predators include jays, kestrels and snakes, and likely include hawks and owls as well.

IV. THREATS: Loss of roosting habitat due to timber harvest is likely the biggest threat to this species. Use of pesticides on public forest lands may also be a potential source of

mortality to roosting bats and their insect prey. In suburban settings, where jays thrive in association with humans, this bird may pose a major threat to sleeping or hibernating hoary bats.

V. GAPS IN KNOWLEDGE: The habitat use and relationships of *L. cinereus*, especially regarding wintering sites, needs to be investigated more thoroughly. The impact of current timber harvest practices on roosting and foraging also should be examined.

VI. SELECTED LITERATURE:

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Lasiurus xanthinus

WESTERN YELLOW BAT

2005 Update by: Jason A. Williams

Original account by: Betsy C. Bolster

I. DISTRIBUTION: Formerly considered conspecific with the southern yellow bat, but currently considered a distinct species, *Lasiurus xanthinus* occurs in northern Mexico, western Arizona, southern California, southern Nevada, and southwestern New Mexico. Western yellow bats are associated with dry, thorny vegetation on the Mexican Plateau, and are found in desert regions of the southwestern United States, where they show a particular association with palms and other desert riparian habitats. They are known to occur in a number of palm oases, but are also believed to be expanding their range with the increased usage of ornamental palms in landscaping. *L. xanthinus* occurs up to ca. 2,000 m. in the mountains in Arizona.

II. STATUS: Global Rank - G5. National Rank – N2. State Ranks: AZ - S1; CA - SNR; NV - S1; NM - S1; TX - S1. *L. xanthinus* is included in Arizona Game and Fish Department's Wildlife of Special Concern.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: Western yellow bats can be distinguished from other bat species by the combination of yellow coloration, size (forearm = 42-50 mm), and short ears. Yellow bats are suspected to be non-colonial. Individuals usually roost in trees, hanging from the underside of a leaf. They are commonly found in the southwestern U.S. roosting in the skirt of dead fronds in both native and non-native palm trees, and have also been documented roosting in cottonwood trees. At least some individuals or populations may be migratory, although some individuals appear to be present year-round, even in the northernmost portion of their range. Yellow bats probably do not hibernate; activity has been observed year-round in both the southern and northern portions of their range. Sexual dimorphism in size exists, with females averaging 2mm longer in forearm length than males. Yellow bats are insectivorous. Analysis of fecal samples of western yellow bats indicate their diet includes Coleoptera, Diptera, Hemiptera, Homoptera, Lepidoptera, and Orthoptera. Capture sites are often associated with natural and non-natural water features in open grassy areas and scrub, as well as canyon and riparian situations. Captures are also reported over swimming pools, lawns in residential areas, and orchards. In northern areas, seasonal segregation between sexes during parturition may occur, as males are scarce from April through June. In the U.S., pregnant females are known from late April through June, with lactation occurring during June and July. The number of embryos carried by pregnant females varies from one to four, with no known geographic trend. Reported predators include barn owls, domestic dogs and domestic cats.

IV. THREATS: Few threats to the survival of yellow bats have been reported. Probably one of the primary threats in the U.S., however, is the cosmetic trimming of palm fronds. The use of pesticides in date-palm and other orchards may also constitute a threat to both roosting bats and the insects upon which they forage. Domestic cats, whether pets or feral, may be a substantial source of predation, as they are for many lizards, songbirds, and rodents.

In general, the long term persistence of North American bat species is threatened by the loss of clean, open water; modification or destruction of roosting and foraging habitat; and, for hibernating species, disturbance or destruction of hibernacula. Chemicals in the environment that affect bats or their prey are also a threat. Because of low fecundity, high juvenile mortality, and long generational turnover, many bat populations may be vulnerable to human-induced pressures.

V. SURVEY METHODS: Morphologically distinct. It is difficult to locate tree roosts, but can sometimes *Lasiurus xanthinus* can be located by monitoring palm trees at emergence time. This species is difficult to observe in the roost, but is easy to identify during emergence from roost. In some habitats, it is readily captured using nets, but apparently difficult to capture in others. Not enough known about appropriate habitats.

Easy to detect acoustically; most sequences diagnostic, but some acoustic overlap with *L. borealis* and *E. fuscus*. *Lasiurus xanthinus* is reasonably distinctive in flight.

VI. GAPS IN KNOWLEDGE: The following areas need more investigation to accurately determine the status of and to conserve the yellow bat in the U.S.: distribution, migration, habitat requirements, activity patterns (both daily and seasonally), and threats including palm frond trimming and pesticide use in orchards.

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Antrozous pallidus

PALLID BAT

Prepared by: Rick Sherwin

Updated by: Daniela A. Rambaldini

I. DISTRIBUTION:

Antrozous pallidus (Vespertilionidae) ranges throughout western North America, from British Columbia's southern interior, south to Queretaro and Jalisco, and east to Texas (Figure 1). An isolated population, *A. p. koopmani*, is endemic to Cuba. *A. pallidus* inhabits low elevation (< 1,830 m / 6,000 feet) rocky arid deserts and canyonlands, shrub-steppe grasslands, karst formations, and higher elevation coniferous forests (> 2,100 m / 7,000 feet). It is most abundant in xeric ecosystems, including the Great Basin, Mojave, and Sonoran Deserts.

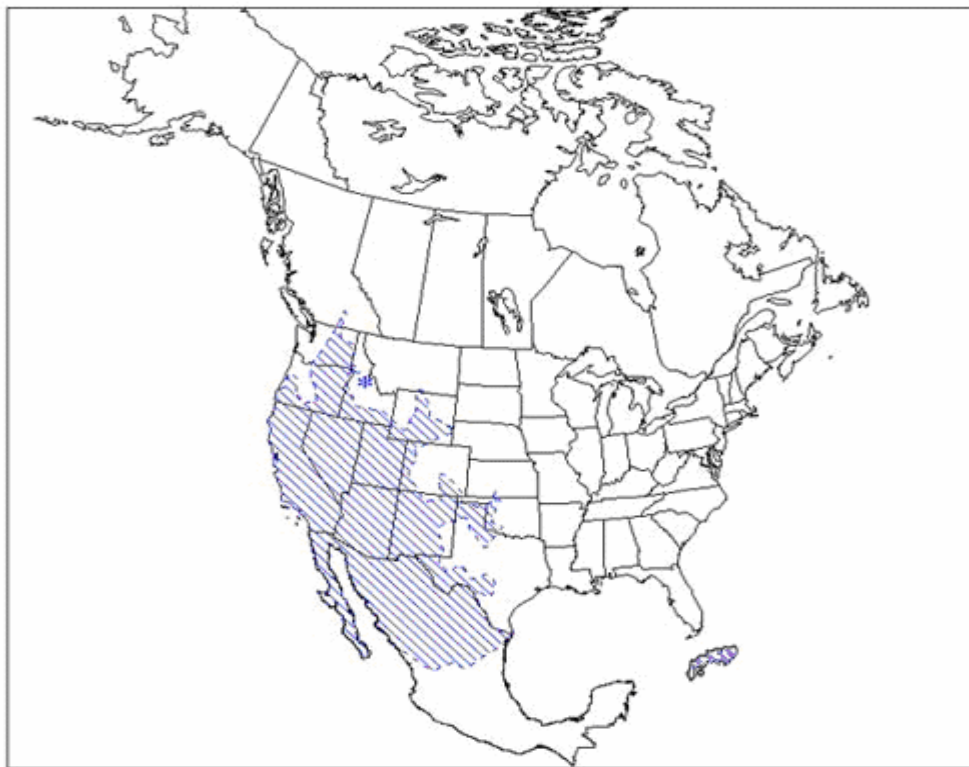


Figure 1. Distribution of *Antrozous pallidus* in North America. Map modified from Bat Conservation International, 2001. Reprinted with permission.

II. STATUS:

Global Rank – G5. State Ranks: AZ – S4/S5; CA – S3; CO – S4; ID – S1; KS – S1; MT – S1; NM – S5; NN – S5; NV – S3B; OK – S3; OR – S3; TX – S5; UT – S4; WA – S3; WY – S1; BC – S1. USFS – None; BLM – Special Status/Sensitive; USFWS – Sensitive. California Species of Special Concern. Mexico – Not a species of concern. IUCN Red List Category – LR.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY:

A. pallidus is a large (forearm length 45-60 mm) light-colored bat with long prominent ears, a blunt snout, and pinkish-brown or gray wing and tail membranes. Glands near the scroll-shaped nostrils secrete a distinct skunk-like scent. Pallid bats can be distinguished from other long eared bats (*i.e.*, *Corynorhinus townsendii* and *Idionycteris phyllotis*) by their lighter fur, longer forearm, and lack of lappets (fleshy flaps) projecting from the base of the ears (*I. phyllotis*) or large rhinal lumps (*C. townsendii*).

Pallid bats roost alone, in small groups (2 to 20 bats), or gregariously (100s of individuals). Day and night roosts include crevices in rocky outcrops and cliffs, caves, mines, trees (*e.g.*, basal hollows of coast redwoods and giant sequoias, bole cavities of oaks, exfoliating Ponderosa pine and valley oak bark, deciduous trees in riparian areas, and fruit trees in orchards), and various human structures such as bridges (especially wooden and concrete girder designs), barns, porches, bat boxes, and human-occupied as well as vacant buildings. Roosts generally have unobstructed entrances/exits, and are high above the ground, warm, and inaccessible to terrestrial predators. However, this species has also been found roosting on or near the ground under burlap sacks, stone piles, rags, and baseboards. Although year-to-year and night-to-night roost reuse is common, they may switch day roosts on a daily (1-13 d) and seasonal basis. "Rallying" behavior, accompanied by distinct vocalizations, may help alert colony members and juveniles to new roost sites. *A. pallidus* has an extensive repertoire of social communication calls, some of which are audible to humans.

Pallid bats are opportunistic generalists that glean a variety of arthropod prey from surfaces, but also capture insects on the wing. They eat antlions, beetles, centipedes, cicadas, crickets, grasshoppers, Jerusalem crickets, katydids, moths, praying mantids, scorpions, solpugids, termites, and rarely take geckos, lizards, skinks, small rodents, and plant material, which is likely ingested when arthropod prey are gleaned from plant surfaces. Large (3-7 cm / 1-3 in) flying prey are sometimes captured by 'wing-cupping', whereby prey are forced down to the substrate. They forage over open shrub-steppe grasslands, oak savannah grasslands, open Ponderosa pine forests, talus slopes, gravel roads, lava flows, fruit orchards, and vineyards. They may echolocate (short FM 60-25 kHz) while flying, but generally use passive acoustic cues to locate prey. 'Perch feeding' has also been observed in some individuals from different populations. Diet composition and foraging style vary within and between populations.

Females have 1 to 2 pups per year, although 3 embryos have been reported. Adult and yearling males may roost in maternity colony structures, albeit usually separate from the females and young. Mating occurs from October to February, parturition from late April to July, and weaning in August; exact dates vary across latitudes and between years, with populations at higher latitudes and in cooler climates giving birth later in the season. Yearling females are reproductively mature and males may be capable of mating in their first year. Maternity colonies disperse between August and October.

Winter habits are poorly known, but this species apparently does not migrate long distances between summer and winter sites. In coastal California, males and females overwinter in a primary roost but occasionally use alternate roosts throughout the winter. Overwintering roosts have relatively cool, stable temperatures and are located in protected structures beneath the forest canopy or on the ground, out of direct sunlight. In other parts of the species' range, males and females have been found hibernating alone or in small groups, wedged deeply into narrow fissures in mines, caves, and buildings. At low latitudes, outdoor winter activity has been reported at temperatures between -5 and 10 °C.

Recommended survey methods include active acoustic monitoring of echolocation and audible social "directive" calls, visual observation, and mist netting in foraging habitats and at roost entrances/exits. Day roosts in natural structures are often difficult to identify, but capture at open night roosts such as bridges may be easier and less invasive. Pallid bats are a high priority species at the northern and eastern limits of the species' range, and along the western coast in California.

IV. THREATS:

Pallid bats' tendency to roost gregariously and their relative sensitivity to disturbance makes them vulnerable to mass displacement. Roosts and hibernacula can be damaged or destroyed by vandalism, mine closures and reclamation, recreational activities such as rock climbing, forestry practices such as timber harvest, and, where man-made structures are occupied, demolition, modification, chemical treatments, or intentional eradication and exclusion. Maternity colonies and hibernating bats are especially susceptible to disturbance. Loss or modification of foraging habitat due to prescribed fire, urban development, agricultural expansion, and/or pesticide use pose potential threats. This is especially true in coastal California, where urbanization has reduced roosting and foraging habitat, and in British Columbia, Canada where agricultural expansion may compromise prey availability and quality.

V. GAPS IN KNOWLEDGE:

There are scant records of seasonal movements, locations of hibernacula and winter roosts, and mating behavior. There is a paucity of information quantifying tolerance to habitat modification (*i.e.*, conversion of native habitat for agriculture and forced roost relocation) and impacts of threats such as roost disturbance and pesticide or heavy metal contamination. Data are also lacking for population trends, roosting and habitat

requirements, and limiting factors, especially for peripheral populations. There have been few studies of this species in Mexico and Cuba .

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Eptesicus fuscus
BIG BROWN BAT

Prepared by: Mark Perkins

I. DISTRIBUTION: *Eptesicus fuscus*, a member of the Family Vespertilionidae, has an extremely broad distribution reaching from Alaska and northern Alberta to northern South America. It occurs in all western States and Provinces associated with the Western Bat Working Group. Two subspecies are recognized in the western U.S. : *E. f.*

bernardinus and *E. f. pallidus*. *E. fuscus* occurs in a wide variety of habitats from desert scrub and moist coastal forests to high elevation conifer forests, and is one of the few species that persists in relatively urbanized environments.

II. STATUS: Global Rank - G5. State Ranks: AZ - S4; CA - S5; CO - S5; ID - S5; MT - S4; NM - S5; NV - S?; OR - S4; TX - S5; UT - S4; WA - S?; WY - S5; AL - S4S5; BC - S4S5. Not listed by any State or Province. Perceived as relatively common in many localities. It is the second most common bat found in urban areas in Washington and Oregon.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *E. fuscus* is a medium to large sized North American vespertilionid. It can be distinguished from all other large vespertilionids by the combination of relatively dark color, a keeled calcar, and a blunt tragus. The tip of its tail usually extends 3 mm beyond the uropatagium. *E. fuscus* is a colonial species, with the size of maternity colonies varying from about a dozen to several hundred. This species is well known for its propensity to roost in anthropomorphic structures, including buildings, mines, and bridges, but it has also been found in caves, crevices in cliff faces, and a hole in a giant saguaro. More recently extensive tree roosting (particularly in large diameter snags) has been documented in forested, preferably uncluttered, landscapes. Bridges are commonly used as night roosts by males and pre-parturition and post-lactating females. In the west, *E. fuscus* is known to hibernate in relatively small numbers per site in caves, buildings and mines. *E. fuscus* forages within a few kilometers of its roost, generally pursuing prey in tree canopies, over meadows, or along water courses. It feeds primarily on heavy-bodied insects, and is an important predator on certain agricultural pests (e.g. *Diabrotica*, the spotted cucumber beetle). Although primarily beetle (coleopteran) specialists, their diet also includes hemipterans, dipterans, lepidopterans, trichopterans and hymenopterans. *E. fuscus* mate in the fall and winter, but ovulation does not occur until the spring. Each female produces producing one young (the eastern subspecies produce twins) in early summer, after a gestation of about 60 days. The young are volant in three to four weeks. *E. fuscus* appears to be a relatively sedentary species and is not known to migrate large distances (although males may migrate elevationally in the Cascade Mountains). Females roost separately from males in the spring and summer, and roost with males at hibernating sites. This species hibernates for most of the winter in the northern portion of its range, but is active on warm nights in the winter in the southwest.

IV. THREATS: Potential threats to this species include roost disturbance and destruction, particularly eradication of building dwelling colonies by pest control operations, and removal of important roost trees in timber harvest operations. Grazing practices and loss of riparian could affect foraging habitat. Mine closures and renewed mining in historic districts could also impact this species.

V. GAPS IN KNOWLEDGE: More information is needed on roosting requirements, particularly in forested landscapes. The effects of timber harvest need to be investigated. Studies are needed to further investigate the role of this species in controlling insect pests. Information is generally lacking on seasonal movements, and hibernation sites.

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Idionycteris phyllotis

ALLEN'S LAPPET-BROWED BAT

2005 Update by: Patricia Brown and Lyle Lewis

Original account by: Michael J. O'Farrell

I. DISTRIBUTION: Allen's lappet-browed bat (*Idionycteris phyllotis*) is one of the rarest bats in North America, occurring from central Mexico north through the southwestern United States, including Arizona, New Mexico, southern Nevada and southern Utah (Figure 1). It is also known as Allen's big-eared bat, Allen's lappet-eared bat, or Mexican big-eared bat. Although it ranges close to the California and Colorado borders, it is not yet verified from those states. Recorded locations range from Mojave Desert scrub to fir forest at elevations ranging from 403-3225 meters (m) (1320 to 9800

feet (ft)), although most captures are from elevations between 1,100-2,500 m (3,500-7,500 ft) in oak-juniper woodland and ponderosa pine forest.



Figure 1. Approximate range of *I. phyllotis* (Bat Conservation International, www.batcon.org).

II. STATUS: Global Rank - G4. State Ranks: Arizona - S2, California –no ranking; Colorado - no ranking; Nevada – S1; New Mexico - S2; and Utah - S1. Lappet-browed bat is a former U.S. Fish and Wildlife Service Category 2 Candidate for listing under the Endangered Species Act and is now a Species of Concern for U.S. Fish and Wildlife Service, a Candidate for listing by Arizona Game and Fish Department, a Species of Special concern in Utah , and a Bureau of Land Management Sensitive Species.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: The lappet-browed bat can be distinguished from all other species by the presence of a pair of lappets projecting over the forehead from the median bases of the large ears, hence the common name of lappet-browed or lappet-eared bat. Based on 138 cranial characters, Tumlison (1993) split *Idionycteris phyllotis* into two subspecies that appear to have different habitat requirements. The preponderance of captures is in scrub woodland and forest, often associated with cliffs and rocky slopes, suggesting a roosting relationship with caverns and rock fissures. Maternity colonies have been found within passages in a large boulder pile (Commissaris 1961), in a sandstone crevice in a natural bridge in Canyon lands (M. Bogan pers. comm.) and a cliff in Grand Escalante (M. Siders, pers. comm.), under exfoliating bark on ponderosa pine snags (Rabe *et al.* 1998; Morrell *et al.* 1999) and in

abandoned mines (Cockrum and Musgrove 1964, Brown and Berry 2001). In Arizona , the only known permanent maternity roosts of lappet-browed bats are in three mines in the vicinity of Union Pass in the Black Mountains, Mojave County . Pregnant individuals have been found in June, parturition occurs in mid- to late June, and lactation extends through July and early August. A single young is produced annually. Lactating females have been captured entering a mine after dark in Utah , possibly to catch moths inside the entrance and to night roost (M. Perkins, pers. comm.). R. Sherwin (pers. comm.) has also seen night-roosting bats and individual males in abandoned uranium mines in Utah . Individuals may move from higher elevation summer ranges to low elevation winter habitats (O'Farrell, unpublished data).

Foraging lappet-browed bats emit loud human-audible echolocation calls, similar to those of spotted bats (*Euderma maculatum*). Lappet-browed bats eat primarily small moths (6-12 millimeters) that possess simple “ears” tuned to ultrasonic frequencies, which may explain the use of lower frequency echolocation signals below the range of the moths’ hearing (Simmons and O’ Farrell 1977). The bats also emit human-audible communication signals, especially near roosts.

An August 2004 telemetry study of 12 post-lactating females from a mine in the Black Mountains demonstrated high roost fidelity when the bats traveled between 70-100 km (43-62 mi) roundtrip nightly to forage in the next mountain range to the east, despite the fact that there were many abandoned mines in the foraging area (Brown and Berry, 2004). Mesquite grassland, scrub oak and pinyon/juniper woodland were present in the higher elevation areas (1500-2000 m; 4921-6562 ft) where the bats were foraging. The elevation of the roost mine is 1000 m (3280 ft) in creosote bush scrub.

IV. THREATS: The threats to the identified lappet-browed bat mine roosts are from active mining and human entry. Chalk Peak Mine is the largest known colony of lappet-browed bats. Currently, the active quarry operation protects the roost from recreational entry; however the roost sites may be eventually mined. The area is under increased recreational pressure by the growing resident and tourist population in nearby Laughlin and Bullhead City . Another colony of lappet-browed bats at the Excelsior Mine (a.k.a. OK Mine) in the White Hills was collapsed in 1999 by renewed mining, possibly burying the bats. A mine roost at Union Pass was destroyed by relocation of a nearby highway (Cockrum *et al.* 1996). The threat of recreational entry into abandoned mines may be exacerbated because preliminary information suggests this species may not accept mine gates. In 2001, three mines used by lappet-browed bats at Union Pass were gated. In 2004, these mines were not occupied and the maternity colony had moved into a nearby un-gated mine.

In the forest range of this species, specific physical requirements and the ephemeral nature of exfoliating bark on tree snag roosts may be limiting (Rabe *et al.* 1998). It is critical that proper forest management provide sufficient roosts for this species. The rarity and patchy distribution of this species, as well as the apparent high degree of specialized feeding strategy, compounds the sensitivity to perturbations or disturbance.

The potential separation of roosting and foraging locations makes management decisions difficult.

In general, the long term persistence of North American bat species is threatened by the loss of clean, open water; modification or destruction of roosting and foraging habitat; and, for hibernating species, disturbance or destruction of hibernacula. Chemicals in the environment that affect bats or their prey are also a threat. Because of low fecundity, high juvenile mortality, and long generational turnover, many bat populations may be vulnerable to human-induced pressures.

V. SURVEY METHODS: *Idionycteris* is captured relatively infrequently in mist nets. They may be difficult to locate during initial surveys. Finding roosts may be difficult, especially in trees and rock crevices, unless radio-telemetry is used. In mines, they are easy to detect since they roost in clusters on an open surface (e.g., domes of mines). However, without disturbing the cluster they can be mistaken for *Corynorhinus townsendii*. The easiest method of detection is acoustic (with a low frequency microphone). Most sequences are diagnostic, except they may be difficult to distinguish from *Euderma maculatum*, with which they geographically overlap throughout much of their range. A very distinctive social call is used, especially near roosts.

VI. GAPS IN KNOWLEDGE: Relatively little is known of maternity roost requirements or the range of roost types used, especially during the winter. Foraging behavior and seasonal requirements in different habitats needs further research. Reproductive biology and population dynamics are poorly understood. It will be necessary to gather these data to properly evaluate potential threats and provide adequate management protocols. The current lack of knowledge of lappet-browed bats suggests the need for focused surveys throughout their geographic range.

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Myotis auriculus

SOUTHWESTERN MYOTIS

Prepared by: M. A. Bogan, E. W. Valdez, and K.W. Navo

I. DISTRIBUTION: *Myotis auriculus*, a member of the Family Vespertilionidae, ranges from central Arizona and New Mexico to southern Mexico. Its distribution in the United States is quite limited. *Myotis auriculus* occurs in southwestern forests that include oak, cottonwood, and mixed conifer, but it is primarily a resident of ponderosa pine forests.

II. STATUS: Global Rank - G5. State Ranks: AZ - S3; NM - S4. Take is regulated by permit in New Mexico and Arizona.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *Myotis auriculus* is a member of the long-eared group of *Myotis* that includes *M. evotis*, *M. keenii*, *M. septentrionalis*, and *M. thysanodes*. *M. auriculus* does not occur within the range of *M. keenii* or *M. septentrionalis* and barely overlaps with *M. evotis*. *Myotis auriculus* has shorter (18-20 mm), brown, not glossy black, ears compared to *M. evotis* and does not have a distinct uropatagial fringe like *M. thysanodes*. It has been observed to glean insects off tree trunks and buildings. When in sympatry with *M. evotis*, *M. auriculus* preys upon moths and some beetles, whereas *M. evotis* feeds primarily on beetles. In allopatry, both species have similar food habits, but exhibit differences in food preference between sexes (e.g., male *M. auriculus* eat more moths). *M. auriculus* is most active from 0.5 to 2 h after sunset and in New Mexico is seasonally active from April to September. Some evidence for seasonal migrations exists in Arizona. The species is known to roost in caves, mines, and buildings. Females are pregnant in early to mid-June and give birth to a single young in late June and early July. One banded individual lived a minimum of 3 years, 2 months. The early literature refers to this species as *M. evotis* or *M. keenii*.

IV. THREATS: May be affected by recreational caving, closure of abandoned mines without surveys, and certain forest-management practices.

V. GAPS IN KNOWLEDGE: No information known about population trends, roost requirements, and use and acceptance of bat gates. Also more information is needed on foraging requirements.

VI. RELEVANT LITERATURE:

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Myotis californicus

CALIFORNIA MYOTIS

Prepared by: M. A. Bogan, E. W. Valdez, and K.W. Navo

I. DISTRIBUTION: *Myotis californicus*, a member of the Family Vespertilionidae, ranges across much of western North America from southeastern Alaska and southwestern British Columbia, through most of the United States west of the Rocky mountains, and south to Baja California and much of mainland Mexico, and into Guatemala. This species occurs in a wide variety of habitats. While typical of deserts and interior basins in the western U. S., it also occurs in forested and montane regions.

II. STATUS: Global Rank - G5. State Ranks: AZ - S4S5; CA - S5; CO - S3S4; ID - S3; MT - S4; NM - S5; NV - S?; OR - S4; TX - S4; UT - S3S4; WA - S?; WY - S4; BC - S4S5. Take usually regulated by permit procedures in individual states.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *Myotis californicus* is a small bat with dark brown to black ears and wing membranes, a distinctly keeled calcar, and pelage that varies from dark brown to pale reddish-yellow to blond. It is an acrobatic flyer and uses small waterholes to obtain needed moisture; its kidneys are adapted for arid environments. *Myotis californicus* differs from *M. ciliolabrum*, which is sympatric and similar in appearance, by having a more globose skull, narrower rostrum, overall more delicate appearance, and no black mask. These two species are often difficult to distinguish in the field. Individuals are most active soon after sunset and periodically rest at a night roost. They typically feed on moths and flies, but have been known to eat other insects. *Myotis californicus* mates during autumn, perhaps in the spring in California. In spring or early summer, females form maternity colonies where they give birth to one pup per year. Individuals have been known to live up to 15 years. During summer, *M. californicus* roost alone or in small groups in caves, mines, rocky hillsides, under tree bark, and in buildings. Recent studies in Canada have documented maternity colonies of up to 52 individuals roosting under sloughing bark, and in cracks and hollows of large diameter, intermediate stage snags (preferably ponderosa pine). In winter, solitary individuals and small groups have been found in caves, mines, and buildings. Individuals are known to be active periodically in the winter, even at temperatures below freezing.

IV. THREATS: May be affected by closure of abandoned mines without adequate surveys and by recreational caving. This species may be affected by some timber harvest practices, particularly the removal of large diameter snags. Like all bats it also could be subject to contaminant poisoning.

V. GAPS IN KNOWLEDGE: No information known on population trends and use and acceptance of bat gates. More information is needed on roosting and foraging requirements.

VI. RELEVANT LITERATURE:

- Bogan, M. A. 1974. Identification of *Myotis californicus* and *M. leibii* in southwestern North America. Proceedings Biological Society Washington 87:49-56.
- Bogan, M. A. 1975. Geographic variation in *Myotis californicus* in the southwestern United States and Mexico. U.S. Fish and Wildlife Service, Wildlife Research Report 3: 1-31.
- Bogan, M. A. In Press. *Myotis californicus*. In: Book of North American Mammals, D. E. Wilson, ed. Smithsonian Press, Washington, D.C.
- Brigham, R. M., M. J. Vonhof, R. M. R. Barclay, and J. C. Gwilliam. 1997. Roosting behavior and roost-site preferences of forest-dwelling California bats (*Myotis californicus*). Journal of Mammalogy, 78(4):1231-1239.
- Simpson, M. R. 1993. *Myotis californicus*. American Society of Mammalogists, Mammalian Species, 428:1-4.

Myotis ciliolabrum

WESTERN SMALL-FOOTED MYOTIS

Prepared by: M. A. Bogan, E. W. Valdez, and K.W. Navo

- I. DISTRIBUTION: *Myotis ciliolabrum*, a member of the Family Vespertilionidae, ranges across the western half of North America from British Columbia, Alberta, and Saskatchewan in Canada, throughout most of the United States west of the 100th Meridian, and into central Mexico.
- II. STATUS: Global Rank - G5. State Ranks: AZ - S3; CA - S?; CO - S4; ID - S4; MT - S4; NM - S5; NV - S3; OR - S3; TX - S3; UT - S3S4; WA - S3; WY - S4; AL - S2; BC - S2S3. Former category 2 candidate species. U.S. Forest Service and Bureau of Land Management list as special status; generally regulated by state permit procedures.
- III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *M. ciliolabrum* is a small bat with a keeled calcar, small foot, black ears, and a black mask across the eyes and nose. Pelage varies from brown to pale yellow. *Myotis ciliolabrum* differs from *M. californicus*, which is sympatric and similar in appearance, by having a longer, broader, and flatter skull with a gradual slope from cranium to rostrum; overall it is a more robust bat. However, these two species are often difficult to distinguish in the field. *M. ciliolabrum* occurs in deserts, chaparral, riparian zones, and western coniferous forest; it is most common above piñon-juniper forest. Individuals are known to roost singly or in small groups in cliff and rock crevices, buildings, concrete overpasses, caves, and mines. They forage early in the evening, feeding on various small insects. Copulation takes place

in the fall, with sperm being stored in females until spring when ovulation occurs. *M. ciliolabrum* produces one young per year in late spring or early summer. Individuals have been known to live up to 12 years. Older literature refers to this species as *M. subulatus* and *M. leibii*.

IV. THREATS: May be affected by closure of abandoned mines without adequate surveys and by recreational caving. Contaminant poisoning is a possibility.

V. GAPS IN KNOWLEDGE: No information known on population trends, and use and acceptance of bat gates. More information is needed on roosting and foraging requirements.

VI. RELEVANT LITERATURE:

Bogan, M. A. 1974. Identification of *Myotis californicus* and *M. leibii* in southwestern North America. Proceedings Biological Society Washington 87:49-56.

Bogan, M. A. In Press. *Myotis ciliolabrum*. In: Mammals of North of America, D. E. Wilson, ed. Smithsonian Press, Washington, D.C.

van Zyll de Jong, C.G. 1984. Taxonomic relationships of Nearctic small-footed bats of the *Myotis leibii* group (Chiroptera: Vespertilionidae). Canadian Journal Zoology 62:2519-2526.

van Zyll de Jong, C.G. 1985. Handbook of Canadian mammals; 2, bats. National Museum of Natural Sciences, Ottawa, 212 pp.

Myotis evotis

LONG-EARED MYOTIS

Prepared by: M. A. Bogan, E. W. Valdez, and K.W. Navo

I. DISTRIBUTION: *Myotis evotis*, a member of the Family Vespertilionidae, ranges across western North America from southwestern Canada (British Columbia, Alberta and Saskatchewan) to Baja California and eastward in the United States to the western Great Plains.

II. STATUS: Global Rank - G5. State Ranks: AZ - S3; CA - S3S4; CO - S4; ID - S4; MT - S4; NM - S4; NV - S?; OR - S3; TX - SX; UT - S3S4; WA - S3; WY - S4; AL - S2; BC - S4S5. Former category 2 candidate species. Some federal agencies list the species as being of concern; take usually regulated by state permit.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *M. evotis* has pale brownish to straw-colored pelage. It is distinguished from *M. auriculus* and *M.*

thysanodes by having long (19 to 25 mm), glossy black ears and no distinct fringe of hairs along the edge of the uropatagium. *M. evotis* eats moths and small beetles, as well as flies, lacewings, wasps, and true bugs. In areas where *M. evotis* and *M. auriculus* are sympatric, *M. evotis* tends to eat more beetles. This species is a slow flier and is often described as a hovering gleaner that feeds by eating prey off foliage, tree trunks, rocks, and from the ground. It generally leaves its roost for foraging after dark, but individuals have been caught as early as 0.5 h after sunset. *M. evotis* occurs in semiarid shrublands, sage, chaparral, and agricultural areas, but is usually associated with coniferous forests. Individuals roost under exfoliating tree bark, and in hollow trees, caves, mines, cliff crevices, sinkholes, and rocky outcrops on the ground. They also sometimes roost in buildings and under bridges. During the summer, females form small maternity colonies, whereas males and non-reproductive females roost alone or in small groups nearby. Females give birth to one young in late spring to early summer. Individuals have lived up to 22 years. Presumably, most individuals hibernate during the winter.

IV. THREATS: May be affected by closure of abandoned mines without surveys, recreational caving, some forest-management practices, and activities (such as highway construction, water impoundments, blasting of cliffs for avalanche control) that impact cliff faces or rock outcrops.

V. GAPS IN KNOWLEDGE: Little or no information known on population trends, winter roosting requirements, winter range, importance of snags as summer roosts, and use and acceptance of bat gates. Also more information is needed on foraging requirements.

VI. RELEVANT LITERATURE:

Bogan, M.A. In Press. *Myotis evotis*. In: Mammals of North America, D.E. Wilson, ed. Smithsonian Press, Washington, D.C.

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Manning, R.W. 1993. Systematics and evolutionary relationships of the long-eared myotis, *Myotis evotis* (Chiroptera: Vespertilionidae). Special Publications, The Museum, Texas Tech University No. 37, 1-58pp.

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Vonhof, M. J. and R. M. Barclay 1997. Use of tree stumps as roosts by the western long-eared bat. *Journal of Wildlife Management*, 61:674-684.

Myotis keenii

KEEN'S MYOTIS

Prepared by: J. Wenger

I. DISTRIBUTION: *Myotis keenii*, a member of the Family Vespertilionidae, has a very limited distribution, reaching from southeastern Alaska south along the coast and coastal islands of British Columbia to the area of Puget Sound in Washington. The winter range is unknown.

II. STATUS: Global Rank - G2G3. State Ranks: WA - SH; BC - S2?. *M. keenii* was **designated rare in 1988 (WHERE?) in 1988**; in 1990 the designation known as rare was changed to a new designation, vulnerable.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *M. keenii* is an inhabitant of dense, mature forests. The only known maternity colony of 70 animals roosts under rocks heated by a natural hot spring. Other likely roost sites are hollow trees, rock crevices and small caves. This species has been observed foraging over hot spring pools, over shrubs, and possibly in the forest canopy, along the forest edge, and over ponds and clearings. Juveniles and lactating females have been observed in late July, suggesting young are born in late June or early July. This species has recently been discovered hibernating in a cave in British Columbia.

IV. THREATS: Habitat (roosting as well as foraging) loss through logging and forest fires seem to be the main limiting factors for Keen's long-eared bats. Old growth forests and riparian areas appear to be essential for continued viability of this species.

V. GAPS: Information is needed on *M. keenii* regarding the status of the species, size of population, biology, and ecology. There is little information on this species due to difficulties in field identification. *M. keenii* is virtually identical to *Myotis evotis* which has longer ears (3 mm longer) and very similar to *Myotis thysanodes* which has a fringe of hairs on the edge of the tail membrane and shorter ears.

VI. RELEVANT LITERATURE:

Chatwin, T.A., M. Davis, and D. Nagorsen. 1997. [ABS]. Bat usage of the Weymer Creek cave system on northern Vancouver Island, Canada. *Bat Research News* 38(3). In Press.

Nagorsen, D. W. and R. M. Brigham 1993. *Bats of British Columbia*. Vol. University of British Columbia Press, Vancouver, BC. 164 pp.

Parker, D.I., J.A. Cooko., and S.W. Lewis. 1996. Effects of timber harvest on bat activity in southeastern Alaska's temperate rainforests. Pp. 277-292 in R. M. R. Barclay and M. R. Brigham, eds. Bats and Forests Symposium, October 19-21, 1995, Victoria, British Columbia, Canada. Research Branch, Ministry of Forests, Victoria, British Columbia, Working Paper 23/1996.

van Zyll de Jong, C. G. 1985. Handbook of Canadian mammals. Vol. 2: Bats. National Museum of Natural Sciences, Ottawa, Ontario. 212 pp.

Myotis lucifugus

LITTLE BROWN BAT

Prepared by: William E. Rainey

I. DISTRIBUTION: *Myotis lucifugus* is among the most widespread and common bats in mesic, typically forested, areas of temperate North America. Overall distribution extends from near the treeline in Canada and Alaska to the southern tier of the United States. There is a distributional gap extending south from the largely treeless Great Plains through Texas. In the western U.S., this species is typically absent from hot, arid lowlands, but extends south (at increasing elevation) along forested mountain ranges into southern California, Nevada, Utah, and Colorado.

II. STATUS: Global Rank - G5. State Ranks: AZ - S3; CA - S4; CO - S5?; ID - S5; MT - S5; NM - S5; NV - S?; OR - S4; TX - SA; UT - S4; WA - S?; WY - S5; AL - S5; BC - S4S5.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *M. lucifugus* is a medium size *Myotis* which lacks a calcar and has moderate length pointed ears with a blunt tragus. Pelage color is highly variable, but fur is typically longer, darker, and more glossy than similar co-occurring species. In the Northwest, external morphology and skull characters are insufficient to reliably assign a small percentage of individuals to *M. lucifugus* or the similar *M. yumanensis*, but intermediate individuals in southwest British Columbia were identifiable to species on biochemical characters. A few individuals in southern Colorado and northern New Mexico are intermediate in skull characters between *M. lucifugus* and *M. occultus* (which are sometimes synonymized). Body size (and time to maturity) increases with latitude.

Among woodland/forest bats, *M. lucifugus*, is an ecological generalist exploiting a wide variety of natural and man-made roost sites and a taxonomically wide spectrum of flying insect prey, including emerging adults of aquatic species. Summer maternity colony sites (consisting largely of reproductive females and dependent young) include tree cavities, caves and human-occupied structures. Fidelity to physically stable day and night roost sites is strong and individuals return for many years. Active season roosting by males and non-reproductive females is little studied, but male aggregations are known. Daily

foraging movements are likely in the 1-10 km range, seasonal aggregation at mass hibernation sites may involve larger distances. Hibernation sites (typically caves and abandoned mines) and seasonality have been studied in eastern and mid-continent populations, but are poorly known in the west.

IV. THREATS: The primary threats are common themes for forest bats -- alterations in snag density and recruitment by timber harvest, liability reduction, agricultural or residential habitat conversion or riparian forest alteration for flood control. This species often occupies structures and is vulnerable to pest control operations. Highly aggregated hibernation in abandoned mines in eastern and central North America suggests closure of cold mines without adequate survey could have major population impact. Populations in montane forest islands, especially near the southern range limit, are at greater risk because population sizes and available habitat are small and development pressures (e.g., forest recreation) can be high.

V. GAPS IN KNOWLEDGE: Lack of knowledge of hibernation sites (and the degree of population aggregation at these sites) is a key point of vulnerability for this species. Inadequate systematic resolution may affect management decisions (e.g., the status of *M. occultus*). Isolated populations in montane forest islands may be sufficiently differentiated to deserve taxonomic recognition. The status of these should be carefully evaluated as their habitats and population sizes may be small and subject to strong development pressure.

VI. SELECTED LITERATURE:

Adams, R. A. 1990. Biogeography of bats in Colorado - ecological implications of species tolerances. *Bat Research News* 31:17-21.

Fenton, M. B. and R. M. R. Barclay 1980. *Myotis lucifugus*. *Mammal. Species* 142: 1-8.

Herd, R. M. and M. B. Fenton 1983. An electrophoretic, morphological, and ecological investigation of a putative hybrid zone between *Myotis lucifugus* and *Myotis yumanensis* (Chiroptera: Vespertilionidae). *Can. J. Zool.* 61:2029-2050.

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Jones, J. K., D. M. Armstrong, R. S. Hoffmann, and C. Jones. 1982. *Mammals of the Northern Great Plains*. University of Nebraska Press, Lincoln. 379 pp.

Thomas, D. W. and S. D. West. 1991. Forest age associations of bats in the southern Washington Cascade and Oregon coast ranges. U.S. Forest Service. General Technical Reports PNW 295-303.

Schmidly, D. J. 1991. *The bats of Texas*. University of Texas Press, Austin. 189 pp.

Myotis occultus

ARIZONA MYOTIS

Prepared by: Susan Murdock

I. DISTRIBUTION: *Myotis occultus*, a member of the Family Vespertilionidae, has been found from southeastern California through Arizona, New Mexico, and south into Chihauhau, Mexico. There is a single record from western Texas. It occurs south into Chihauhau, Mexico. The Western Bat Species Global and State Ranks also lists this species as occurring in Nevada.

II. STATUS: Global Rank - G5T3T4. State Ranks: AZ - S3; CA - S?; NM - S3; NV - S1; TX - SA. It is considered a Species of Special Concern in California, and was formerly a category 2 candidate (as a subspecies of *Myotis lucifugus*).

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *M. occultus* is a medium sized *Myotis* (forearm 36-41 mm) that lacks a keeled calcar, and could most easily be confused with *M. yumanensis* (forearm 33-36 mm) or *M. lucifugus* with which it overlaps in size. Although originally described as a separate species, it was for many years considered a subspecies of *M. lucifugus*. While some investigators still treat it as a subspecies of *M. lucifugus*, Hoffmeister (1986) argued, based on a principal components analysis of 25 cranial measurements, that *M. occultus* should be considered a separate species. *M. occultus* is most commonly found in conifer forests in the 6,000 - 9,000 foot elevation range, although nursery colonies were known from much lower elevations (e.g., along the Colorado River in California). In the 1960's, it was reported to be one of the most common *Myotis* species at higher elevations in New Mexico. This species has been found using bridges and attics as maternity roosts, with colony size up to 800. A recent radiotracking study in Arizona identified three maternity roosts, one in a building and two in large ponderosa pine snags. Limited information suggests that females give birth to a single young, generally in June, at lower elevations they are known to forage in association with orchards, permanent water, and riparian vegetation, and at higher elevations over ponds in forest clearings. No information is available on its diet. No information is available on winter habits.

IV. THREATS: The main threat to these animals appears to be lack of enough knowledge about them to develop any kind of conservation strategy. Recent discovery of tree roosting suggests timber harvest practices could affect status.

V. GAPS IN KNOWLEDGE: More systematic investigations, including molecular comparisons, are needed to evaluate the status of this species. More information is

needed on roosting requirements (particularly in natural roosts), seasonal patterns, foraging requirements, and status of populations.

VI. RELEVANT LITERATURE:

Barbour, R.W. and W.H. Davis. 1969. Bats of America. University of Kentucky Publ., 286 pp.

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Cockrum, E. L., B. Musgrove, and Y. Petryszyn. 1996. Bats of Mohave County, Arizona: Populations and Movements. Occasional Papers, the Museum, Texas Tech University, 157:1-71.

Findley, J. S., and C. Jones. 1967. Taxonomic relationships of the bats of the species *Myotis fortidens*, *M. lucifugus*, and *M. occultus*. Journal of Mammalogy, 48:429-444.

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MYOTIS SEPTENTRIONALIS **NORTHERN MYOTIS**

Prepared by: M. A. Bogan, E. W. Valdez, and K.W. Navo

I. DISTRIBUTION: *Myotis septentrionalis*, a member of the Family Vespertilionidae, ranges from British Columbia and Alberta, Canada, eastward to the Atlantic Ocean and southward to Arkansas and Florida. It is primarily an eastern species, but does occur in North Dakota, South Dakota, eastern Wyoming, eastern Nebraska, Kansas, and eastern Oklahoma.

II. STATUS: Global Rank - G4. State Ranks: MT - S2; TX - SA; AL - S3; BC - S1S3. Take regulated by permit in some states.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *Myotis*

septentrionalis is a medium-sized bat that has dull, yellowish-brown pelage with pale, grey ventral pelage. This species is similar to *M. lucifugus*, from which it can be distinguished by having ears that extend beyond the tip of the nose when laid forward (ear length: 17-19 mm) and a long, pointed tragus. The calcar often has a slight keel. This species forages at dusk or shortly after sunset with intermittent periods of night roosting and then a second peak of activity just before dawn. It roosts singly or as small groups in buildings, under shingles of buildings, under exfoliating tree bark, and in caves and mines. Occasionally, these bats day roost with other bat species such as *M. lucifugus*, *Eptesicus fuscus*, and *Pipistrellus subflavus*. During autumn, *M. septentrionalis* congregate into groups of a few hundred individuals, and often copulate before they go into torpor. Pregnant females have been recorded in late spring and lactating females were captured as late as mid-August in the Black Hills. Females give birth to one young per year. Individuals have been known to live up to 18.5 years. This species was formerly considered an eastern subspecies of *M. keenii* (*M. keenii septentrionalis*).

IV. THREATS: May be affected by recreational caving, closure of abandoned mines without surveys, pest control activities in human structures, and some forest-management practices.

V. GAPS IN KNOWLEDGE: No information known about population trends, reproduction, and use and acceptance of bat gates. More information is needed on roosting and foraging requirements.

VI. RELEVANT LITERATURE:

Sasse, D.B. and P. J. Pekins. 1996. Summer roosting ecology of northern long-eared bats (*Myotis septentrionalis*) in the White Mountain National Forest. Pp. 91-101 in Bats and forests symposium, R.M. R. Barclay and R.M. Brigham, eds. B.C. Ministry of Forests, Research Branch, Victoria, B.C., Working Paper 23/1996.

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Myotis thysanodes

FRINGED MYOTIS

2005 Update by: Theodore J. Weller

Original account by: Pete Bradley and Mark Ports

I. **DISTRIBUTION:** *Myotis thysanodes* ranges through much of western North America from southern British Columbia, Canada, south to Chiapas, Mexico and from Santa Cruz Island in California, east to the Black Hills of South Dakota (Figure 1). *M. thysanodes* occurs from sea-level to 2850 m but is most common at middle elevations 1200 Ð 2100 m. Distribution is patchy. It appears to be most common in drier woodlands (oak, pinyon-juniper, ponderosa pine) but is found in a wide variety of habitats including desert scrub, mesic coniferous forest, grassland, and sage-grass steppe.

Three subspecies have been recognized: *M. t. thysanodes* in the main portion of its range, *M. t. pahasapensis* from the Black Hills of South Dakota, Wyoming and Nebraska, and *M. t. aztecus* from Oaxaca, Mexico. A fourth subspecies, *M. t. vespetinus* has been suggested to occur west of the Cascade mountains in southern Washington, Oregon, and northern California. Recent molecular work has found great genetic variation within long-eared *Myotis* species in western North America. For instance, within species sequence divergence has so far appeared greater across the range of *M. thysanodes* than from *M. evotis* in close geographic proximity. Further, genetic variability has not been consistent with recognized subspecies boundaries.

II. **STATUS:** Global Rank Ð G4. State Ranks: AZ - S3S4; CA - S4; CO - S3; ID Ð S2; MT -S3; NM - S5; NV Ð S2B; OR Ð S2S3; SD Ð S2; TX - S3; UT - S3B; WA - S3; WY Ð S2; BC - S2S3. *M. thysanodes* is widespread in western North America but distribution is patchy in most portions of its range. It is a Species of Special Concern in California, Idaho, Oregon, Utah, and Wyoming.

III. **IDENTIFYING CHARACTERISTICS AND LIFE HISTORY:** *M. thysanodes* can be distinguished from other species by a conspicuous fringe of hair along the posterior edge of its interfemoral membrane. It has long forearms and ears relative to other *Myotis* in the region. Pelage color is variable (brown to reddish brown) and often noticeably lighter on ventral side. In some areas, *M. thysanodes* can be difficult to distinguish from *M. evotis*. *M. thysanodes* may also be difficult to distinguish from *M. keenii* in the northwest portion of its range.

M. thysanodes roosts in crevices in buildings, underground mines, rocks, cliff faces, and bridges. Roosting in decadent trees and snags, particularly large ones, is common throughout its range in western U. S. and Canada. *M. thysanodes* roosts have been documented in a large variety of tree species and it is likely that structural characteristics (e.g. height, decay stage) rather than tree species play a greater role in selection of a snag

or tree as a roost. Maternity roosts are colonial with colonies ranging from 10-2,000 individuals, though large colonies are exceedingly rare. Much less information is available on roosts of males, but it is thought that they roost singly or in small groups. The information available on hibernation is largely limited to an accounting of the types of structures used as hibernacula including: caves, mines and buildings.

Copulation likely occurs in the fall following break-up of the maternity colony. Sperm are stored over winter and ovulation, fertilization and implantation occur late April to early May. Gestation lasts about 50 - 60 days. One young per female is born beginning in late June but likely varies according to latitude, elevation, and climate. Young are capable of flight at 16 days and fully volant at 20 days.

M. thysanodes feeds on a variety of invertebrate taxa and the relative importance of prey items may vary according to prey availability, geography, or time period. The two most commonly reported orders in its diet are beetles (Coleoptera) and moths (Lepidoptera). However, several potentially flightless taxa such as Phalangida (harvestmen), Araneida (spiders), and Gryllidae (crickets) have been found in its diet. The presence of non-flying taxa in its diet indicates that *M. thysanodes* may glean prey from vegetation in addition to capturing prey on the wing. The potential to glean prey in concert with its wing-loading, flight style, morphological adaptations of wing and tail membranes, and design of its echolocation call indicate that *M. thysanodes* is adapted for foraging within forest interior and along forest edges.

IV. THREATS: Threats identified to date for *M. thysanodes* largely focus on loss or modification of roosting habitat. Specifically *M. thysanodes* may be threatened by: closure or renewed activity at abandoned mines, recreational caving and mine exploration loss of current and future large, decadent trees and replacement of buildings and bridges with non- bat friendly structures. Removal of large blocks of forest or woodland habitat may also threaten the species due to its apparent propensity for foraging in and around trees.

In general, the long term persistence of North American bat species is threatened by the loss of clean, open water; modification or destruction of roosting and foraging habitat; and, for hibernating species, disturbance or destruction of hibernacula. Chemicals in the environment that affect bats or their prey are also a threat. Because of low fecundity, high juvenile mortality, and long generational turnover, many bat populations may be vulnerable to human-induced pressures.

V. SURVEY METHODS: Capture is the most reliable method to identify *M. thysanodes* because of its low-intensity echolocation call and habit of roosting in crevices. Once captured, identification is generally easy, but it may be morphologically similar to *M. evotis* in some regions. Low-intensity makes echolocation calls difficult to detect but, relative to other *Myotis*, are more readily identified. Identification using echolocation requires experience and humility. Not all calls will be identifiable and confirming species presence with capture is preferable. As *M. thysanodes* is a crevice roosting species it is difficult to detect particularly at natural roosts (e.g., trees and rock crevices). It can

sometimes be detected in man-made roosts, but requires capture to confirm species identification

VI. GAPS IN KNOWLEDGE: Knowledge of the following is lacking: 1. Hibernation roosts and winter behavior; 2. migration behavior; 3. range or region-wide population status; 4. foraging habitat selection; 5. adult male life history; 6. breeding locations and behavior; 7. reason that distribution appears patchy.

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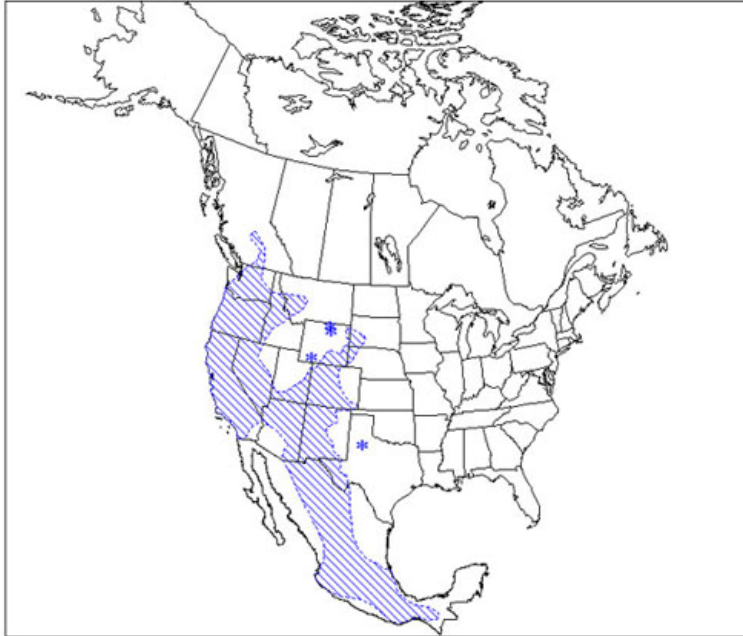


Figure 1. Range map courtesy of Bat Conservation International.
<http://www.batcon.org/discover/species/mythysan.html>

Myotis volans

LONG-LEGGED MYOTIS

Prepared by: M. A. Bogan, E. W. Valdez, and K.W. Navo

I. DISTRIBUTION: *Myotis volans*, a member of the Family Vespertilionidae, ranges across western North America from southeastern Alaska, British Columbia and Alberta in Canada to Baja California and central Mexico. It occurs throughout the western United States from the Pacific coast to the Great Plains and central Texas.

II. STATUS: Global Rank - G5. State Ranks: AZ - S3; CA - S5; CO - S5; ID - S3; MT - S4; NM - S5; NV - S?; OR - S3; TX - S4; UT - S3S4; WA - S3; WY - S4; AL - S2; BC - S4S5. Former category 2 candidate species. Take regulated by permit in various states. Proposed as a Species of Special Concern in California.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *Myotis volans* is recognized by its short rounded ears, small hindfeet, long tibia, distinctly keeled calcar, and long, dense fur on the underside of the wing membrane that extends from the body to a line joining the elbow and the knees. Although some variation in color exists, it is typically dark brown. It is a bat primarily of coniferous forests, but also occurs seasonally in riparian and desert habitats. It is a relatively poor urine concentrator. *M. volans* uses abandoned buildings, cracks in the ground, cliff crevices, exfoliating tree bark, and

hollows within snags as summer day roosts; caves and mine tunnels as hibernacula. It is active throughout the night, but peak activity is 3-4 hours after sunset. It is a rapid, direct flier, often traveling some distance while foraging, and feeds in and around the forest canopy, primarily on moths and other soft-bodied insects. Individuals copulate in autumn, with females storing the sperm overwinter, ovulating in the spring, and giving birth from May through August. Individuals have lived a minimum of 21 years.

IV. THREATS: May be affected by closure of abandoned mines without adequate surveys and certain forest-management practices. Residues of DDT and its metabolites have been found in this species in Oregon.

V. GAPS IN KNOWLEDGE: No information known on population trends and use and acceptance of bat gates. More information is needed on roosting and foraging requirements.

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Myotis yumanensis YUMA MYOTIS

Prepared by: M. A. Bogan, E. W. Valdez, and K.W. Navo

I. DISTRIBUTION: *Myotis yumanensis*, a member of the Family Vespertilionidae, ranges across the western third of North America from British Columbia, Canada, to Baja California and southern Mexico. In the United States, it occurs in all the Pacific coastal

states, as far east as western Montana in the north, and as far east as western Oklahoma in the south.

II. STATUS: Global Rank - G5. State Ranks: AZ - S3S4; CA - S5; CO - S3; ID - S3; MT - S3; NM - S5; NV - S?; OR - S3; TX - S4; UT - S3; WA - S?; WY - S2?; BC - S4S5. Former category 2 candidate species. Take regulated by permit in some states.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: *Myotis yumanensis* is a small bat that is usually gray or brown to pale tan dorsally with a paler venter of tan or gray; ears and membranes are frequently pale brown to gray. In some areas *M. yumanensis* is difficult to distinguish from *M. lucifugus* and caution is required. Both species are usually associated with permanent sources of water, typically rivers and streams, but Yuma myotis also use tinajas in the arid West. It occurs in a variety of habitats including riparian, arid scrublands and deserts, and forests. The species roosts in bridges, buildings, cliff crevices, caves, mines, and trees. Individuals become active and forage just after sunset, feeding primarily on aquatic emergent insects. Their diet is known to include caddis flies, flies, midges, small moths and small beetles. After feeding, they periodically rest at night roosts where the food is digested. Mating is typically in the fall and females give birth to one young from mid-spring to mid-summer in maternity colonies that may range in size up to several thousand; males tend to roost singly in the summer.

IV. THREATS: May be affected by closure of abandoned mines without adequate surveys, some forest management practices, and disturbance of maternity roosts in caves and buildings. Since this species frequently occurs in anthropogenic structures, it is vulnerable to destructive pest control activities. Some riparian-management practices may be detrimental.

V. GAPS IN KNOWLEDGE: No information known on use and acceptance of bat gates, impacts of grazing and riparian habitat management, winter range, and winter roost requirements. Information is needed on geographic variation in roosting and foraging requirements.

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Tadarida brasiliensis mexicana
MEXICAN FREE-TAILED BAT

Prepared by: Bat Conservation International

I. DISTRIBUTION: *Tadarida brasiliensis*, a member of the Family Molossidae, is one of the most widely distributed mammalian species in the Western Hemisphere. There are nine recognized subspecies, two in the United States. *T. b. mexicana* is primarily western, occurring from southern Oregon to eastern Nebraska, and south through Mexico. *T. b. cynocephala* is primarily a southeastern species, from eastern Kentucky into South Carolina and south through Florida. *T. brasiliensis* ranges southward through most of Central America. In the western United States, *T. brasiliensis* is most commonly associated with dry, lower elevation habitats, yet it also occurs in a variety of other habitats, and is found up to at least 3,000 m. in some of the western mountain ranges.

II STATUS: Global Rank - G5. State Ranks: AZ - S3/S4; CA - S4/S5; CO - S1; NM - S2; NV - S?; OR - S2; TX - S5; UT - S3/S4; WY - S5. *T. brasiliensis* is widely regarded as one of the most abundant mammals in North America, and is not on any Federal lists. However, its proclivity towards roosting in large numbers in relatively few roosts makes it especially vulnerable to human disturbance and habitat destruction. Documented declines at some roosts are cause for concern. It is considered a Species of Special Concern due to declining populations and limited distribution in Utah.

III. IDENTIFYING CHARACTERISTICS AND LIFE HISTORY: Like other molossid (free-tail) species, *T. brasiliensis* has a tail which extends well beyond the back edge of the interfemoral membrane. *T. brasiliensis* can be distinguished from the other molossids occurring in the United States by the characteristic that its the ears are not joined basally at the mid-line. This species is highly colonial with maternity colonies ranging in size from a few hundred to 20 million. The most commonly used natural roosts are caves and rock crevices on cliff faces. This species also roosts in abandoned mines and tunnels, highway bridges and large culverts, buildings, and bat houses. Maternity roosts are usually warmer and larger than bachelor or non-reproductive female roosts. *T. brasiliensis*

will, during spring cold snaps, take refuge in cliff swallow nests. Brazilian free-tailed bats often fly more than 50 km to reach foraging areas. Such flight is rapid, direct, and often involves gliding. Bats from one colony may cover areas as large as 400 km² and move at speeds over 40 km/hour and at altitudes of 3,000 meters or more. Foraging occurs at high elevations and also at heights of 6 to 15 meters. *T. brasiliensis* consumes a large variety of agricultural pests, mostly moths, but also flying ants, weevils, stink-bugs and ground beetles. *T. b. mexicana* is primarily migratory, with large numbers of females returning to large, warm caves in Texas, New Mexico, Arizona, and Oklahoma each spring. Few adult males return northward; mating probably occurs in lower latitudes of the winter range. Seasonal patterns elsewhere in the west are less clear. Birth usually occurs between mid-June and mid-July. Adult mass is reached in as little as three weeks, and first flight occurs 2-3 weeks later.

IV. THREATS: Besides the human disturbance and habitat destruction, or alteration of suitable caves, mines, bridges, and old buildings noted above, there are problems with pesticide poisoning and deliberate eradication attempts. Human rabies deaths attributed to *T. brasiliensis* foster attitudes for the destruction of *T. brasiliensis* roosts and colonies.

V. GAPS IN KNOWLEDGE: Although most major maternity roosts in the United States are now protected, much remains to be done with winter roosts in Mexico. More documentation of the role of *T. b. mexicana* in agriculture, and the use of artificial roosts to attract them, is needed. Its ecology, distribution, and seasonal patterns are not well understood in some parts of its range, particularly California, Nevada, southern Oregon, and Utah).

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