Nevada Bat
Conservation Plan

Nevada Bat
Working Group
2002

Abstract

The Nevada Bat Working Group (NBWG), a subcommittee of the Western Bat Working Group (WBWG) is an assemblage of wildlife scientists dedicated to the preservation, protection, management and restoration of Nevada's bat fauna. In 1998, the NBWG dedicated itself to the production of a comprehensive conservation plan for Nevada's 23 bat species. This document is a result of those efforts. The plan assesses the current state of bat conservation in Nevada and suggests proactive strategies for improving and standardizing the conservation of all of Nevada's bats. The plan profiles each species and cross-references conservation strategies by roosting and foraging habitats specific to each bat. Conservation support materials in the form of research need summaries, survey protocols, permit requirements, standardized data collection sheets, approved gate and bridge designs, current and proposed legislation, as well as NBWG habitat position statements were appended for ease of retrieval for managers charged with the stewardship of Nevada's bat resource. This document is designed to guide and educate public and private land managers in the conservation of Nevada's bats into the next decade. Signatories have dedicated their agencies to the implementation of the plan. It is the intent of the NBWG that this plan is seen as a dynamic document and one that would be updated on a ten-year cycle to reflect improvements in the knowledge base of bat conservation in the State of Nevada.

KEY WORDS: Nevada, bats, conservation, habitat, *Chiroptera*.

CITATION:

Altenbach, J. S., W. Amy, P. V. Bradley, P. E. Brown, K. Dewberry, D. B. Hall, J. Jeffers, B. Lund, J. E. Newmark, M. J. O'Farrell, M. Rahn, R. E. Sherwin, C. R. Tomlinson, J. A. Williams. 2002. Nevada Bat Conservation Plan. Nevada Bat Working Group. Austin, Nevada. 188 pp.

COVER AND TEXT ILLUSTRATIONS:

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SIGNATURE PAGE

Whereas, the conservation of Nevada's biological diversity is one of the cornerstones of our quality of life,

Therefore, we the undersigned pledge to work toward the conservation of Nevada's bat fauna through implementation of the tenets of this plan.

Cooperators	Date
Bat Conservation International, President	6/28/02
Nevada Department of Conservation and Natural Resources Nevada Division of Wildlife, Administrator	2 July 02
Nevada Department of Conservation and Natural Resources Nevada Natural Heritage Program, Director	27 Jun '02
The Nature Conservancy Nevada Chapter, State Director	6/31/02
Western Bat Working Group, Chairman	6/27/02

EXECUTIVE SUMMARY

This document is a product of several years of research by dozens of wildlife scientists dedicated to the conservation of Nevada's bats. Individuals from several jurisdictions came together with a common purpose, a commitment to the long term preservation, protection, management and restoration of all bat populations in the State. This document is intended to be a dynamic model for the conservation of Nevada's bat fauna far into the next decade.

ACKNOWLEDGMENTS

A big thank you goes out to several individuals and agencies for their moral and financial support of the Nevada Bat Working Group and in the initiation, production and eventual distribution of this document. They include:

American Cave Conservation Association
Audubon Society
Bat Conservation International, Inc.
Bechtel Nevada
Brown-Berry Biological Consulting
Bureau of Land Management (BLM)
Great Basin College-Elko (GBC)
National Nuclear Security Administration, Nevada Operations Office (NNSA/NV)
National Park Service (NPS)
Nevada Division of Wildlife (NDOW)
Nevada Natural Heritage Program (NNHP)
O'Farrell Biological Consulting
San Diego State University (SDSU)
The Nature Conservancy (TNC)
University of Nevada-Las Vegas (UNLV)
University of Nevada-Reno (UNR)
University of New Mexico (UNM)
U.S. Department of Energy (DOE)
U.S. Fish and Wildlife Service (USFWS)
U.S. Forest Service (USFS)
Western Bat Working Group (WBWG)

A heartfelt thanks also goes out to the whole crew of the Nevada Bat Working Group:

J. Scott Altenbach, University of New Mexico
Will Amy, USFS, Jarbidge/Ruby Ranger District
Janet Bair, USFWS, Nevada Field Office
Cristi Baldino, NPS, Death Valley National Park
Bob Berry, Brown-Berry Biological Consulting
Pete Bradley, NDOW, Eastern Region
Pat Brown, Brown-Berry Biological Consulting
Brian Buttazoni, BLM, Red Rock Canyon
Sandy Canning, NDOW, Reno
Glenn Clemmer, NNHP, Carson City
Marti Collins, USFWS, Ruby Lake NWR
Kerwin Dewberry, USFS, Spring Mountain NRA
Jay Frederick, USFS, Jarbidge/Ruby Ranger D
John Gebhardt, NDOW, Western Region
Ross Haley, NPS, Lake Mead NRA
Derek Hall, Bechtel Nevada
John Hiatt, Red Rock Audubon Society
Hernin Hiatt, Red Rock Audubon Society
Jenni Jeffers, NDOW, Western Region
Jeri Krueger, USFWS, Las Vegas
Bruce Lund, TNC, Moapa
Larry Neel, NDOW, Reno
Jennifer Newmark, NNHP, Carson City
Michael J. O'Farrell, O'Farrell Biological Consulting
Elizabeth Pierson, WBWG
Mark Ports, GBC
Matt Rahn, SDSU
Ben Roberts, NPS, Great Basin NP
Rick Sherwin, UNM
Mike Stamm, BLM, Battle Mtn
Cris Tomlinson, NDOW, Southern Region
Jason A. Williams, Las Vegas

CONSERVATION ASSESSMENT

Introduction

This Conservation Plan applies to 23 bat species within the State of Nevada. The purpose of this Plan is to reduce the threats to bat populations and their habitats within Nevada's borders and is intended to diminish the likelihood that any bat species in Nevada will require protection under the Endangered Species Act. Recognizing that Nevada's bats are part of a much larger ecosystem, the goal of the Plan is to promote healthy bat habitats and stable and/or increasing bat populations throughout western North America.

Landscape Description

Nevada is the seventh largest State in the Union, covering 110,540 square miles. Our State also has the distinction of being the driest as well as the most mountainous. Habitats range from the Mojave Desert (*Ambrosia dumosa, Yucca brevifolia* and *Larrea tridentata)* in the south to alpine tundra (*Aquilegia* spp, *Saxifraga* spp) on several mountains throughout the State. Salt desert shrub (*Atriplex* spp.), sagebrush steppe (*Artemisia* spp)., wetland (*Scirpus* spp), pinyon/juniper/mahogany woodland (*Pinus monophylla, Juniperus* spp, *Cercocarpus* spp.), mountain brush (*Amelanchier* spp), willow/cottonwood/aspen riparian (*Salix* spp, *Populus* spp), and subalpine coniferous forest of pine, fir and spruce (*Pinus* spp, *Abies* spp*, Pseudotsuga* spp, *Picea* spp) habitats fill the gap between hot deserts and cold alpine mountain peaks (Munz, 1973). Extreme differences in elevation (200-4,000 meters) and latitude (35-42 degrees), rain shadow and storm track influences, as well as geological variability in parent rock materials have provided a grand mosaic of habitats throughout Nevada. The habitat diversity displayed by this mosaic contributes to Nevada's distinction of being ranked fifth in the Nation, behind only Hawaii, California, Florida and Texas in terms of its biological diversity. Nevada's bat fauna mirrors this biological diversity. Bats inhabit or utilize many niches across the Nevada landscape. These include caves, abandoned mines, cliffs, springs, riparian, aspen, pinyon-juniper, subalpine coniferous forest, and desert shrub habitats (Ports and Bradley, 1996; Kuenzi et al., 1999; Sherwin et al., 2000a; Williams, 2001).

Bat Conservation in Nevada - A Brief History

Aside from an inadvertent introduction of bats from Sacramento into the Virginia City area in 1858 (Covington, 1976), bat conservation is a relatively new phenomenon in the field of conservation biology in the State of Nevada. It wasn't long ago (1985) that, along with several other "undesirable" mammalian species, the entire order of *Chiroptera*, with the exception of the spotted bat, was assigned the status of "unprotected mammal" in Nevada. Similar to the black-tailed jackrabbit, the valley pocket gopher, the coyote, the house mouse and the Norway rat, there was no protection afforded these species. Currently, 22 of 23 Nevada bat species remain unprotected.

Bat conservation began in earnest in 1946 with the publication of *Mammals of Nevada* (Hall). Hall provided the first species accounts and distribution maps based on empirical data for 18 bat species in the State. He also provided the first sound arguments for a conservative treatment of this order of mammals in Nevada:

> " The population of most species of bats is maintained by the birth of only one young per year, whereas most other kinds of mammals must necessarily produce far more young to maintain themselves…and…Bats usually return annually to the same caves to hibernate. Destruction of every individual in a wintering colony therefore might have more lasting effect on the number of bats than it would if they were less provincial…and…The many popularly held superstitions about bats generally prove upon experiment to be groundless…and… Only the deeper caves and mine tunnels are suitable as winter quarters for the [bats] that hibernate, because they require a temperature above freezing."

Hall's treatise appears to have landed on deaf ears for over half a century. In 1993, it was brought to the attention of several Nevada biologists, by way of local newspaper editorials, that 3,000 mine shafts and adits had been bulldozed and dynamited closed for human safety concerns. Apparently, a young man had driven his off-road dirt bike into a vertical mine shaft the previous year near Virginia City and new funding had become available to close all historical mine workings. While the NBWG agrees with immediate closure of mines in cases where extreme human safety concerns exist, the news of 3,000 closings came as a shock to the western bat conservation community as there had been no communication with wildlife professionals prior to the closures. Estimates range from thousands to tens of thousands of individuals of some 20 species lost as a result of these closures (M. O'Farrell and P. E. Brown, personal communication). In 1993, the Nevada Attorney General's Office approved alternative closure measures (either fencing and hazard signage or gated closures) to ensure the safety of the public as well as protect the integrity of local wildlife populations (Del Papa and Sammons 1994). Today, an attempt is being made to provide input to closure plans for the remaining 300,000 mine openings based on recent empirical data. Three of Nevada's most significant bat roosts on record occupy historical mine workings, i.e. 1) the largest known big-eared bat (*Corynorhinus townsendii*) hibernation roost in Nevada (White Pine County), 2) the largest known small-footed Myotis bat (*Myotis ciliolabrum*) hibernation roost in Nevada (Eureka County), and 3) Nevada's largest known pallid bat (*Antrozous pallidus*) maternity roost (Pershing County). There is considerable and justified concern about those mine roosts that are, as yet, unknown to science, as some private and public entities continue to use *hard* closure techniques such as bulldozing, backfilling, implosion and foaming.

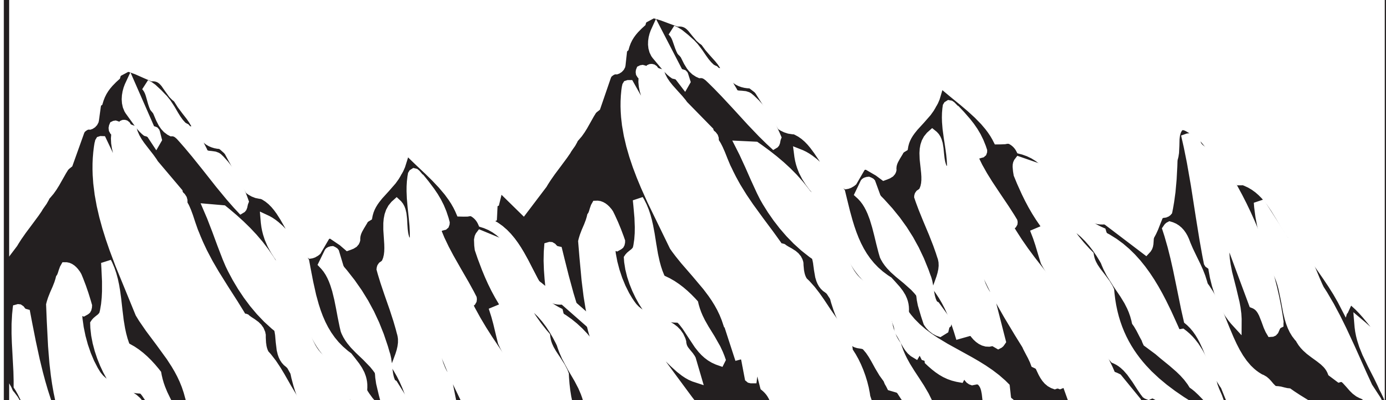
Several additional threats to the long-term stability of bat populations continue to surface. The lack of accurate information/education dissemination is perhaps the most insideous and damaging to the bats' public relations image and ultimately to the conservation of this order of mammals. For example, the State Health Lab continues to provide the statistic that 10-15% of all bats carry the rabies virus, which carries with it the baggage of all bats being placed on a *State Vector List* for disease-carrying animals. This statistic is based on a biased sample of injured and/or sick and therefore easily captured individual bats that make their way to the lab for rabies testing. The normal background incidence of rabies in North American bats is closer to 0.1%. By comparison, the greatest incidence of rabies infection continues to be found in racoon, skunk, coyote, fox and domestic dog populations (Krebs et al. 1993). Interestingly, the incidence of Chronic Wasting Disease in the nation's deer herds, Brucellosis in livestock and the West Nile Virus in some east coast bird populations has not resulted in these species appearing on any disease vector lists. It is likely in the best interest of all Nevadans and the bat resource that rabies education be continued. However, this education process must be made fair and accurate and put into the proper context. Only then will society understand the truth about the ultimate benefits of managing for a healthy and diverse bat fauna.

Since Hall's work in the 1930s and 40s, five additional bat species have been documented in Nevada and range distribution maps for all species have been greatly enhanced. Bat survey and inventory techniques have become less intrusive and more accurate and sophisticated. Conservation of critical roosting habitats has commensed, foraging habitats are being identified with ever-icreasing accuracy and conservation education is in full swing in many parts of the State. Still, as Hall pointed out in 1946, we are dealing with a group of 23 species that share characteristics, beyond leather wings, which make them some of the most sensitive animals we manage. First, they are, in many cases, extremely rare. Second, they are often thinly distributed across the landscape. Third, most spend a good part of their summers clumped in caves, adits, shafts, tree trunks, behind exfoliating bark and incessantly circling water sources. Therefore, they put many of their "eggs in only a few baskets". Fourth, they spend their relatively long K-regulated lives giving birth to one or two young per year. Fifth, most do not migrate long distances, but rather congregate during winter to hibernate. For all of these reasons, scientists and managers need to proceed with caution and in the best interest of Nevada's bat populations. The ecological, economic and human health benefits Nevada realizes from their role as primary predators on insect pests may reach into the millions of dollars.

"So much remains to be learned about them and so little is known that they well repay study."

E. R. Hall, 1946

Bat Species
Profiles



Species Profiles

Species Profiles

Taxonomic Checklist for Nevada Bats and Habitat Conservation Guild Cross-Reference

FAMILY / SPECIES	COMMON NAME	HABITAT CONSERVATION GUILDS
Phyllostomidae		
Choeronycteris mexicana	Mexican Long-tongued Bat	CA, WS, DW
Macrotus californicus	California Leaf-nosed Bat	CA, WS, DW
Vespertilionidae		
Antrozous pallidus	Pallid Bat	CA, CL, TR, BB, WS, DW
Corynorhinus townsendii	Townsend's Big-eared Bat	CA, CL, TR, BB, WS, FW
Eptesicus fuscus	Big Brown Bat	CA, TR, BB, WS, FW
Euderma maculatum	Spotted Bat	CL, TR, BB, WS, FW, DW, CA
Idionycteris phyllotis	Allen’s Lappet-browed Bat	TR, CA, WS, FW, DW
Lasionycteris noctivagans	Silver-haired Bat	TR, CA, WS, FW, CA, BB
Lasiurus blossevillii	Western Red Bat	TR, WS, FW
Lasiurus cinereus	Hoary Bat	TR, FW, WS, CA, CL
Lasiurus xanthinus	Western Yellow Bat	TR, WS, FW
Myotis californicus	California Myotis	CA, CL, TR, BB, WS, DW, FW
Myotis ciliolabrum	Small-footed Myotis	CA, CL, TR, FW, WS
Myotis evotis	Long-eared Myotis	TR, CA, FW, WS, CR, BB
Myotis lucifugus	Little Brown Myotis	TR, BB, WS, CL, CA
Myotis thysanodes	Fringed Myotis	CA, TR, BB, WS, DW, FW
Myotis velifer	Cave Myotis	CA,WS, BB
Myotis volans	Long-legged Myotis	TR, CA, CL,WS, BB
Myotis yumanensis	Yuma Myotis	TR, BB, WS, CA, CL
Pipistrellus hesperus	Western Pipistrelle	CL, CA, WS, BB, DW, TR
Molossidae		
Eumops perotis	Western Mastiff Bat	CL, BB, WS, DW, FW
Nyctinomops macrotis	Big Free-tailed Bat	CL, CA, WS, DW, FW, BB
Tadarida brasiliensis	Brazilian Free-tailed Bat	CA, CL, BB, TR, WS, DW

BB	Bridge and Building Roosting Habitat
CA	Natural Cave, Mine Shaft and Adit Roosting Habitat
CL	Cliff, Crevice and Talus Roosting Habitat
DW	Desert Wash Foraging Habitat
FW	Forest and Woodland Foraging Habitat
TR	Tree Roosting Habitat
WS	Water Source Foraging and Watering Habitat

Bat Species Risk Assessment in Nevada

Scientific Name	Common Name	Populations/Habitats At Risk
Antrozous pallidus	**Pallid Bat**	**MODERATE**
Choeronycteris mexicana	**Mexican Long-tongued Bat**	**HIGH/EDGE OF RANGE**
Corynorhinus townsendii	**Townsend's Big-eared Bat**	**HIGH**
Eptesicus fuscus	**Big Brown Bat**	**LOW**
Euderma maculatum	**Spotted Bat**	**MODERATE**
Eumops perotis	**Western Mastiff Bat**	**MODERATE/EDGE OF RANGE**
Idionycteris phyllotis	**Allen's Lappet-browed Bat**	**HIGH**
Lasionycteris noctivagans	**Silver-haired Bat**	**MODERATE**
Lasiurus blossevillii	**Western Red Bat**	**HIGH**
Lasiurus cinereus	**Hoary Bat**	**MODERATE**
Lasiurus xanthinus	**Western Yellow Bat**	**MODERATE/EDGE OF RANGE**
Macrotus californicus	**Cal. Leaf-nosed Bat**	**HIGH/EDGE OF RANGE**
Myotis californicus	**California Myotis**	**MODERATE**
Myotis ciliolabrum	**Small-footed Myotis**	**MODERATE**
Myotis evotis	**Long-eared Myotis**	**MODERATE**
Myotis lucifugus	**Little Brown Myotis**	**MODERATE**
Myotis thysanodes	**Fringed Myotis**	**HIGH**
Myotis velifer	**Cave Myotis**	**HIGH/EDGE OF RANGE**
Myotis volans	**Long-legged Myotis**	**LOW**
Myotis yumanensis	**Yuma Myotis**	**MODERATE**
Nyctinomops macrotis	**Big Free-tailed Bat**	**MODERATE/EDGE OF RANGE**
Pipistrellus hesperus	**Western Pipistrelle**	**MODERATE**
Tadarida brasiliensis	**Brazilian Free-tailed Bat**	**LOW**

Adapted from: *"Western Bat Species - Regional Priority Matrix" (*Western Bat Working Group, 1998).

Species Profile Texts and Range Maps for Nevada

Phyllostomidae

Mexican Long-tongued Bat—*Choeronycteris mexicana*

Distribution: Reaches northern limit of its range in southwestern U.S. Known only from a single individual found in Las Vegas. Recent collection of an individual on the Colorado River at 600m (C. Corben, personal communication) suggests the possibility of occasional occurrence.

Habitat Characteristics: Found in a variety of habitats in the Lower and Upper Sonoran life zones, from thorn scrub to tropical deciduous forests. Favors desert canyons with riparian vegetation.

Resident Status: Possible summer resident but more likely occasional transient.

Winter Status: Does not hibernate.

Roost Sites: Selects primarily mines, caves, and rock fissures for diurnal roosting. Also, sometimes in buildings. Prefers sites near the entrance in shade (i.e., twilight zone) rather than total darkness.

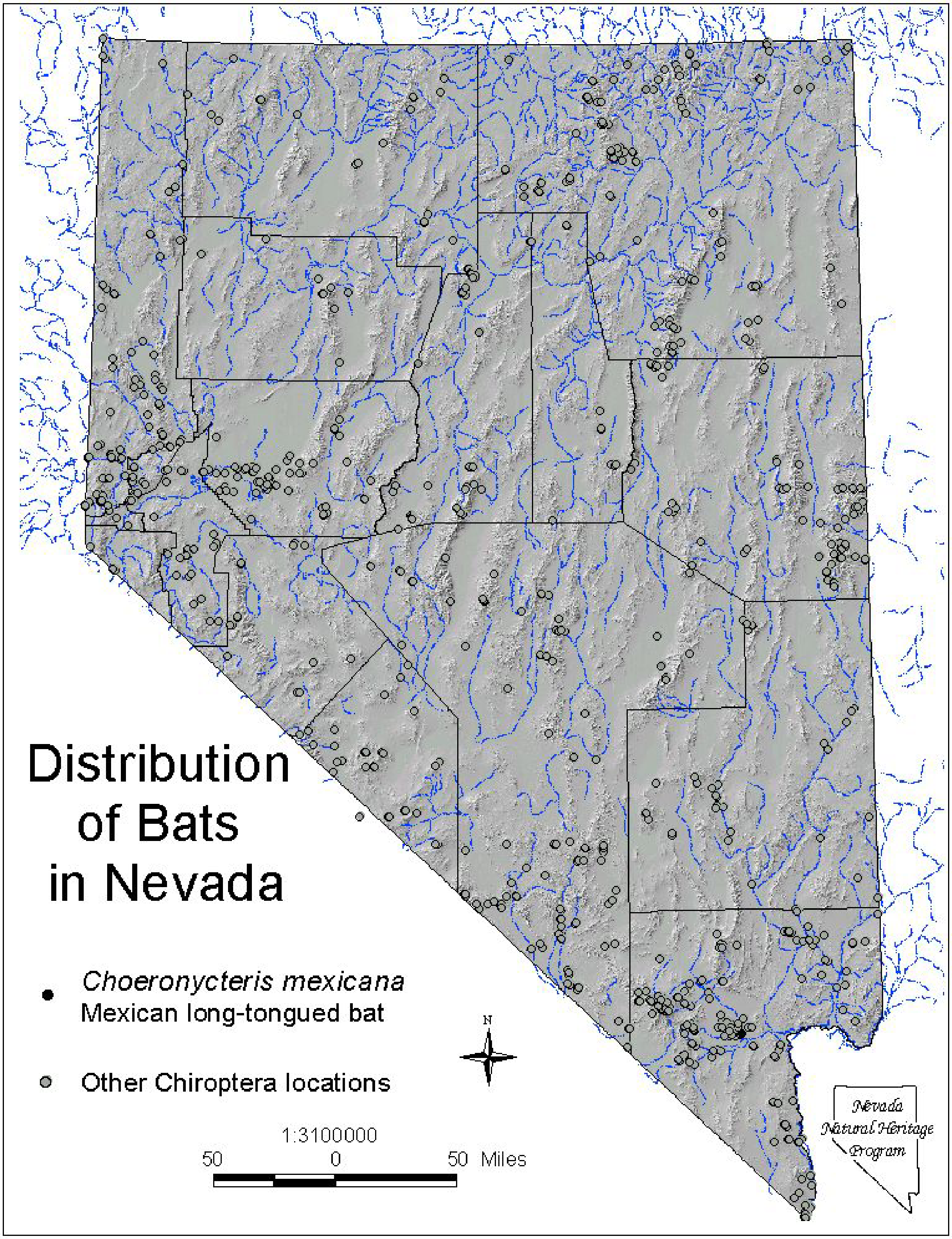
Reproduction: One young per year with birth occurring in June to July. Females congregate in maternity colonies. Colony size can be up to 40-50, but more commonly is a dozen or fewer.

Food Habits: Food items limited to pollen and nectar.

Status: Unprotected. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Recreational caving; mine reclamation; renewed mining; water impoundments; availability of desert wash riparian vegetation. Behaviorally sensitive to roost disturbance.

Relevant References: Arroyo-Cabrales et al. (1987), Barbour and Davis (1969), Constantine (1987).


Distribution of Bats in Nevada
Choeronycteris mexicana
Mexican long-tongued bat
Other Chiroptera locations
N
1:3100000
50 0 50 Miles
Nevada Natural Heritage Program

California Leaf-nosed Bat — *Macrotus californicus*

Distribution: Historical roosts in the Las Vegas Valley and along the Colorado River have been destroyed by vandalism, abandoned mine closure and inundation by the formation of Lakes Mead and Mojave. Only a few roosts are known to exist although there may be some foraging activity along the Virgin River based on Arizona reports from the confluence of Virgin River and Beaver Dam Wash. Recent capture of both sexes, including a pregnant female, in the Muddy River drainage (Williams, 2001) indicate presence of maternity roosts in the immediate vicinity. Most historical roosts have been destroyed by inundation of Lakes Mead and Mojave. Although it is believed that this species does not migrate, local movements among roosts occur, particularly on a seasonal basis.

Habitat Characteristics: Low elevation desert scrub habitats. Roosts are located below 915 m elevation in proximity to desert riparian areas. Current Nevada records indicate this species is distributed between 210-690 m (mean = 391 m ± 195 m) primarily in creosote, Mojave scrub and riparian areas.

Resident Status: Year round resident.

Winter Status: Do not hibernate. Both sexes congregate together in specific, warm winter roosts. Year-round activity.

Roost Sites: Dependent on caves and mines for diurnal roosting. Mines used as winter roosts have internal temperatures > 29° C, and are usually geothermally heated. More than one diurnal roost may be used during the year. Night roosting occurs in a variety of places, including buildings, cellars, porches, bridges, rock shelters, and mines. Summer colonies may range from 6 to several hundred individuals, with winter colonies containing 100 to over 1,000 individuals. There is one Nevada record of this species occupying a building near Searchlight for a period in January (Hatfield, 1937) when ambient temperature was 29° C.

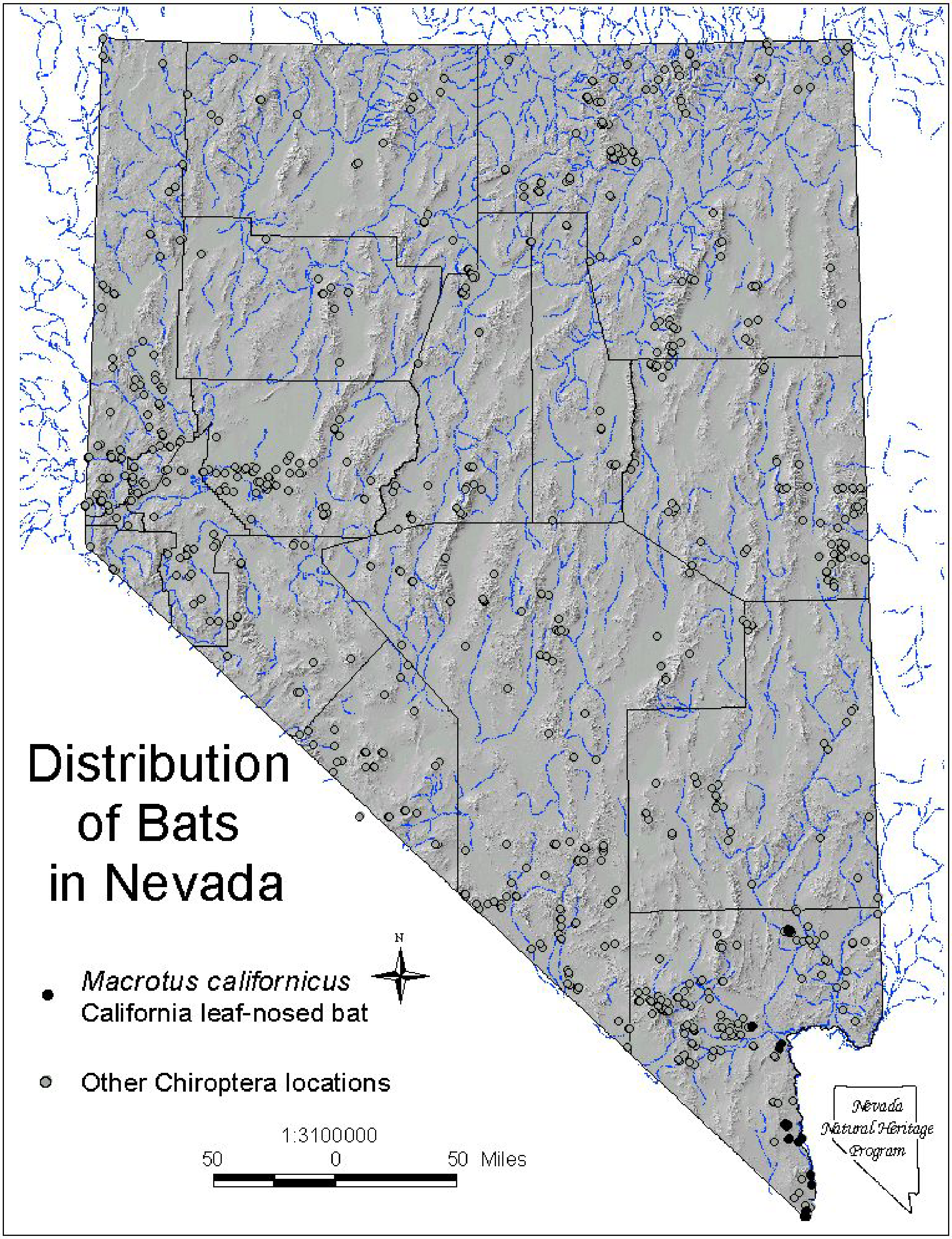
Reproduction: One young per year with birth occurring from mid-May to early July, depending on annual variations in weather conditions. Females congregate in maternity roosts of 6 to > 100. They are frequently spatially clustered, each cluster being associated with an adult male. Other males disperse and roost separately in small groups. In the fall, males congregate at lek courtship sites in mines. Mating and fertilization occurs in the fall with delayed development of the embryo until spring.

Food Habits: Food items include grasshoppers, cicadas, moths, butterflies, dragonflies, beetles, and caterpillars. Foraging occurs close to vegetation or the ground and prey items are gleaned from these surfaces. Does not require drinking water, but gets moisture from prey items.

Status: Unprotected. Distribution limited to the extreme southern portion of the state. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Recreational caving; mine reclamation; renewed mining; water impoundments; availability of desert wash riparian vegetation. Behaviorally sensitive to roost disturbance. Distribution in adjoining States declining.

Relevant References: Anderson (1969), Bell (1985), Bell et al. (1986), Brown (1994), Brown et al. (1993), Burt (1934), Hall (1946), Hatfield (1937), Lu and Bleier (1981), O'Farrell (1970), Vaughan (1959), Williams (2001).


Distribution of Bats in Nevada
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Macrotus californicus
California leaf-nosed bat
Other Chiroptera locations
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Nevada Natural Heritage Program

Vespertilionidae

Pallid Bat—*Antrozous pallidus*

Distribution: Found throughout the state, primarily in the low and middle elevations (1,800 m), although has been found at over 3,100 m.

Habitat Characteristics: Found in a variety of habitats from low desert to brushy terrain to coniferous forest and non-coniferous woodlands. Current Nevada records indicate this species is distributed between 420-2,580 m (mean = 1,426 m ± 431 m) in pinyon-juniper, blackbrush, creosote, sagebrush, and salt desert scrub habitats.

Resident Status: Year round resident.

Winter Status: Hibernates but periodically arouses and actively forages and drinks throughout the winter.

Roost Sites: Selects a variety of day roosts including rock outcrops, mines (favors geothermally-influenced adits), caves, hollow trees, buildings, and bridges. Recent research suggests high reliance on tree roosts. Night roosts very commonly under bridges, but also caves and mines. Intolerant of roosts in excess of 40°C.

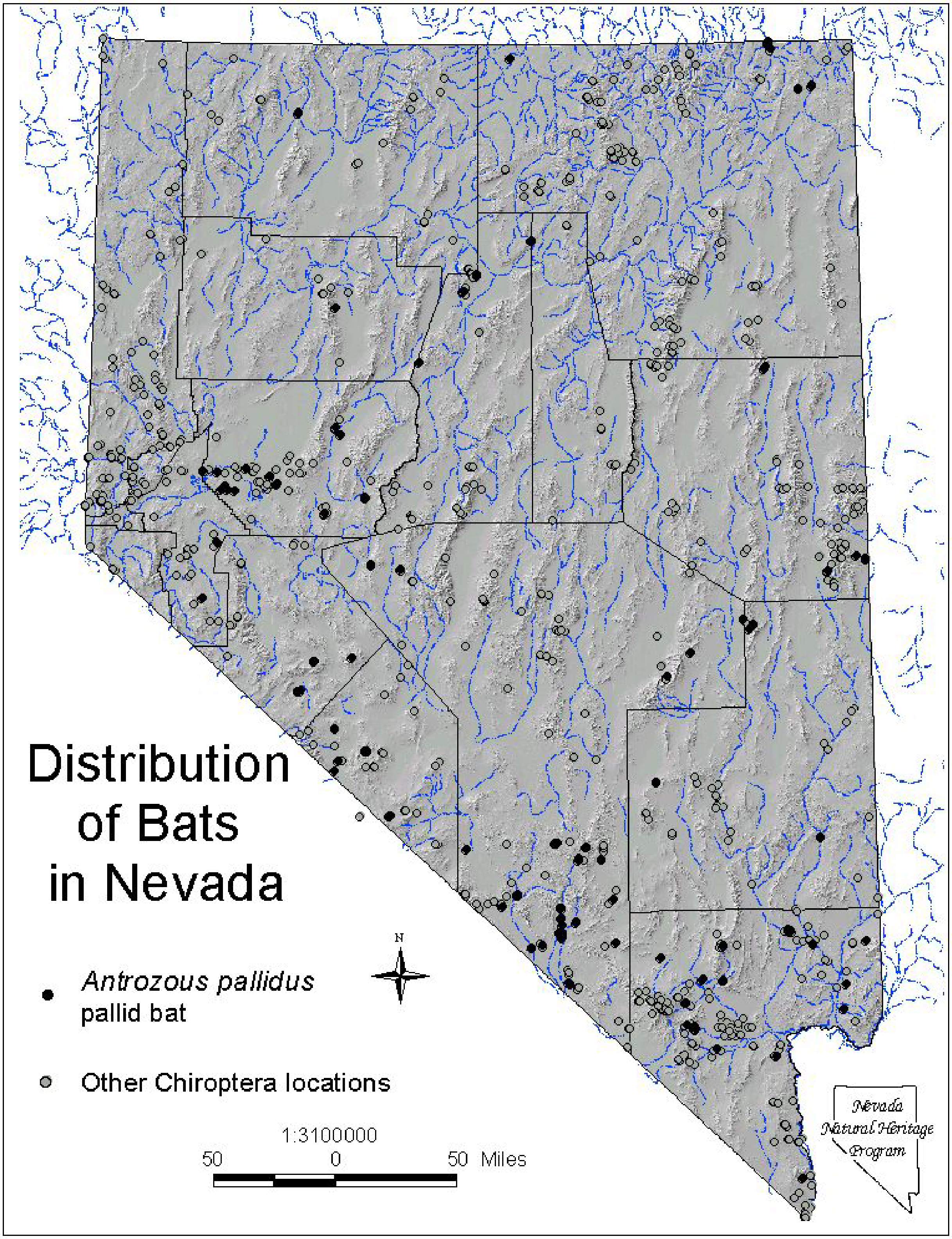
Reproduction: One to two young per year but usually two, with birth occurring in May to June. Nursery colonies may contain up to several hundred females, but generally less than 100 individuals.

Food Habits: Food items are primarily large ground-dwelling arthropods (scorpions, centipedes, millipedes, grasshoppers, long-horned beetles, Jerusalem crickets), but also include large moths. Foraging occurs in and among vegetation as well on the ground surface. The animal may actually land and take prey.

Status: Unprotected

Conservation/Management Issues: Recreational caving; closure of mines for reclamation; renewed mining; water impoundments; availability of desert wash riparian vegetation. Behaviorally sensitive to roost disturbance.

Relevant References: Brown (1976), Hall (1946), Hermanson and O'Shea (1983), Lewis (1993, 1994), Licht and Leitner (1967), O'Farrell and Bradley (1977), Orr (1954), Pierson et al. (1996), Ruffner et al. (1979).


Distribution of Bats in Nevada
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Antrozous pallidus
pallid bat
Other Chiroptera locations
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Nevada Natural Heritage Program

Townsend's Big-eared Bat—*Corynorhinus townsendii*

Distribution: Found throughout the state, from low desert to high mountain habitats. Observed foraging in krumholz bristlecone pine as high as 3,500 m in Snake Range of eastern White Pine County. Concentrated in areas offering caves or mines as roosting habitats.

Habitat Characteristics: Highly associated with caves and mines. Found primarily in rural settings from deserts to lower, mid to high-elevation mixed coniferous-deciduous forest. Current Nevada records indicate this species is distributed between 210-3,500 m (mean = 1,720 m ± 421 m) primarily in pinyon-juniper-mahogany, white fir, blackbrush, sagebrush, salt desert scrub, agricultural, and urban habitats.

Resident Status: Year round resident.

Winter Status: Hibernates in mixed sex aggregations of a few to many hundred. Periodically arouses, moves to alternate roosts and actively forages and drinks throughout the winter. Hibernation prolonged in colder areas, and intermittent where climate is predominantly non-freezing.

Roost Sites: A cavern-dwelling species that uses mines, caves, trees and buildings. One of the species most dependent on mines and caves. Trees and buildings must offer "cave-like" spaces in order to be suitable. Will night roost in more open settings, including under bridges. Colony size is typically 35-150, with a few larger (> 200) colonies known.

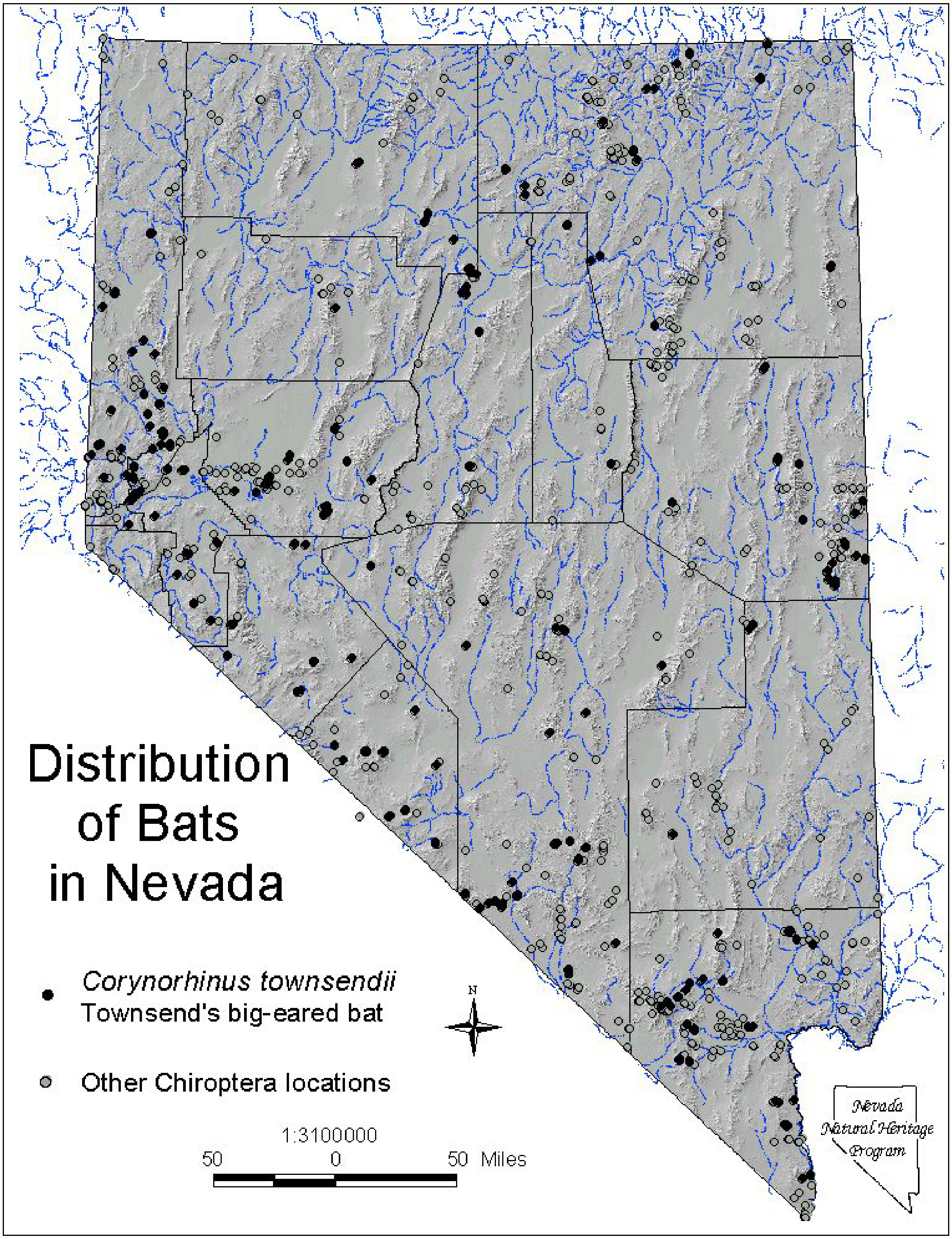
Reproduction: One young per year with birth occurring in May to July, depending on latitude and local climate. Females form maternity colonies; males roost individually. Historically, maternity colonies typically contained several hundred females.

Food Habits: Food items are primarily small moths. Foraging occurs near vegetation and other surfaces and prey is probably gleaned from these surfaces. Telemetry studies in Nevada have revealed over 95% of foraging activity to be concentrated in open forest habitats of pinyon, juniper, mahogany, white fir, aspen and cottonwood (Bradley, 2000).

Status: Unprotected. Serious population declines in past forty years in parts of the Western States (Pierson and Rainey, 1996). Roost size reductions have been documented in Nevada (P. Bradley, personal communication). Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Highly sensitive to disturbance at roost sites. Recreational caving; closure of mines for reclamation; renewed mining; survey methodology; water impoundments; loss of building roosts; bridge replacement.

Relevant References: Bradley (2000a), Brown et al. (1994), Hall (1946), Fellers and Pierson (2002), Kunz and Martin (1982), Pearson et al. (1952), Perkins (1990), Pierson and Fellers (1994), Pierson and Rainey (1996), Pierson et al. (1991), Pierson et al. (1999), Sherwin et al. (2000b).


Distribution of Bats in Nevada
Corynorhinus townsendii
Townsend's big-eared bat
Other Chiroptera locations
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Nevada Natural Heritage Program

Big Brown Bat—*Eptesicus fuscus*

Distribution: Found throughout the state, from low to high elevations (220 to > 3,000 m).

Habitat Characteristics: Occurs in a variety of habitats, including pinyon-juniper, blackbrush, creosote, sagebrush, agriculture, and urban habitats. Better adapted to human habitation than most species. Current Nevada records indicate this species is distributed between 300-3,000 m (mean = 1,723 m ± 573 m).

Resident Status: Year round resident.

Winter Status: Hibernates but periodically arouses and actively forages and drinks in the winter. Year-round resident.

Roost Sites: Selects a variety of day roosts including caves, trees (e.g., Ponderosa pine, quaking aspen and oaks), mines, buildings and bridges. Often night roosts in more open settings in buildings, mines and bridges. Roosts in groups up to several hundred.

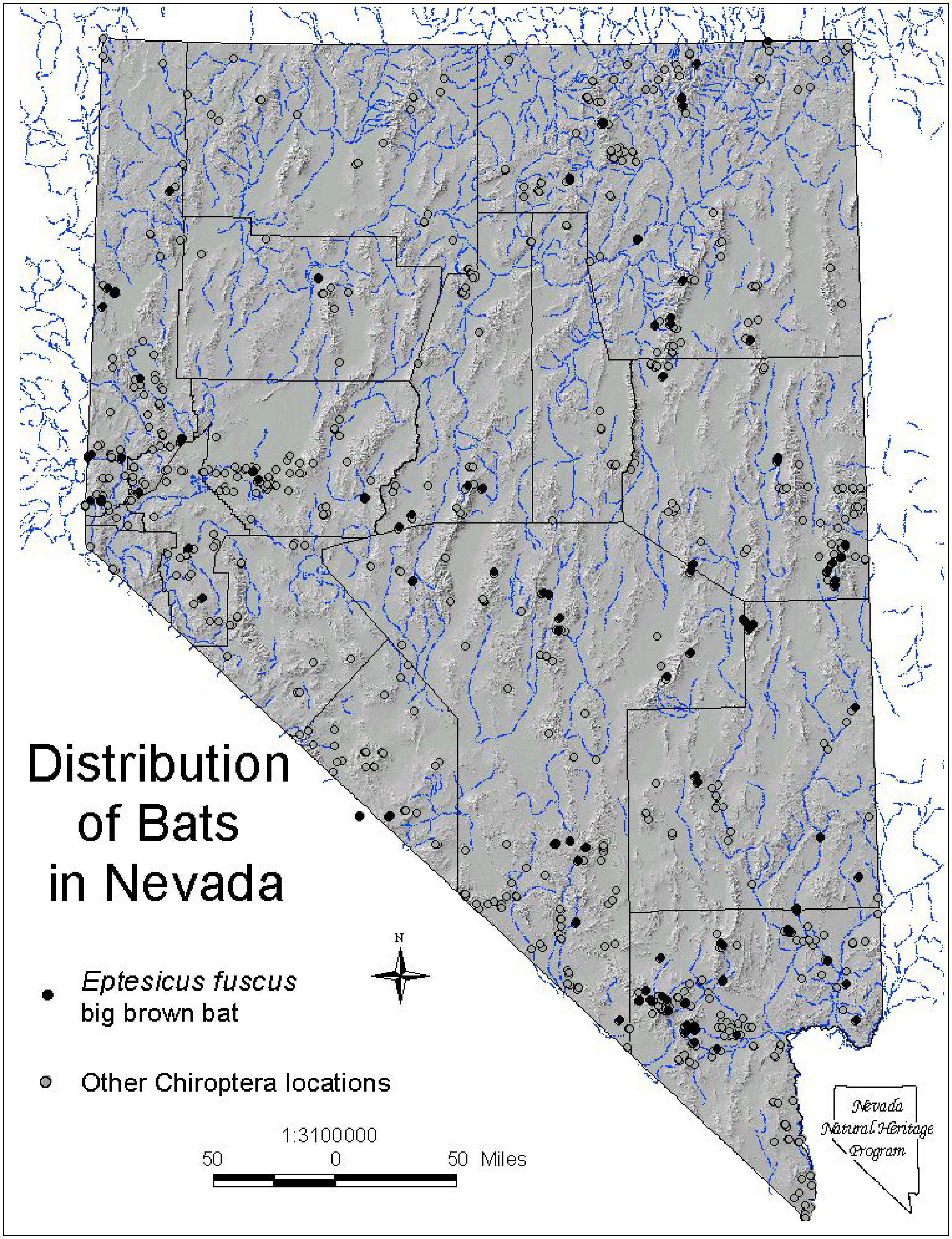
Reproduction: One young per year (twins in portions of its eastern range) with birth occurring in May to June. Females form relatively small maternity colonies (20-200).

Food Habits: Feed on a wide range of insect taxa, but beetles and caddis flies are dominant in the diet. Foraging occurs in the open over land and water, as well as in both forested and edge situations.

Status: Unprotected. Widespread and regionally common.

Conservation/Management Issues: Timber harvest; bridge replacement; building demolition; recreational caving; mine reclamation; renewed mining; water impoundments; pest control exclusion.

Relevant References: Betts (1996), Black (1976), Brigham (1991), Brigham and Fenton (1986), Hall (1946), Kurta and Baker (1990), O'Farrell and Bradley (1977), Vonhof (1996), Whitaker et al. (1997).


Distribution of Bats in Nevada
Eptesicus fuscus
big brown bat
Other Chiroptera locations
1:3100000
50 0 50 Miles
N
Nevada Natural Heritage Program

Spotted Bat—*Euderma maculatum*

Distribution: A scattered distribution throughout Nevada. The distribution is patchy and linked to availability of cliff roosting-habitat. Known from only eleven localities in Nevada. A new location documented significant activity throughout the summer months (Williams, 2001). There are recent high elevation records from the Sierra Nevadas in California (P.E. Brown, personal communication) and lower elevation basalt canyon records just across the border in southern Idaho. The Idaho portion of the Bruneau-Jarbidge River area appears to be an important population center as five of eleven sampling localities yielded spotted bats (Doering and Keller, 1998).

Habitat Characteristics: Found in a wide variety of habitats from low elevation desert scrub to high elevation coniferous forest habitats, including pinyon-juniper, sagebrush, riparian and on urban high-rise (cliff analog) habitats. Closely associated with rocky cliffs. Current Nevada records indicate this species is distributed between 540-2,130 m (mean = 1,447 m ± 569 m).

Resident Status: Year round resident.

Winter Status: Hibernates but periodically arouses and actively forages and drinks throughout the winter.

Roost Sites: Day roosts primarily in crevices in cliff faces but some indication that mines and caves may occasionally be used, primarily in winter. Has been found roosting on/in buildings but reliance on such roosts is unclear. Likely roosts singly.

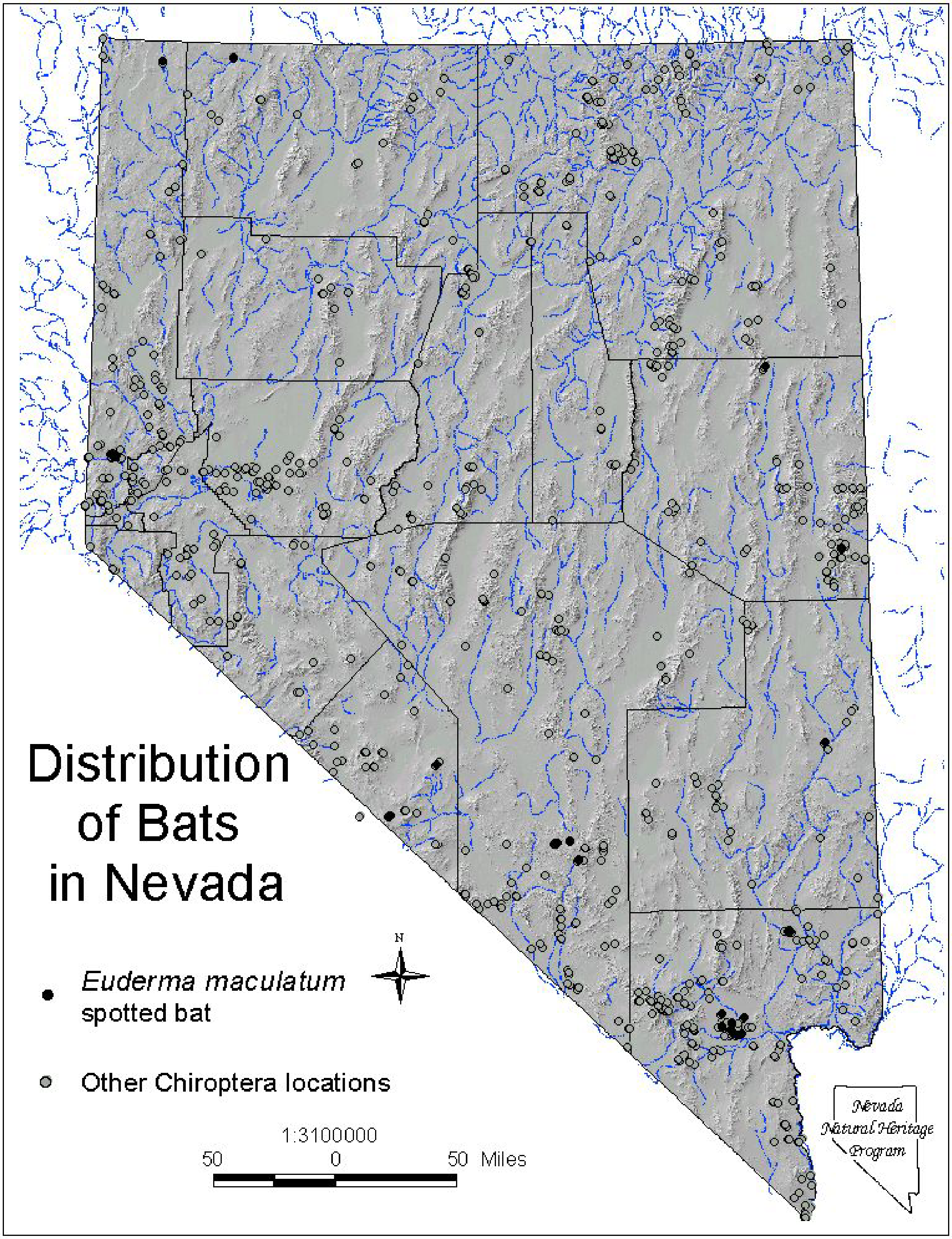
Reproduction: One young per year with birth occurring in June to July.

Food Habits: Diet includes a variety of insects but predominantly consists of moths. In desert settings, foraging occurs in canyons, in the open, or over riparian vegetation. In montane habitats, individuals forage over meadows, along forest edges, or in open coniferous woodland. Animals generally forage alone, apparently maintaining foraging territories, and at other times "trap lining".

Status: State Protected:Threatened. Rare and patchy in occurrence although recent findings indicate it may be more common than previously thought. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Recreational climbing; water impoundments; grazing/meadow management; mining and quarry operations.

Relevant References: Doering and Keller (1998), Geluso (2000), Hall (1946), Leonard and Fenton (1983), Navo et al. (1992), Pierson and Rainey (1995), Szewczak et al. (1998), Wai-ping and Fenton (1989), Watkins (1977), Williams (2001), Woodsworth et al. (1981).


Distribution of Bats in Nevada
Euderma maculatum
spotted bat
Other Chiroptera locations
N
1:3100000
50 0 50 Miles
Nevada Natural Heritage Program

Allen's Lappet-browed Bat—*Idionycteris phyllotis*

Distribution: Found in southern Nevada. Records limited to Clark County. May be in southern Lincoln and Nye as well. Known from various localities in the Spring Mountain Range and a capture near Gold Butte (M. J. O'Farrell, personal communication).

Habitat Characteristics: In the summer, generally occupies high elevation pine and oak woodland but also uses a variety of riparian woodland across a wide elevational gradient. In the winter, generally found at lower elevations from creosote bush to pinyon-juniper habitats. Current Nevada records indicate this species is distributed between 510-1,830 m (mean = 1,192 m ± 440 m).

Resident Status: Probably year round resident, but shifts elevations from summer to winter.

Winter Status: Hibernates but periodically arouses and actively forages and drinks throughout the winter.

Roost Sites: Day roosts in trees (large dead snags) but mines and caves are also used. There is a known mine roost in Arizona.

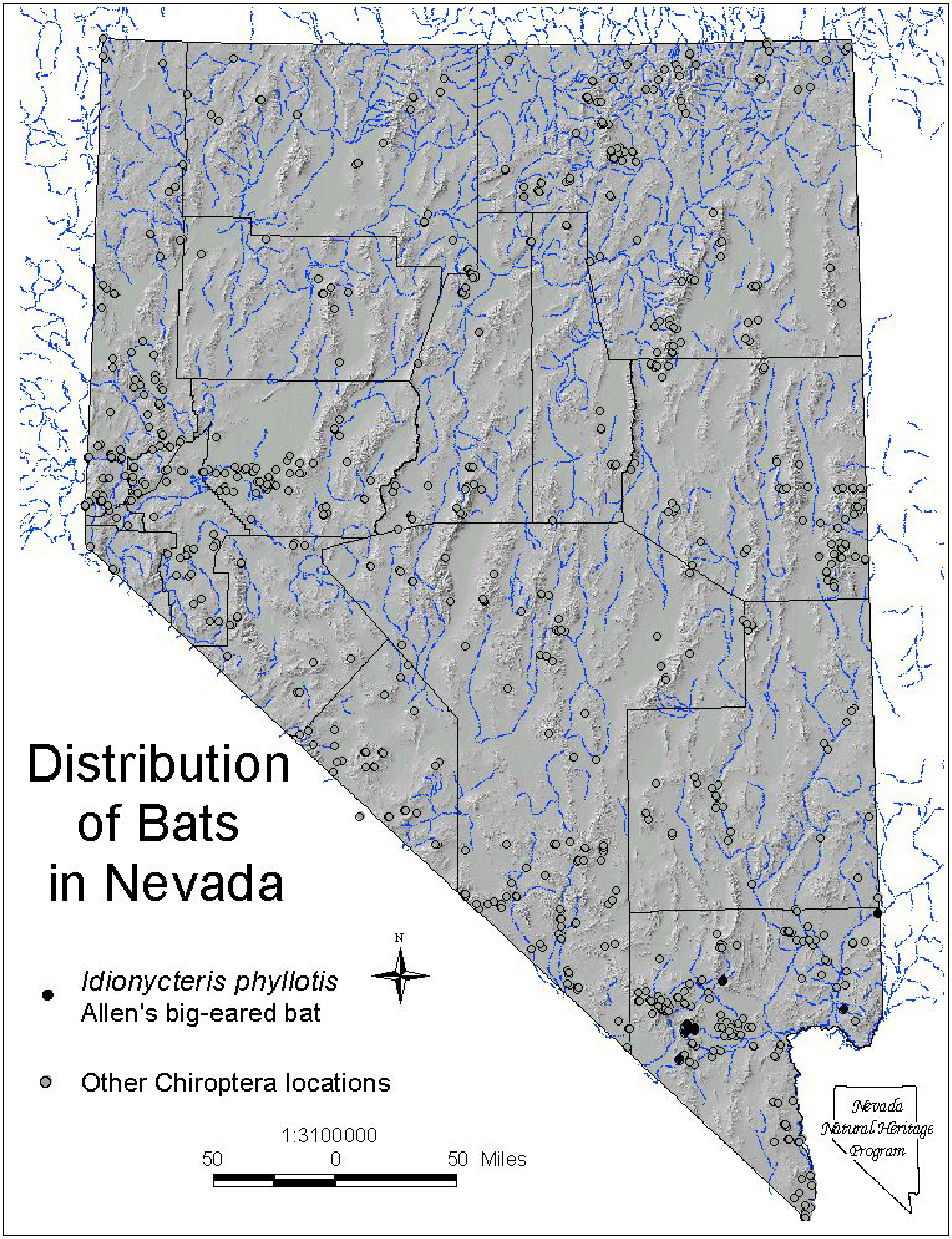
Reproduction: One young per year with birth occurring in June to July.

Food Habits: Food items include a variety of insects but predominantly consists of moths. May be a specialist targeting "hearing" moths.

Status: Unprotected. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Mine and quarry operations; mine reclamation; renewed mining; water impoundments; grazing/meadow management; timber management, particularly snag management.

Relevant References: Czaplewski (1983), Hoffmeister (1986), O'Farrell and Bradley (1969), Rabe et al. (1998b), Simmons and O'Farrell (1977).


Distribution of Bats in Nevada
N
Idionycteris phyllotis
Allen's big-eared bat
Other Chiroptera locations
1:3100000
50
0
50 Miles
Nevada Natural Heritage Program

Silver-haired Bat—*Lasionycteris noctivagans*

Distribution: Widely distributed in the state, but confined primarily to forested habitats. Found in riparian habitats in the south and in woodland and riparian habitats in the central and northern portions of the state.

Habitat Characteristics: A forest-associated species, more common in mature forests. Found primarily at higher latitudes and altitudes. Found in coniferous and mixed deciduous/coniferous forests of pinyon-juniper, subalpine fir, white fir, limber pine, aspen, cottonwood and willow. Usually found at lower elevations in southern Nevada associated with riparian corridors. Current Nevada records indicate this species is distributed between 480-2,520 m (mean = 1,679 m ± 525 m).

Resident Status: Poorly understood. Probably a transient spring and fall migrant. Recent August records of seven post-lactating females and four juveniles in mixed subalpine fir/limber pine/aspen suggest maternity activity in northern Nevada (Bradley, 2000b).

Winter Status: Migrates but probably hibernates in winter range. Migratory patterns not well understood. Recent October records of migrating individuals, one juvenile near Mesquite, in the foothills of the Virgin Mountains (M. J. O'Farrell, personal communication) and one in the Santa Rosa Mountains of Humboldt County (P.V. Bradley, personal communication).

Roost Sites: Roosts almost exclusively in trees in summer. Maternity roosts are generally in woodpecker hollows. Uses multiple roost sites, switching them frequently. Small groups and single animals will roost under exfoliating bark. Winter roosts include hollow trees, rock crevices, mines, caves, and houses. Also has been found roosting under leaf litter.

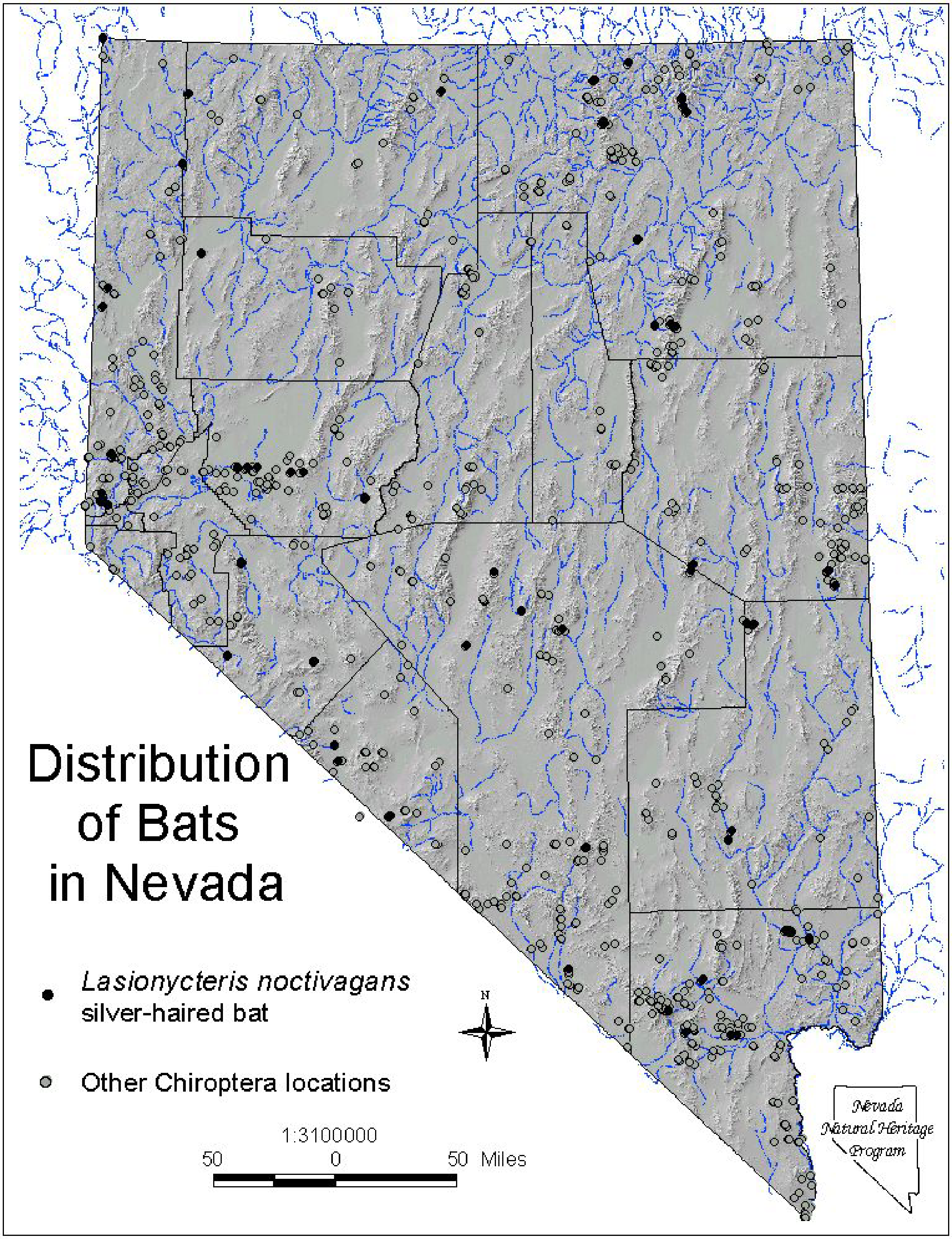
Reproduction: One to two young per year but generally two, with birth occurring in June to July. Forms small maternity colonies of several to about 75 individuals.

Food Habits: Diet consists of a variety of insects but moths feature prominently. Foraging is generally in or near wooded areas and along edges of roads, streams or water bodies. Travels considerable distances (up to 15 km) from roost sites to foraging areas.

Status: Unprotected. Locally common, at least seasonally.

Conservation/Management Issues: Timber harvest; grazing of riparian habitats; pesticide spraying.

Relevant References: Barclay et al. (1988), Betts (1996), Bradley (2000b), Bradley et al. (1965), Burt (1934), Hall (1946), Izor (1979), Kunz (1982), Kurta and Stewart (1990), Mattson et al. (1996), Perkins and Cross (1988), Sanborn (1953), Vonhof (1996).


Distribution
of Bats
in Nevada
Lasionycteris noctivagans
silver-haired bat
Other Chiroptera locations
N
1:3100000
50 0 50 Miles
Nevada
Natural Heritage
Program

Western Red Bat—*Lasiurus blossevillii*

Distribution: Known from only two historical locations, one of which (Fallon area) has yielded additional specimens in 1958 (R. Alcorn Collection, Nevada State Museum, Las Vegas). A third location near Dyer was documented in September 1999 (P.E. Brown, personal communication). Recent acoustic sampling in the Muddy River drainage in Clark County have yielded records of occurrence in late spring and early summer 2000 (J. A. Williams and M. J. O'Farrell, personal communication). Additionally, three females and two males were captured between July and September in the same drainage (Williams, 2001). It has also been detected acoustically in the northern portion of the Nevada Test Site during the summers of 1999 and 2000 (Bechtel Nevada, 2001). Two acoustic records were obtained near the Truckee River west of Fernley (O'Farrell, 2001a and b).

Habitat Characteristics: Found primarily in wooded habitats, including mesquite bosque and cottonwood/willow riparian areas. Current Nevada records indicate this species is distributed between 420-2,010 m (mean = 1,200 m ± 602 m).

Resident Status: Thought to be a migrant but may be a summer resident in the Fallon and Muddy River areas.

Winter Status: Thought to be migratory, although migratory patterns are not well documented.

Roost Sites: Day roosts in trees, within the foliage and presumably in leaf litter on the ground. A close relative (*Lasiurus borealis*) has been documented roosting in deciduous and coniferous leaf litter on the ground (Moorman et al., 1999; Saugey et al., 1998).

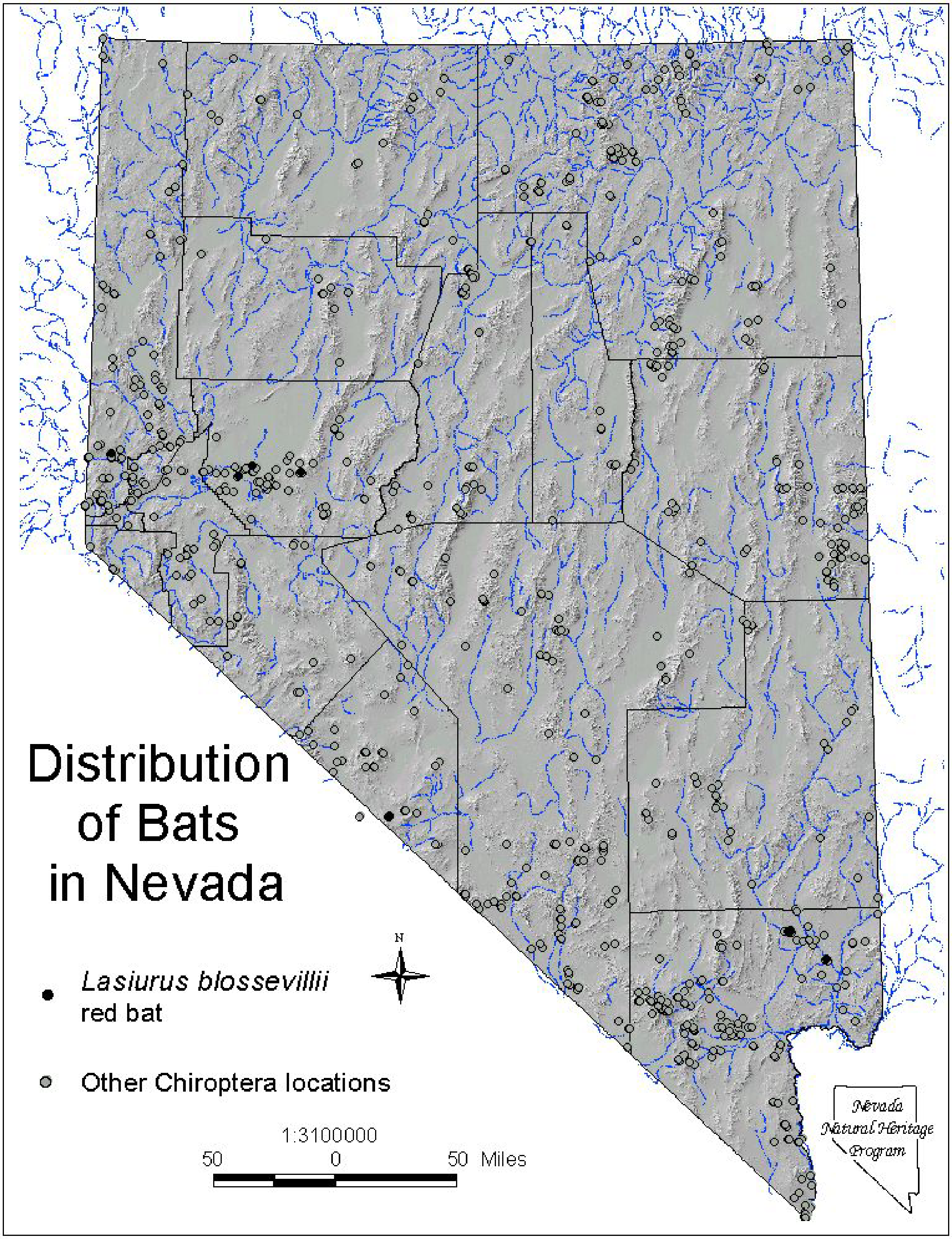
Reproduction: One to five young per year, with an average of 2.3, with birth occurring in June. Individuals roost singly. Colonies are not formed.

Food Habits: Food items consist of a wide variety of insects, taken opportunistically apparently based on size rather than type. Foraging is generally high altitude over the tree canopy.

Status: Unprotected. Extremely rare in Nevada.

Conservation/Management Issues: Overgrazing of riparian habitat and resultant agricultural conversion to upland habitat; agricultural spraying; water impoundments; fire; predation, particularly by jays; found by humans and pets in suburban areas.

Relevant References: Constantine (1959), Hall (1946), Moorman et al. (1999), O'Farrell (2001a, b), Orr (1950a), Saugey et al. (1998), Shump and Shump (1982a), Williams (2001).


Distribution of Bats in Nevada
Lasiurus blossevillii
red bat
Other Chiroptera locations
N
1:3100000
50 0 50 Miles
Nevada Natural Heritage Program

Hoary Bat—*Lasiurus cinereus*

Distribution: Known only from a few locations in Nevada. Found from 750 to over 3,900 m.

Habitat Characteristics: Tree-associated species. Found primarily in forested upland habitats, as well as in gallery-forest riparian zones (e.g., in cottonwoods along the Colorado River drainage), and agriculture habitats. Also found in valley basins in pure stands of Rocky Mountain juniper (*Juniperus scopulorum*) (Bradley and Baldino, 1997). May occur in park and garden settings in urban areas. Current Nevada records indicate this species is distributed between 570-2,520 m (mean = 1,587 m ± 560 m).

Resident Status: Summer resident. In California, summer residents are primarily males, which may also be the case in much of Nevada although a non-lactating female, along with three reproductively active males were caught over water in August, 1997 at 1,800 m in Spring Valley, east-central Nevada in Rocky Mtn juniper (Bradley and Baldino, 1997). Three females were captured near Yucca Mountain, Nevada in 1991 (Rakestraw *et al*., 1998). One was captured on 6 May and one on 14 August over a well pond (990 meters) in Mojave Desert scrub vegetation. Another individual was captured on 13 August in a dry wash.

Winter Status: Migrates but probably hibernates in winter range. Records are primarily from the spring and fall but migratory patterns in Nevada are not known. Recent acoustic and capture surveys in the Muddy River and Meadow Valley Wash drainages documented arrival and continued presence from early April through late May (J. A. Williams and M. J. O'Farrell, personal communication). The single capture in late April 2000 was an emaciated adult female. Prolonged presence from March through June was recorded in the upper Moapa Valley (Williams, 2001). Until recently, all records from southern Nevada were from the spring. However, two localities at the Nevada Test Site (Rakestraw et al., 1998; Hall, 2000) and the Spring Mountains (O'Farrell, 2002) have yielded records in the fall months. Records from the northeast span 15 July to 21 August (Ports and Bradley, 1996).

Roost Sites: Day roosts in trees, within foliage 3-12 m above the ground in both coniferous and deciduous trees. Some unusual roosting situations have been reported in caves, beneath a rock ledge, in a woodpecker hole, and in a squirrel's nest.

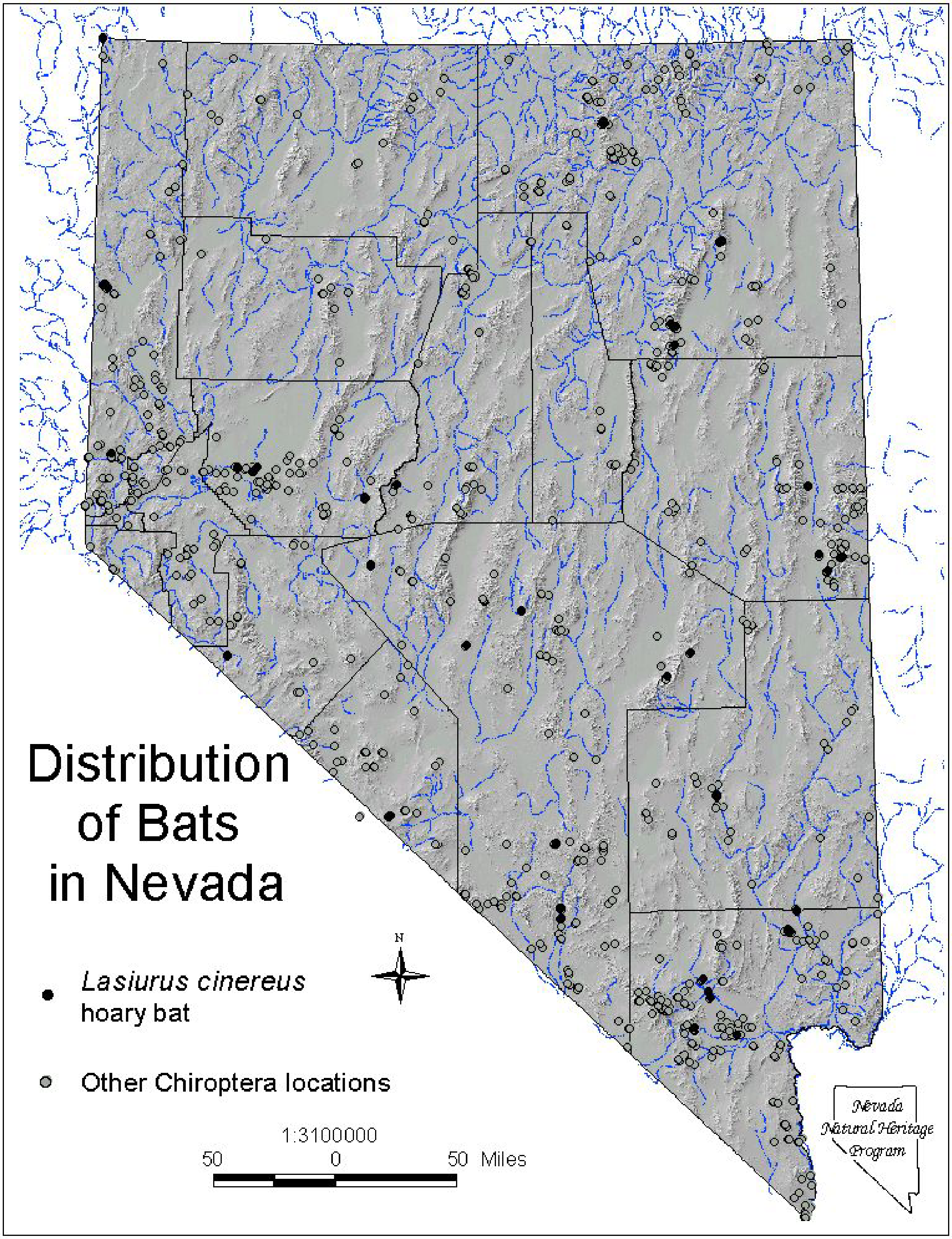
Reproduction: One to four young per year but generally two, with birth occurring in May to June. Individuals roost singly. Colonies are not formed.

Food Habits: Food items include a variety of insects but moths, dragonflies, and beetles feature prominently. Foraging is generally high altitude and occurs over tree canopy. In the open, rapid descending arcs are exhibited. Also, will follow watercourses for foraging and drinking. It forages over long distances, up to 40 km from its roost.

Status: Unprotected. Widespread but may be threatened by reduction in forest cover.

Conservation/Management Issues: Timber harvest; pesticide spraying; loss of riparian. In urban/suburban areas may encounter people and pets (frequently turned in to public health facilities); predation by jays.

Relevant References: Barclay (1985), Bradley and Baldino (1997), Bradley et al. (1965), Constantine (1959), Findley and Jones (1964), Hall (1946), Hall (2000), O'Farrell (2002), O'Farrell and Bradley (1977), O'Farrell et al. (2000), Orr (1950b), Ports and Bradley (1996), Rakestraw et al. (1998), Shump and Shump (1982b), Williams (2001).


Distribution
of Bats
in Nevada
N
Lasiurus cinereus
hoary bat
Other Chiroptera locations
1:3100000
50
0
50 Miles
Nevada
Natural Heritage
Program

Western Yellow Bat—*Lasiurus xanthinus*

Distribution: Formerly referred to as a subspecies of *Lasiurus ega* but recent genetic work indicates specific status. An apparent expansion northward in the species' range in southern California has been documented (Constantine, 1998a; P.E. Brown, personal communication; M. J. O'Farrell, personal communication). The first occurrence of this species in Nevada was in the Muddy River drainage. It was documented by photograph in February 1999 and confirmed by vocal signature and capture in March 2000 (M. J. O'Farrell, J. A. Williams, and B. Lund, personal communication). Distribution is widespread within the upper Moapa Valley (Williams, 2001). Other areas with concentrations of palms are being systematically examined for presence but no further locations in southern Nevada have been found to date.

Habitat Characteristics: Primarily associated with fan palms oases but may occur in riparian corridors. The apparent spread of the species appears related to urban use of palms in landscaping. Current Nevada records indicate this species is distributed between 524-549 m.

Resident Status: Apparent year-round resident.

Winter Status: Active individuals have been found within the extensive palm groves at the Moapa National Wildlife Refuge (M. J. O'Farrell, J. A. Williams, and B. Lund, personal communication). Presence has been documented throughout the year (Williams, 2001).

Roost Sites: Day roosts in the dead leaf skirts of fan palms. An unusual roosting situation was reported in a hackberry and sycamore, suggesting occasional use of trees other than palms. One record of a male roosting in a yucca was reported for Texas (Higginbotham et al., 2000).

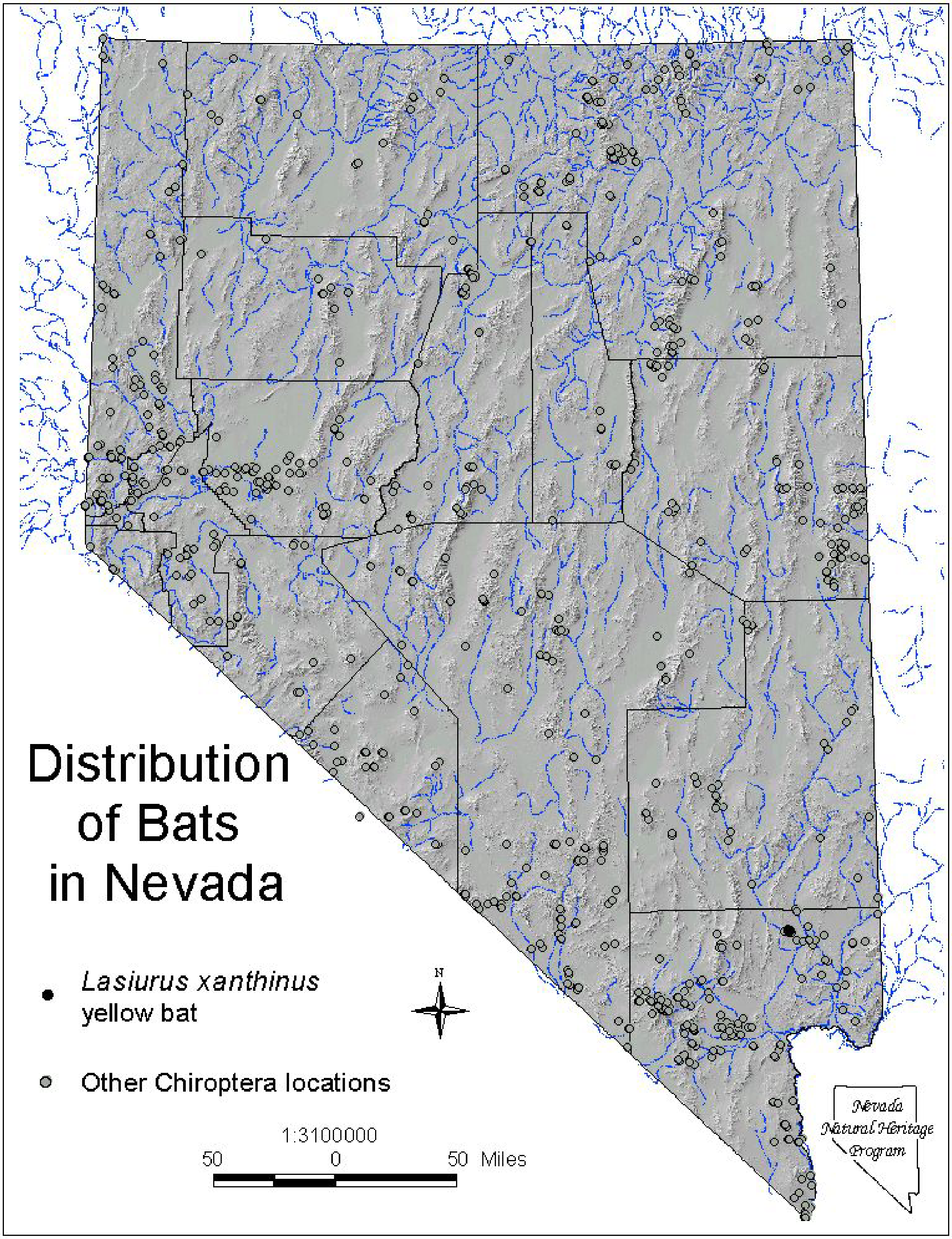
Reproduction: One to four young per year, with pregnancy occurring in April to June. Lactating individuals have been found from June to July. It is suspected that individuals roost singly, but loose clusters may be formed.

Food Habits: A variety of insects including *Hymenoptera*, *Diptera*, *Lepidoptera*, and *Coleoptera* were found in the feces of a single specimen (Higginbotham et al., 1999).

Status: Unprotected. Highly localized, restricted to areas with adequate palm roosts.

Conservation/Management Issues: Trimming of dead leaf skirting, removal of palms, pesticide spraying; loss of riparian. In urban/suburban areas may encounter people and pets (in California it is frequently turned in to public health facilities).

Relevant References: Baker et al. (1988), Barbour and Davis (1969), Constantine et al. (1979), Constantine (1998a), Higginbotham et al. (1999, 2000), Jones et al. (1999), Kurta and Lehr (1995), Morales and Bickham (1995), Mumford and Zimmerman (1963), Williams (2001).


Distribution of Bats in Nevada
Lasiurus xanthinus
yellow bat
Other Chiroptera locations
1:3100000
50
0
50 Miles
N
Nevada Natural Heritage Program

California Myotis—*Myotis californicus*

Distribution: Found throughout Nevada, primarily at the low and middle elevations (to 1,800 m), although occasionally found at higher elevations. More common in the southern half of the state.

Habitat Characteristics: Found in a variety of habitats from Lower Sonoran desert scrub to forests. Current Nevada records indicate this species is distributed between 210-2,730 m (mean = 1,426 m ± 517 m).

Resident Status: Year round resident.

Winter Status: Hibernates but periodically arouses and actively forages and drinks throughout the winter.

Roost Sites: Selects a variety of day roosts including mines, caves, buildings, rock crevices, hollow trees, and under exfoliating bark. Crevice roosting. Night roosts in a wider variety of structures. Generally roost singly or in small groups, although some mines in the Mojave Desert shelter colonies of over 100 in both the summer and winter.

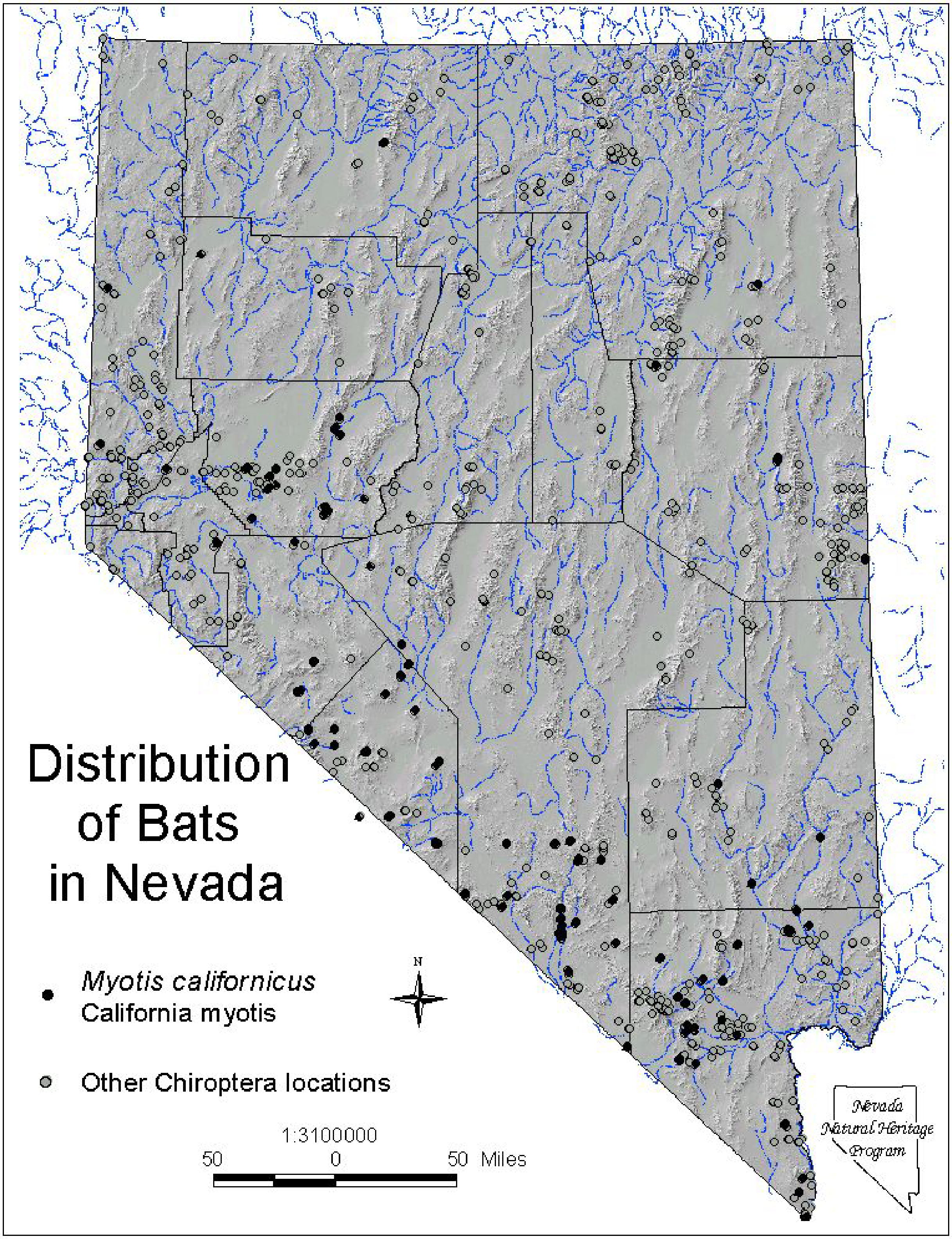
Reproduction: One young per year with birth occurring in May to June. Females may form small maternity colonies, usually less than 100 individuals.

Food Habits: Food items include small moths, flies and beetles. Foraging occurs in the open, but some individuals observed entering mines at dusk presumably to feed on resident insects.

Status: Unprotected. Widespread and regionally common.

Conservation/Management Issues: Closure of mines for reclamation; renewed mining; survey methodology; pesticide spraying.

Relevant References: Bogan (1974), Constantine (1998b), Gannon et al. (2001), Hall (1946), Hoffmeister (1986), Krutzsch (1954), O'Farrell and Bradley (1977), Simpson (1993).


Distribution of Bats in Nevada
Myotis californicus
California myotis
Other Chiroptera locations
1:3100000
50 0 50 Miles
N
Nevada Natural Heritage Program

Small-footed Myotis—*Myotis ciliolabrum*

Distribution: Found throughout the state. In the south, primarily found at the middle and higher elevations (> 1,800 m), although occasionally found at lower elevations. In central and northern part of the State it is more common at valley bottoms (1,050-1,800 m).

Habitat Characteristics: Inhabits a variety of habitats including desert scrub, grasslands, sagebrush steppe, and blackbrush, greasewood, pinyon-juniper woodlands, pine-fir forests, agriculture, and urban areas. Current Nevada records indicate this species is distributed between 510-2,760 m (mean = 1,949 m ± 381 m).

Resident Status: Year round resident.

Winter Status: Hibernates. At least in some areas may tolerate drier and colder hibernacula than some other species. Hibernates individually or in large colonies. A large colony (>100 individuals) was found at a depth of 137 m in an abandoned mine near Eureka (J. S. Altenbach, personal communication).

Roost Sites: Roosts have been found in caves, mines, and trees. Roosting preferences expected to be similar to those for *Myotis californicus*.

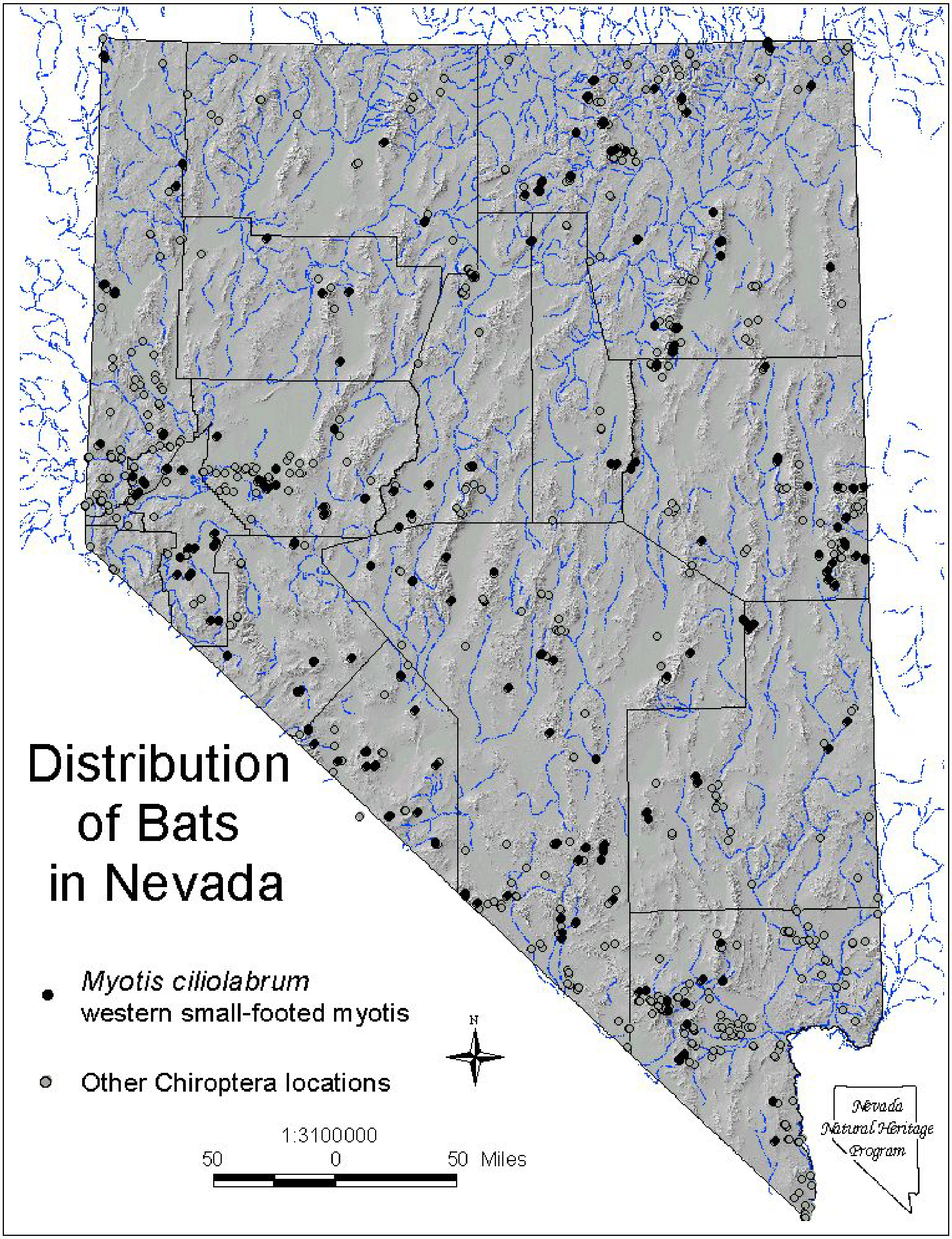
Reproduction: One young per year with birth occurring in May to July. Females may form small maternity colonies, generally fewer than 30 individuals, although one maternity roost in the Mojave Desert had more than 50.

Food Habits: Food items include small moths, flies, ants, and beetles. Foraging occurs in the open.

Status: Unprotected. Widespread and regionally common. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Mine reclamation; renewed mining; recreational caving; survey methodology; water impoundments; timber harvest.

Relevant References: Barbour and Davis (1969), Bogan (1974), Constantine (1998b), Gannon et al. (2001), Hall (1946), Ports and Bradley (1996), Hoffmeister (1986).


Distribution of Bats in Nevada
Myotis ciliolabrum
western small-footed myotis
Other Chiroptera locations
N
1:3100000
50 0 50 Miles
Nevada Natural Heritage Program

Long-eared Myotis—*Myotis evotis*

Distribution: Found throughout the state, primarily at the higher elevations associated with coniferous forest. More widespread and common in the northern half of the state.

Habitat Characteristics: Primarily a forest-associated species. In southern Nevada, only found in Ponderosa pine or above. Found in pinyon-juniper in the northern portion of Nevada Test Site (D. B. Hall, personal communication). In northern Nevada common in pinyon-juniper and above, but also found in sagebrush and desert scrub habitats. Current Nevada records indicate this species is distributed between 690-3,090 m (mean = 2,072 m ± 342 m).

Resident Status: Year round resident.

Winter Status: Presumed to be non-migratory and to hibernate locally.

Roost Sites: Day roosts in hollow trees, under exfoliating bark, crevices in small rock outcrops, and occasionally in mines, caves, and buildings. Has been found in rimrock in Oregon, in a road cut in southern California, and in a riprap boulder jumble in northern California. Found roosting in juniper snags in New Mexico. Night roosts have been found in caves, mines, and under bridges. Generally roost singly or in small groups.

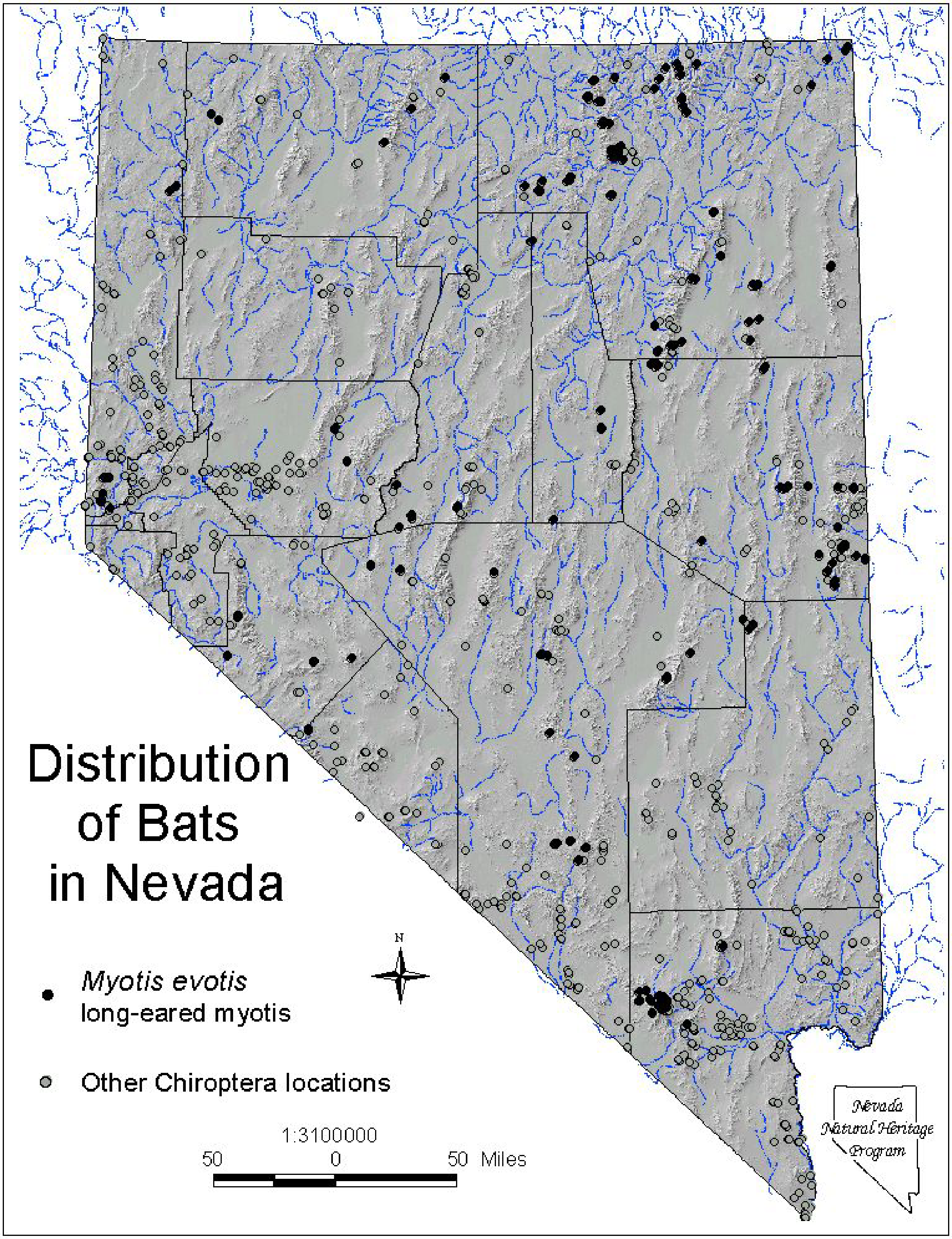
Reproduction: One young per year with birth occurring in June to July. Females may form small maternity colonies with generally less than 40 individuals. A colony of 200 individuals was found in a cave near Sequoia National Park, CA (P.E.. Brown, personal communication).

Food Habits: Food items include moths, small beetles, and flies. Foraging occurs near vegetation and the ground. Appears to have a flexible foraging strategy, catching insects by both substrate and aerial pursuit. Forages along rivers and streams, over ponds, and within cluttered forest environment. Night roost use of caves and mines may involve feeding within the structure, gleaning moths from the rock walls.

Status: Unprotected. Widely distributed but uncommon almost everywhere. Status not well understood. May need mature forest in portions of its range. A severe population decline has occurred in the Spring Mountains in southern Nevada (M. J. O'Farrell, personal communication). Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Timber harvest; recreational caving; mine reclamation; renewed mining; water impoundments; highway projects; bridge replacement; building demolition; pest control.

Relevant References: Chung-MacCoubrey (1996), Cross (1976), Faure and Barclay (1994), Hall (1946), Manning and Jones (1989), Marcot (1984), Miner et al. (1996), Ports and Bradley (1996), Vonhof and Barclay (1997).


Distribution of Bats in Nevada
Myotis evotis
long-eared myotis
Other Chiroptera locations
N
1:3100000
50 0 50 Miles
Nevada Natural Heritage Program

Little Brown Myotis—*Myotis lucifugus*

Distribution: Found primarily through the northern part of the state. Little is known of distribution and abundance.

Habitat Characteristics: Found primarily at higher elevations and higher latitudes, often associated with coniferous forest. Needs water nearby. Occurrence in Dixie Valley, (Churchill County) (1,370 m) has been documented acoustically (P E. Brown and R. D. Berry, personal communication).

Resident Status: Probably a year round resident.

Winter Status: Hibernates but no hibernating colonies have been found in Nevada. It is suspected that there are elevational movements between summer and winter roosts. No large aggregations of this species, like those known in the eastern U.S. have been found.

Roost Sites: Day roosts in hollow trees, rock outcrops, buildings, and occasionally mines and caves. One of the species most commonly found in human structures. Night roosts may be same structures used for day roost but locations nearest the entrance are preferred. Hibernacula elsewhere are generally mines or caves. Often found in the same roost sites with *Myotis yumanensis*. Large numbers (>100) were occupying bat houses at Ruby Lake NWR Headquarters (Elko County) (1,830 m) as well as buildings (P.E. Brown, personal communication).

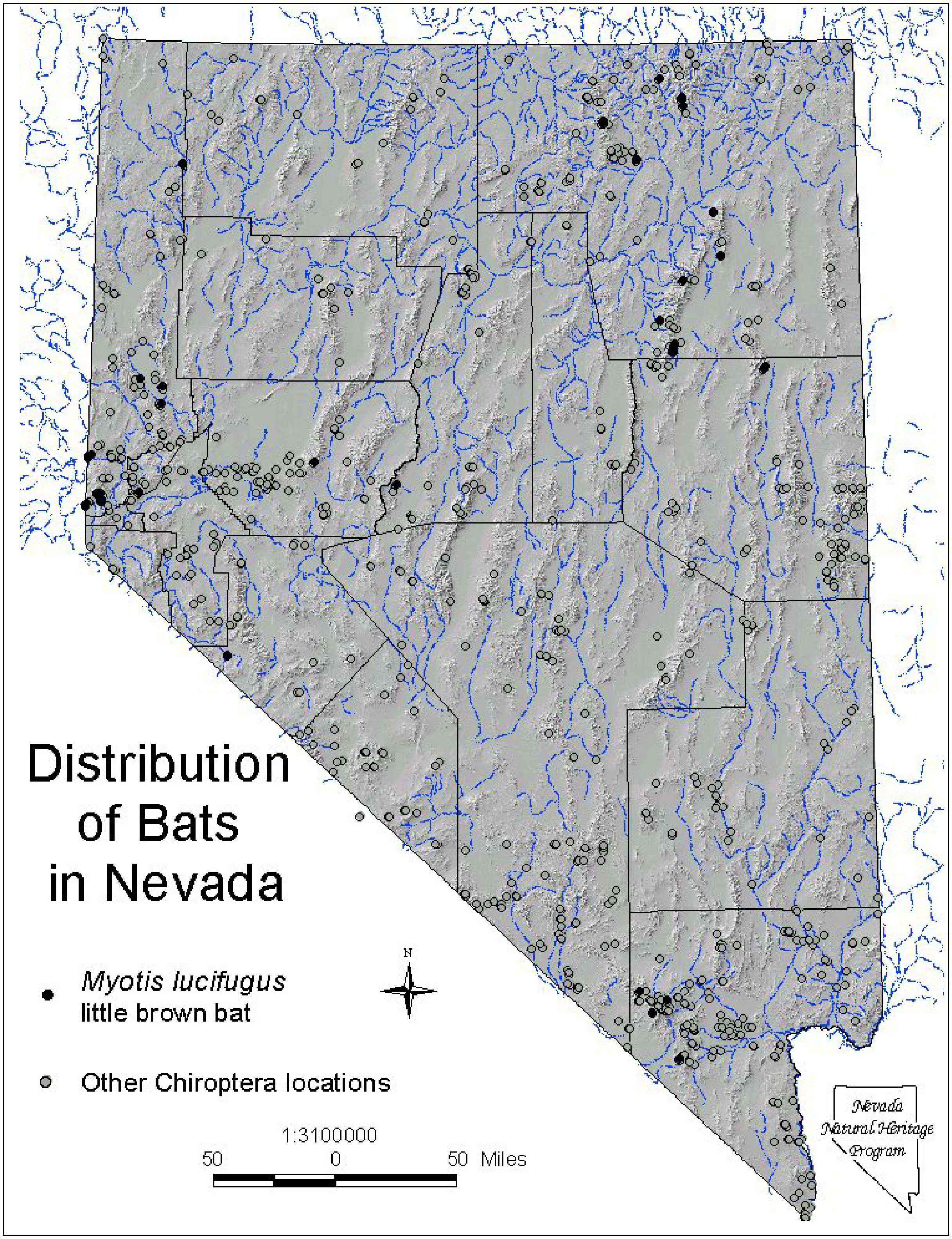
Reproduction: One young per year with birth occurring in May to July. Large maternity roosts (100 to several thousand) are formed comprised of adult females. Males roost singly or in small groups. Hibernating groups contain both sexes.

Food Habits: Feeds heavily on small aquatic insects, such as caddis flies, midges, and mayflies. Foraging occurs in open areas among vegetation, along water margins, and sometimes about 1 m above water surface. When young begin to fly, adults move to more cluttered habitats and leave open foraging areas to the juveniles.

Status: Unprotected. Regionally common and more tolerant of human disturbance than most species.

Conservation/Management Issues: Timber harvest; pesticide spraying; building demolition; pest control exclusion; mine reclamation; renewed mining; cyanide ponding.

Relevant References: Adams (1990), Clark et al. (1991), Fenton and Barclay (1980), Hall (1946), Herd and Fenton (1983), Kalcounis (1992).


Distribution of Bats in Nevada
Myotis lucifugus
little brown bat
Other Chiroptera locations
N
1:3100000
50 0 50 Miles
Nevada Natural Heritage Program

Fringed Myotis—*Myotis thysanodes*

Distribution: Found through central and southern Nevada. Probably occurs in northern Nevada, as well. Found from upper elevation creosote bush desert to pinyon-juniper and white fir (2,150 m) in the White Pine Range (White Pine County).

Habitat Characteristics: Found in a wide range of habitats from low desert scrub habitats to high elevation coniferous forests. Current Nevada records indicate this species is distributed between 420-2,160 m (mean = 1,590 m ± 393 m).

Resident Status: Year round resident.

Winter Status: Hibernates but capable of periodic winter activity.

Roost Sites: Day and night roosts in mines, caves, trees, and buildings. The majority of roosts documented in California have been in buildings or mines. Two small nursery roosts have been found in very cool, wet mines in northern California. A maternity colony of approximately 200 individuals was found in a mine in creosote bush scrub in the Mojave Desert (>750 m; P.E. Brown, personal communication). Has been radiotracked to tree hollows, particularly large conifer snags in Oregon and Arizona, and rock crevices in cliff faces in southern California. Hibernacula are generally mines or caves.

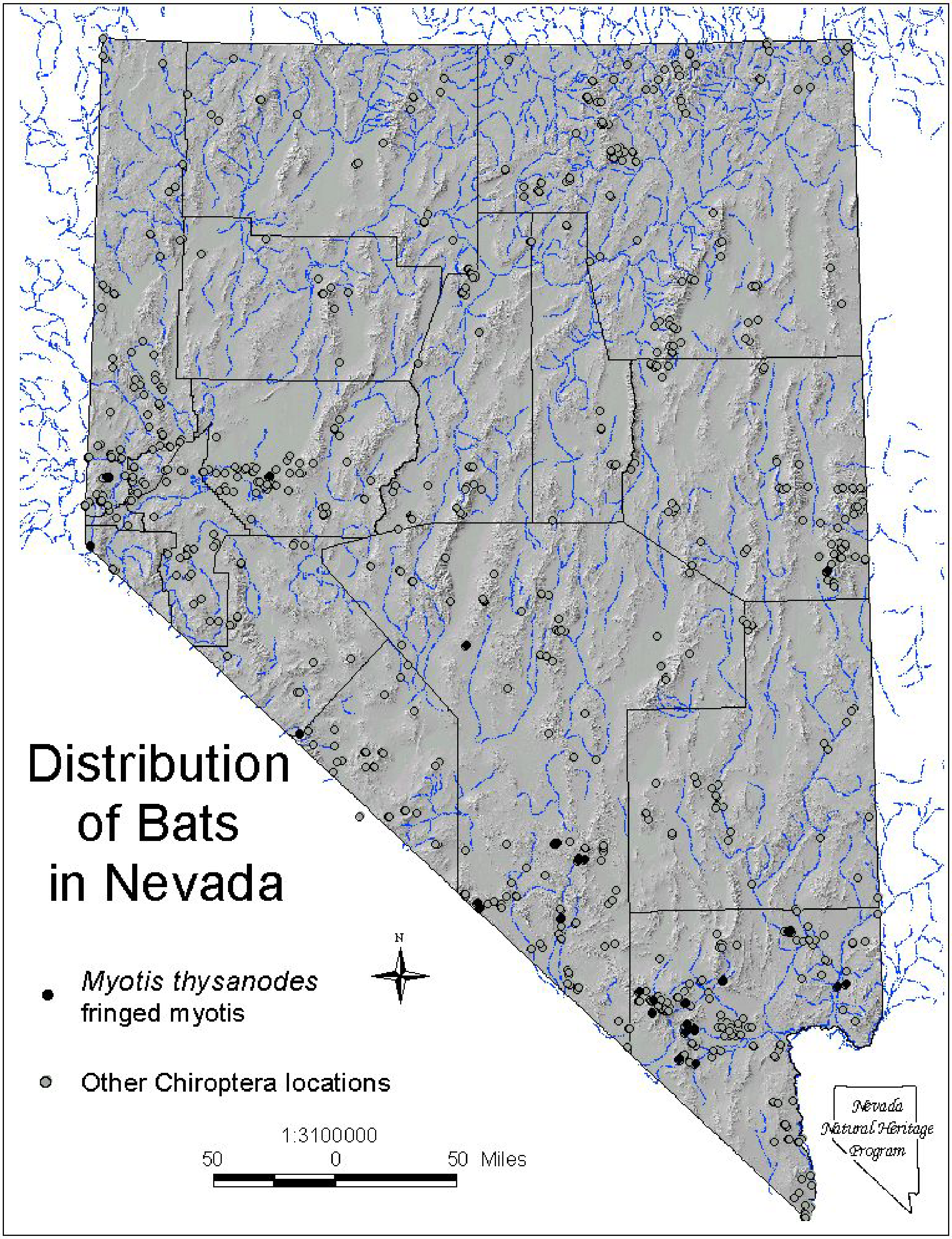
Reproduction: One young per year with birth occurring in May to June. Maternity roosts are comprised of adult females and may include several hundred individuals. Males roost singly or in small groups. Hibernating groups contain both sexes.

Food Habits: Food items vary but there appears to be a selection for small beetles. Foraging occurs in and among vegetation, with some gleaning activity. Diet is primarily beetles, but includes a variety of other taxa including moths. Radiotracking in southern California suggests foraging along forest edges and over the forest canopy.

Status: Unprotected. Widely distributed but rare in Nevada. Relatively few records but an apparent increase in numbers or area occupied in southern Nevada over the past 20 years. Very sensitive to roost disturbance. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Recreational caving; mine reclamation; renewed mining; water impoundments; building demolition; pest control; timber harvest; bridge replacement.

Relevant References: Chung-MacCoubrey (1996), Hall (1946), O'Farrell and Studier (1973, 1975, 1980).


Distribution
of Bats
in Nevada
N
Myotis thysanodes
fringed myotis
Other Chiroptera locations
1:3100000
50 0 50 Miles
Nevada
Natural Heritage
Program

Cave Myotis—*Myotis velifer*

Distribution: A single historical record (1964) from the southern portion of the Lake Mead National Recreation Area west of Lake Mojave. Repeated attempts to re-locate the mine proved fruitless. In May 2001, the mine was relocated and determined to still house the species (P.E. Brown and R. D. Berry, personal communication).

Habitat Characteristics: Found primarily at lower elevations in arid habitat dominated by creosote bush, palo verde, brittlebush, cactus, and desert riparian.

Resident Status: Summer resident.

Winter Status: Hibernates, but a few individuals have been found active in mines in winter (P.E. Brown, personal communication).

Roost Sites: Day roosts in caves and mines, and occasionally buildings and bridges. Tolerates summer roost temperatures as high as 37°C. Night roosts may be same structures used for day roosts, but locations nearest the entrance are preferred. Found repeatedly in swallow nests, particularly in non-reproductive season. Hibernacula elsewhere are generally mines or caves.

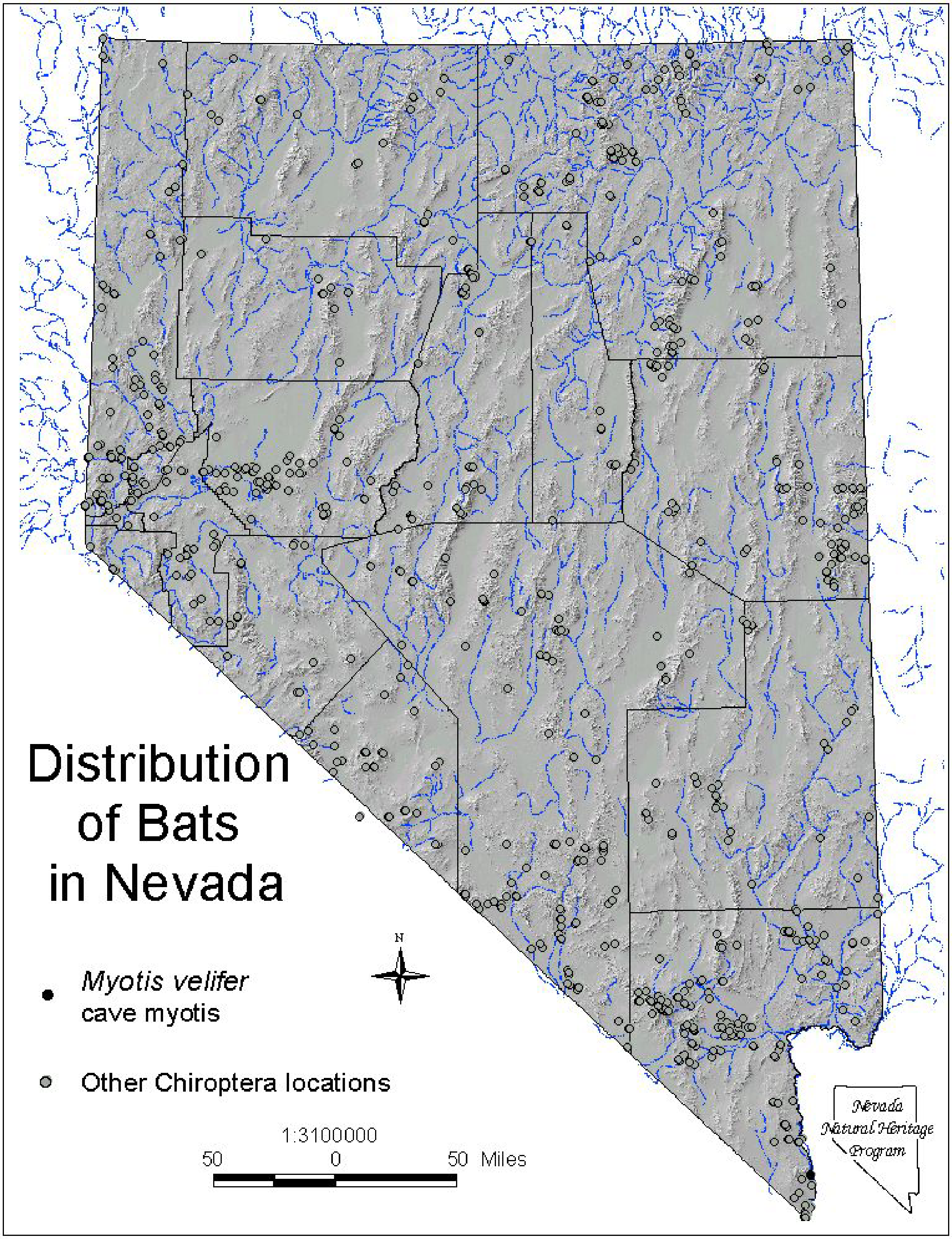
Reproduction: One young per year with birth occurring in June to July. Forms large maternity colonies numbering in the tens of thousands. Males roost in groups of usually less than 100 individuals. Hibernating groups contain both sexes.

Food Habits: Food items include moths and beetles. Foraging occurs in open areas near the edge or over vegetation.

Status: Unprotected. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Loss of riparian habitat and intense agricultural conversion along the Colorado River; agricultural spraying; mine reclamation; renewed mining.

Relevant References: Cockrum and Musgrove (1964), Constantine (1958), Davis and Cockrum (1963), Fitch et al. (1981), Stager (1939), Vaughan (1959).


Distribution of Bats in Nevada
N
Myotis velifer
cave myotis
Other Chiroptera locations
1:3100000
50 0 50 Miles
Nevada Natural Heritage Program

Long-legged Myotis—*Myotis volans*

Distribution: Found throughout the State but more widespread and common in the northern half. Occurs from mid to high elevations. Absent from the low desert.

Habitat Characteristics: Found in pinyon-juniper, Joshua tree woodland, and montane coniferous forest habitats. Occasionally found in Mojave and salt desert scrub (D. B. Hall, personal communication), and blackbrush, mountain shrub, and sagebrush. Current Nevada records indicate this species is distributed between 930-3,420 m (mean = 2,067 m ± 420 m).

Resident Status: Probably a year round resident.

Winter Status: Hibernates but has the capability of winter activity. It is suspected that there are elevational and latitudinal movements between summer and winter roosts. Transient colonies in the spring on the east side of the Sierra Nevada.

Roost Sites: Day roosts primarily in hollow trees, particularly large diameter snags or live trees with lightning scars. Also uses rock crevices, caves, mines, and buildings when available. Caves and mines may be used for night roosts. Hibernacula elsewhere are generally mines or caves.

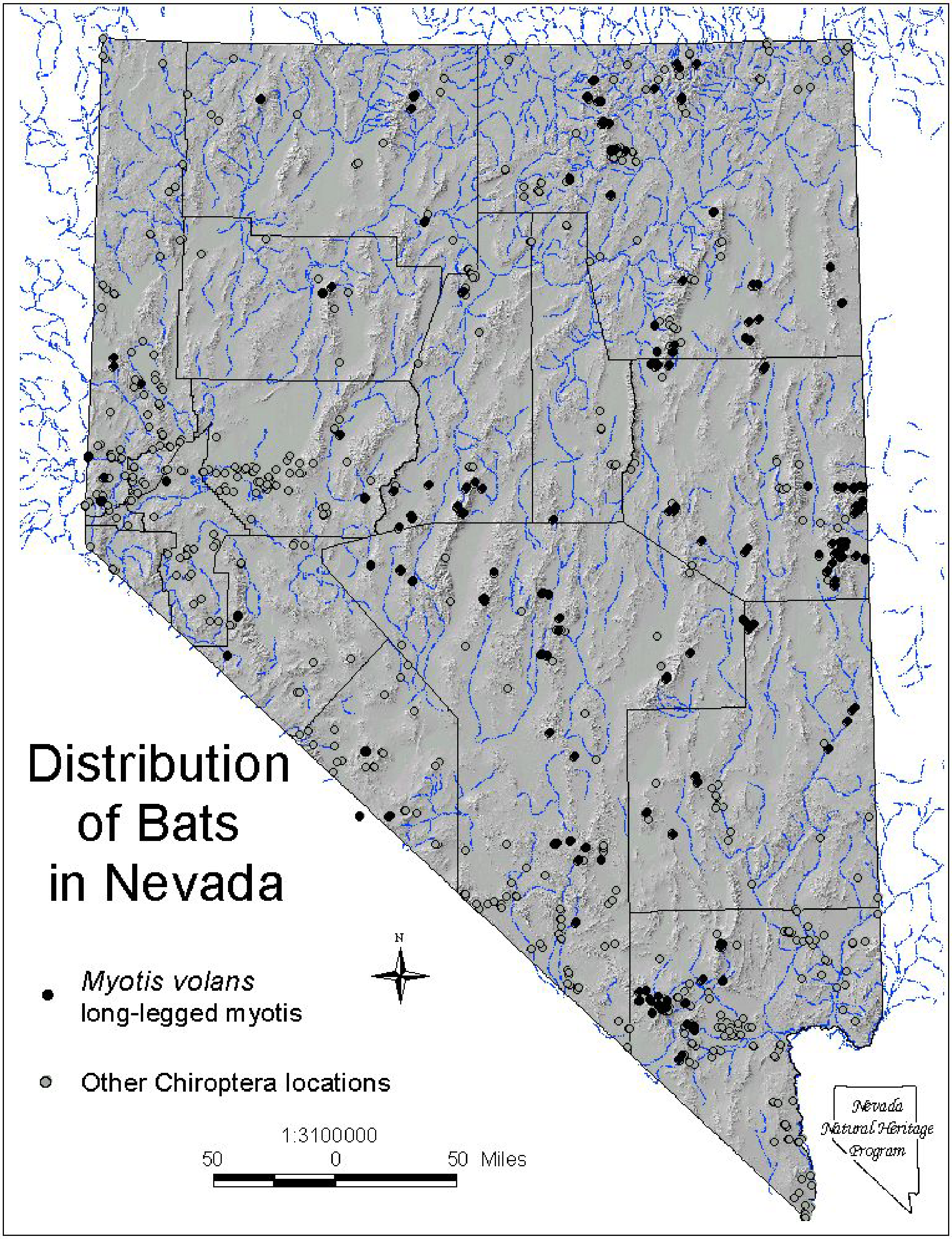
Reproduction: One young per year with birth occurring in June to July. Maternity colonies of up to 200-500.

Food Habits: Feeds primarily on moths but also feeds on other taxa, including beetles, flies and termites. Foraging occurs in open areas, often at canopy height.

Status: Unprotected. Population declines observed in the Spring Mountains of southern Nevada (M. J. O'Farrell, personal communication). Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Timber harvest; aerial pesticide spraying; recreational caving; mine reclamation; renewed mining; water impoundments; building demolition and pest control.

Relevant References: Chung-MacCoubrey (1996), Fenton and Bell (1979), Hall (1946), O'Farrell and Bradley (1977), Ormsbee (1996), Ormsbee and McComb (1998), Ports and Bradley (1996), Saunders and Barclay (1992), Warner and Czaplewski (1984).


Distribution of Bats in Nevada
N
Myotis volans
long-legged myotis
Other Chiroptera locations
1:3100000
50 0 50 Miles
Nevada Natural Heritage Program

Yuma Myotis—*Myotis yumanensis*

Distribution: Found in the southern and western half of the state, primarily at low to middle elevations. A recent collection in east central Nevada (M. J. O'Farrell, personal communication) suggests a wider distribution in the state.

Habitat Characteristics: Found in a wide variety of habitats from low to mid-elevations, including sagebrush, salt desert scrub, agriculture, playa, and riparian habitats. One of the species that is most tolerant of human habitation and one of the few that thrives in a relatively urbanized environment. Although often considered to be a "building" bat, it is also found in heavily forested settings elsewhere. Current Nevada records indicate this species is distributed between 450-2,340 m (mean = 1,434 m ± 395 m).

Resident Status: Year round resident.

Winter Status: Hibernates. No large winter aggregations have been found.

Roost Sites: Day roosts in buildings, trees, mines, caves, bridges, and rock crevices. Night roosts usually associated with buildings, bridges, or other man-made structures.

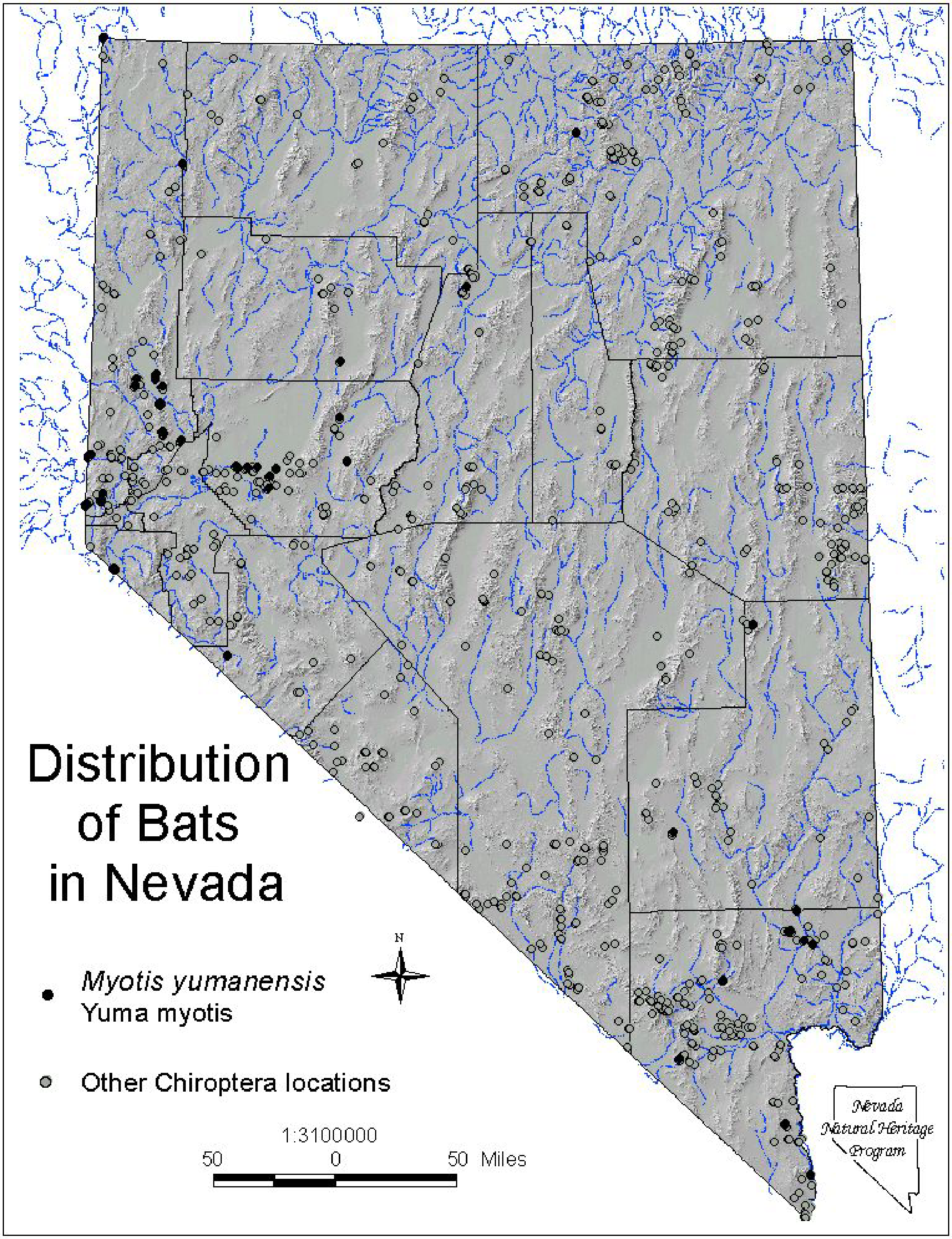
Reproduction: One young per year with birth occurring in June to July. Maternity colonies can be large (200 to several thousand) and contain only adult females and their young. Males roost singly or in small groups.

Food Habits: Feeds primarily on emergent aquatic insects, such as midges and caddis flies. Foraging occurs directly over the surface of open water and above vegetation. Usually found over relatively still water (e.g., ponds, reservoirs, or pools in streams and rivers.

Status: Unprotected. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Timber harvest; building demolition; pest control exclusion; bridge replacement; mine reclamation; renewed mining; water impoundments.

Relevant References: Aldridge (1986), Brigham et al. (1992), Dalquest (1947), Hall (1946), Herd and Fenton (1983), Hoffmeister (1986).


Distribution of Bats in Nevada
N
Myotis yumanensis
Yuma myotis
Other Chiroptera locations
1:3100000
50 0 50 Miles
Nevada Natural Heritage Program

Western Pipistrelle—*Pipistrellus hesperus*

Distribution: Found throughout most of the state, primarily in the southern and western portions. Most common in low and middle elevations (1,800 m), although occasionally found at higher elevations (>2,450 m).

Habitat Characteristics: Lower and Upper Sonoran desert habitats of blackbrush, creosote, salt desert shrub and sagebrush, with occasional occurrence in Ponderosa pine and pinyon-juniper, usually in association with rock features such as granite boulders and canyons. Current Nevada records indicate this species is distributed between 210-2,550 m (mean = 1,276 m ± 532 m).

Resident Status: Year round resident.

Winter Status: Hibernates but periodically arouses and actively forages and drinks throughout the winter.

Roost Sites: Day roosts primarily in rock crevices but may include mines, caves, or occasionally in buildings and vegetation. Generally roost singly or in small groups.

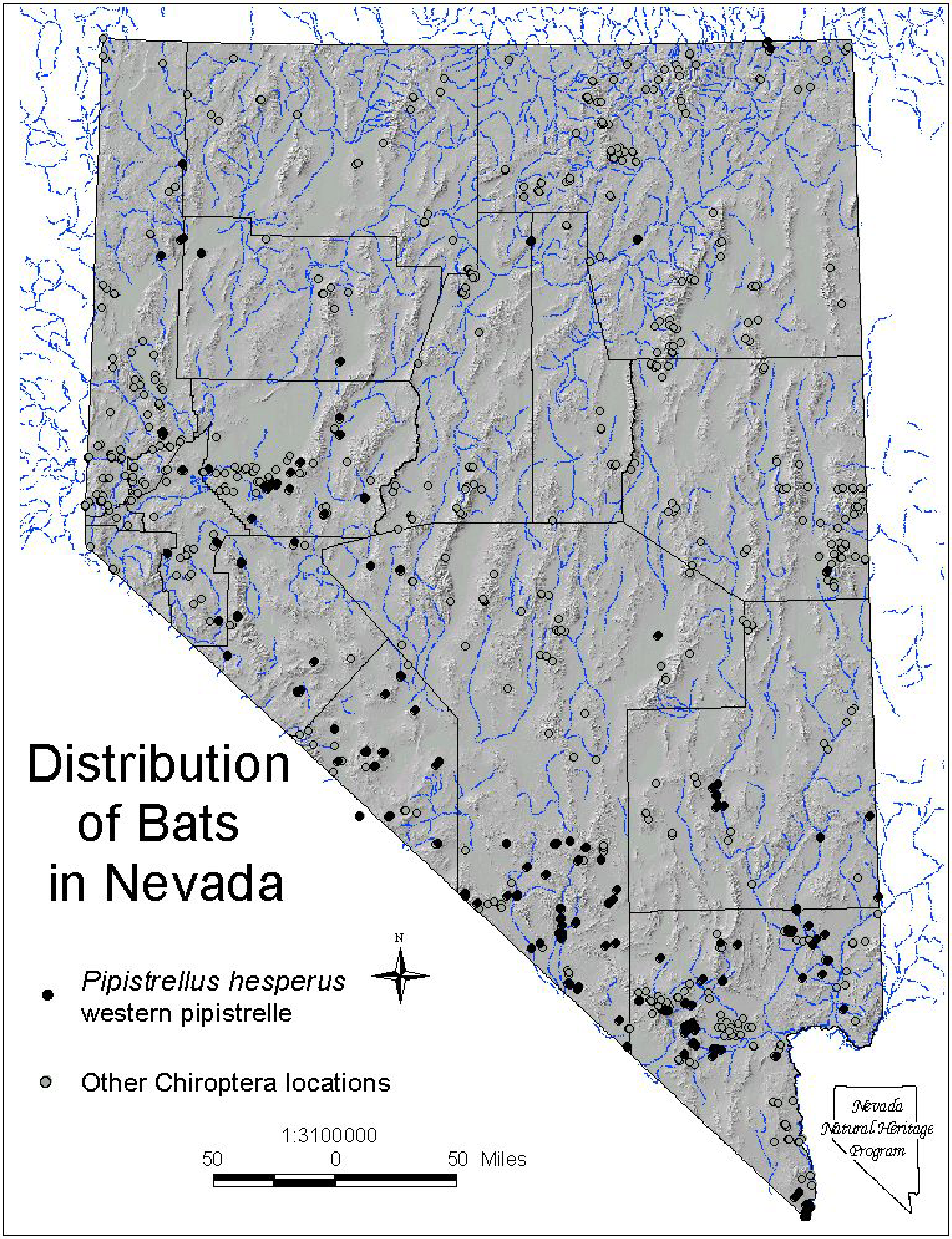
Reproduction: Two young per year with birth occurring in June. Females may form small maternity colonies, usually less than 12 individuals.

Food Habits: Food items include small moths, leafhoppers, mosquitoes, and flying ants. Foraging occurs in the open and is characterized by slow, erratic flight.

Status: Unprotected. Common in appropriate habitat. Population declines have been noted in the Spring Mountains in southern Nevada (M. J. O'Farrell, personal communication).

Conservation/Management Issues: Destruction of roosting and foraging habitat by urban development; water impoundments; mine closure and reclamation.

Relevant References: Bradley and O'Farrell (1969), Cross (1965), Hall (1946), Hayward and Cross (1979), Koford and Koford (1948), Moor et al. (1965), O'Farrell and Bradley (1970, 1977), Stager (1943), Von Bloeker (1932).


Distribution of Bats in Nevada
Pipistrellus hesperus
western pipistrelle
Other Chiroptera locations
N
1:3100000
50 0 50 Miles
Nevada Natural Heritage Program

Molossidae

Western Mastiff Bat—*Eumops perotis*

Distribution: Known only from one specimen found dead in Las Vegas.

Habitat Characteristics: Found in a variety of habitats from desert scrub to chaparral to montane coniferous forest. Have been detected in montane meadows above 2,450 m. Distribution is tied to availability of suitable roosting habitat and can sometimes be predicted based on presence of significant rock features (e.g., large granite or basalt formations).

Resident Status: Probable transient.

Winter Status: Active all winter at lower elevations.

Roost Sites: Day roosts primarily in crevices in cliff faces and cracks in boulders, occasionally buildings. Generally roost in groups less than 100.

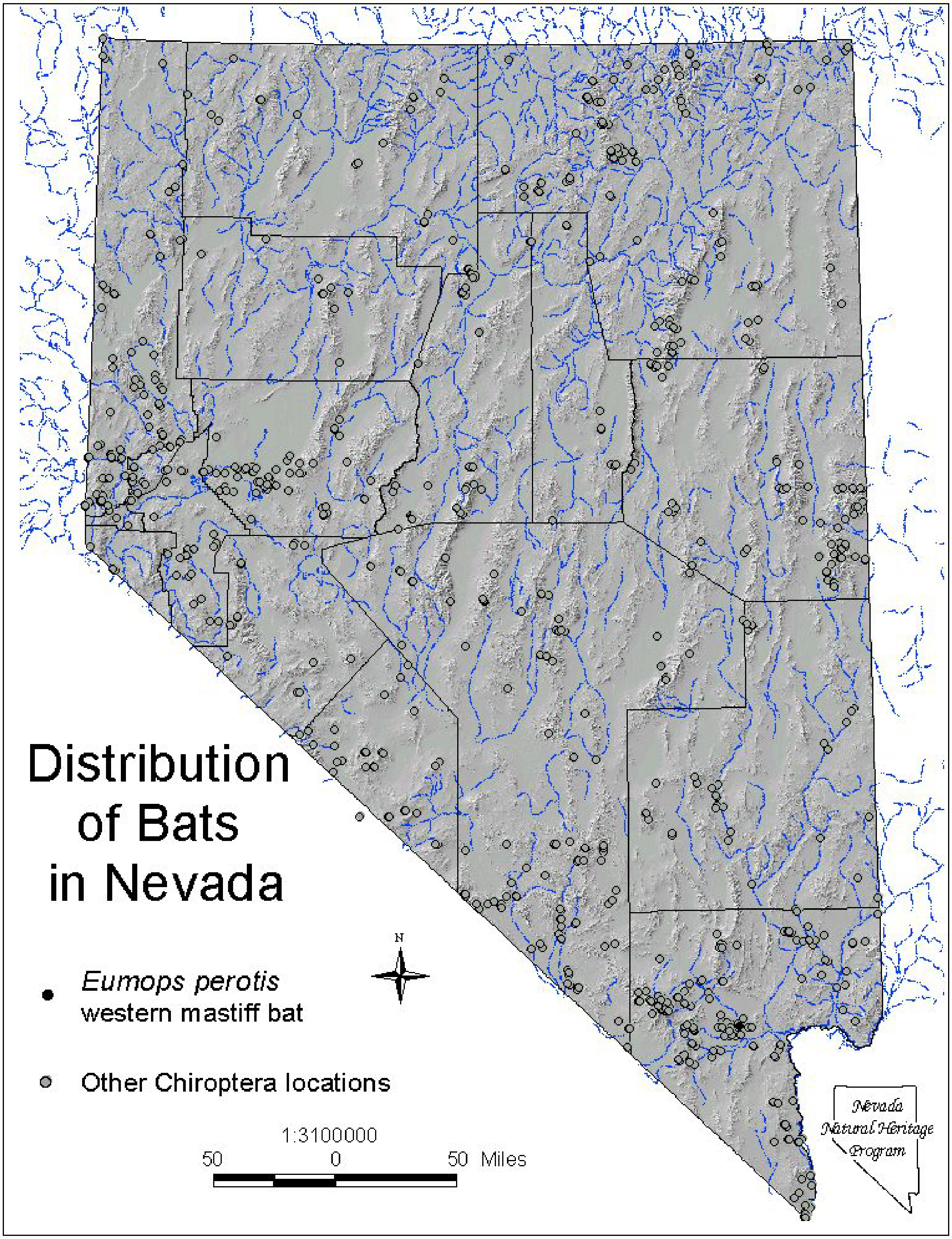
Reproduction: One young per year, with birth occurring in June to July. Females form maternity colonies, although adult males are sometimes present.

Food Habits: Diet appears to be primarily moths, but also includes beetles and crickets in California. Foraging occurs in the open and ranges to high altitude (300 m above ground). Some individuals are known to travel more than 40 km to reach feeding grounds. Detected most frequently over desert washes, grasslands, or meadows but also feed above forest canopy.

Status: Unprotected. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Recreational climbing; water impoundments; pest control exclusion; building demolition; highway projects; loss of foraging habitat due to urban/suburban expansion; agricultural spraying.

Relevant References: Bradley and O'Farrell (1967), Dalquest (1946), Krutzsch (1955), Leitner (1966), Pierson and Rainey (1995), Vaughan (1959).


Distribution of Bats in Nevada
Eumops perotis
western mastiff bat
Other Chiroptera locations
N
1:3100000
50 0 50 Miles
Nevada Natural Heritage Program

Big Free-tailed Bat—*Nyctinomops macrotis*

Distribution: Found in the southern portion of Nevada, from one location in the Las Vegas area and the other a historical unspecified locality. Detected in relatively large numbers within the Muddy River drainage from September through October 2000, and again within the same months in 2001 (J. A. Williams, 2001).

Habitat Characteristics: Associated primarily with very rocky country (canyonlands). Found in arroyo, scrub desert, riparian areas, woodland habitats, although generally a floodplain-arroyo association. Typically low elevation, although has been found to 2,450 m in New Mexico, and in higher elevation conifer forest in northern Arizona.

Resident Status: Transient but possible summer resident. Records for this species are sparse and scattered.

Winter Status: Probably does not hibernate.

Roost Sites: Day roosts primarily in crevices in cliff faces, although occasionally in buildings and caves. Generally roost in groups less than 100.

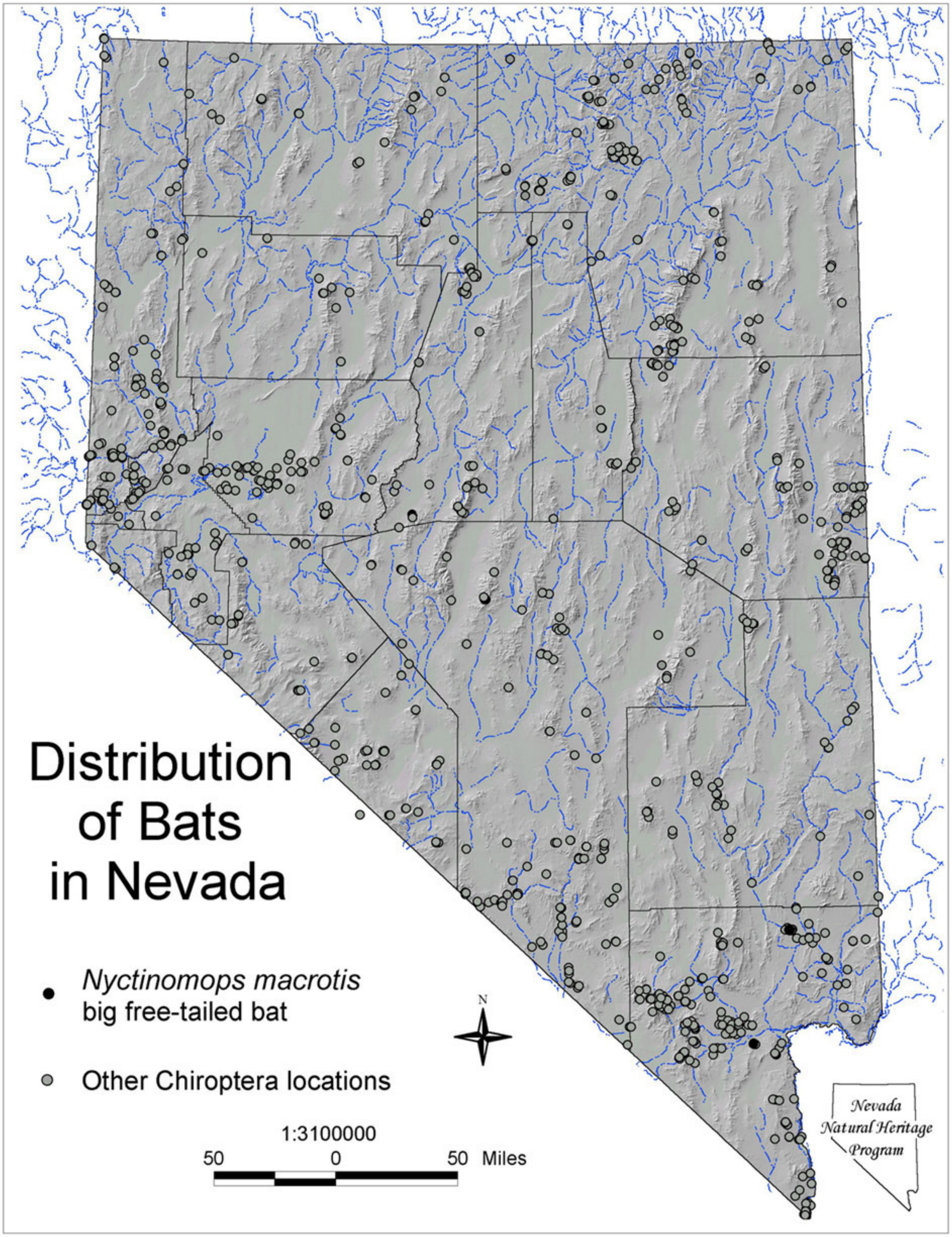
Reproduction: One young per year, with birth occurring in June to July. Females form maternity colonies, males appear to be segregated.

Food Habits: Food items include a variety of insects but moths predominate. Foraging occurs in the open and ranges to high altitude.

Status: Unprotected. Known from very few records. Appears to be rare. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered.

Conservation/Management Issues: Recreational climbing; water impoundments; pest control exclusion; highway projects; loss of foraging habitat due to urban/suburban expansion; agricultural spraying.

Relevant References: Bradley et al. (1965), Easterla (1973), Easterla and Whitaker (1972), Hall (1946), Huey (1932), Milner et al. (1990), Pierson and Rainey (1995), Williams (2001).


Distribution
of Bats
in Nevada
Nyctinomops macrotis
big free-tailed bat
Other Chiroptera locations
N
1:3100000
50
0
50 Miles
Nevada
Natural Heritage
Program

Brazilian Free-tailed Bat—*Tadarida brasiliensis*

Distribution: Found through most of the state, ranging from low desert to high mountain habitats.

Habitat Characteristics: Found in a wide variety of habitats. Although predominantly a lower elevation species has been found from 220 to > 3,500 m in the Sierra Nevadas. Recent acoustic surveys reveal it is more widespread and common, at least in southern Nevada, than previously thought. Current Nevada records indicate this species is distributed between 210-2,550 m (mean = 1,260 m ± 562 m).

Resident Status: Summer resident. Recent observations suggest pockets of year-round residents in southern Nevada (M. J. O'Farrell, personal communication).

Winter Status: Migrations of 1,840 km are documented for this species (Wilkins, 1989). Migrates away from colder regions and overwinters in areas with predominantly non-freezing temperatures but has been found to hibernate in northern California. Migrators appear to be active in the winter range. Winter activity has been observed recently in the low desert of southern Nevada.

Roost Sites: Select a variety of day roosts including cliff faces, mines, caves, buildings, bridges, and hollow trees. Although colonies number in the millions in some areas, colonies in Nevada are generally several hundred to several thousand (largest known colonies have been estimated at ca. 70,000-100,000). Some caves may be used as long term transient stopover roosts during migration. For example, some evidence suggests that the colony at Rose Cave arrives in July and departs in mid October.

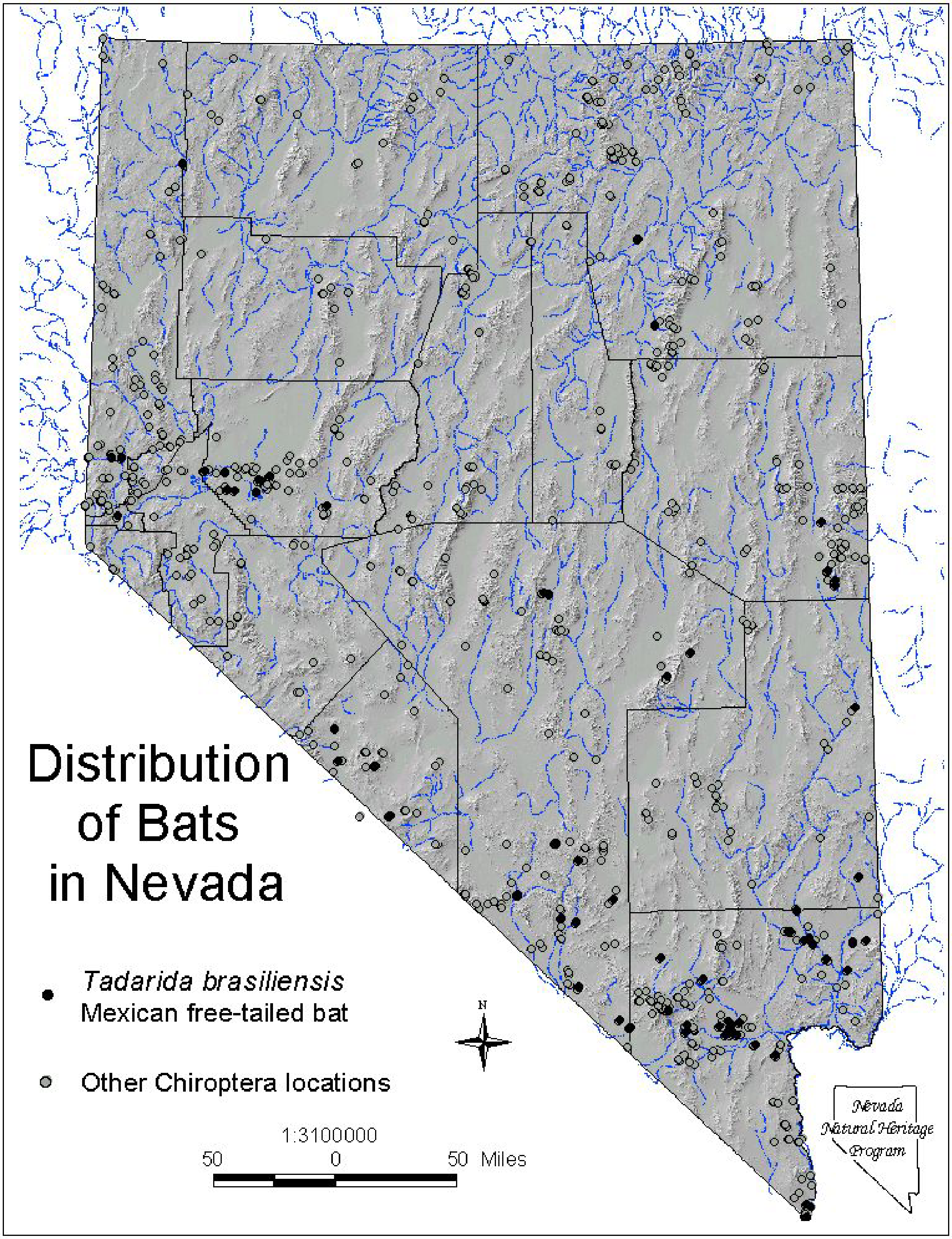
Reproduction: One young per year, with birth occurring in June to July. Females form large maternity colonies, males segregate and may form smaller bachelor colonies.

Food Habits: Food items include a variety of insects but moths predominate. Foraging occurs in the open and may range to high altitudes. Some individuals are known to travel more than 40 km to reach feeding grounds and feed more than 300 m above the ground.

Status: Unprotected. Although one of the most common species in much of the west, its numbers may be well below what they were historically. A large population decline has been documented for the Rose Guano Cave, near Ely. The decline is likely due to the introduction of a second entrance, thereby altering the cave microclimate and allowing for easy access by humans (P.V. Bradley, personal communication). The artificial adit entrance was sealed in October 1996 in an attempt to reverse the declining population trend.

Conservation/Management Issues: Recreational caving; mine reclamation; renewed mining; historical guano mining; water impoundments; agricultural spraying; bridge replacement; pest control exclusion; highway projects; loss of foraging habitat due to urban/suburban expansion.

Relevant References: Barbour and Davis (1969), Cockrum (1969),Constantine (1967), Hall (1946), Simmons et al. (1978), Wilkins (1989).


Distribution of Bats in Nevada
Tadarida brasiliensis
Mexican free-tailed bat
Other Chiroptera locations
1:3100000
50 0 50 Miles
N
Nevada Natural Heritage Program

Accompanying Text To Maps

Records of Nevada's 23 species of bats were gathered from a variety of sources from 1928 to 2002 [Hall (1946), Nevada Division of Wildlife, Nevada Natural Heritage Program, Nevada State Museums (Carson City and Las Vegas), University of California-Berkeley (Museum of Vertebrate Zoology), University of Nevada-Reno (Department of Biology), and unpublished data sources (P. E. Brown, M. J. O'Farrell, M. Rahn and J. A. Williams)]. Only those records with reliable location data were included in the distribution maps. Gaps in knowledge exist in those areas where no records for bats occur (Figure 24). It is reasonable to assume that these areas have not been adequately surveyed.

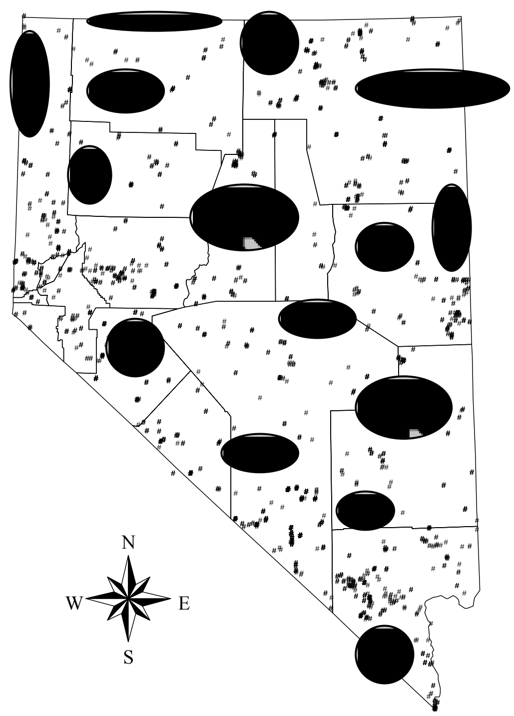


Figure 24. Distribution of all known bat records in Nevada and the associated gaps in knowledge (ovals). These gaps should be considered a high priority for future surveys.

Eight bats should be considered widely distributed throughout the State [Pallid Bat (Page 16), Townsend's Big-eared Bat (Page 18), Big Brown Bat (Page 20), Hoary Bat (Page 30), Silver-haired Bat (Page 26), Small-footed Myotis (Page 36), Long-eared Myotis (Page 38), and Long-legged Myotis (Page 46)]. Six species have distributions limited to only the southern portion of the State [Mexican Long-toughed Bat (Page 12), Western Mastiff Bat (Page 52), Allen's Lappet-browed Bat (Page 24), Western Yellow Bat (Page 32), California Leaf-nosed Bat (Page 14), and Big Free-tailed Bat (Page 54)]. Of these, Mexican Long-toughed Bats, Western Mastiff Bats, Western Yellow Bats, California Leaf-nosed Bats and Big Free-tailed Bat*s* are known from only a few localities. Six species have unique distributions in the state: 1) those with a majority of their records in the western and southern portions of the State, (although there are records throughout the State) [California Myotis (Page 34), Fringed Myotis (Page 42), and Western Pipistrelle (Page 50)]; 2) those having a northern distribution [Little Brown Myotis (Page 40)]; 3) those having very few records in the northern portion of Nevada [Brazilian Free-tailed Bat (Page 56)]; and those species having a patchy distribution, being distributed throughout most of the State but having a majority of the records concentrated in a few areas [Yuma Myotis (Page 48)]. Finally, there is insufficient data to determine an overall distribution pattern for Spotted Bats (Page 22) and Western Red Bats (Page 28).

Summary of Threats

Threats facing Nevada's 23 bat species can be categorized into those that are primarily human-induced (anthropogenic) and those resulting from natural events and/or the natural history of the species. Threats can be further categorized as those with the potential to affect bat habitats (roosting, foraging, or migration corridor habitats) and those that would have the potential to cause direct bat population declines with no disturbance of habitats. All threats have the potential to affect roosting, foraging or migrating segments of the population. Many threats are interrelated, and it was not the intent to down play their connectivity, but rather to make the document as usable as possible.

Anthropogenic Threats

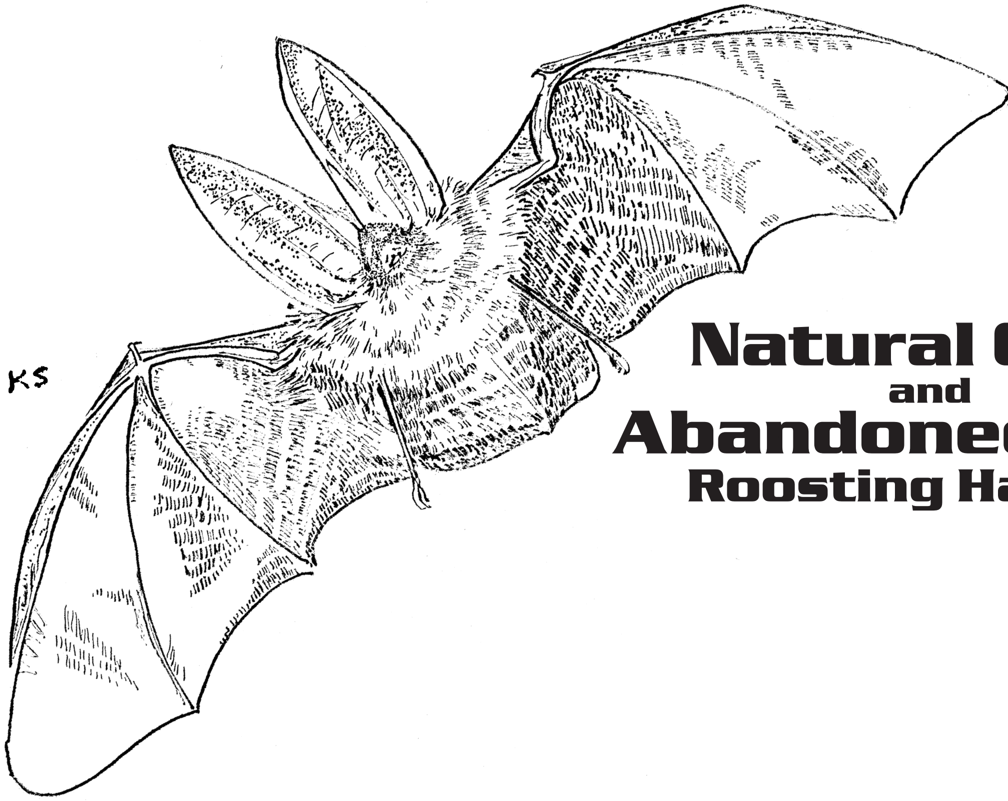
1) **Abandoned Mine Closures** - There continues to be a substantial threat of closures of abandoned mines with hard closure techniques (bulldozing, foam and dynamite) that are devastating to bats and bat habitats (P. Bradley, personal communication). **Fix** - Bat-friendly closure techniques (fencing, hazard signs and gating) should be employed wherever possible. When hard closure techniques are the only option, adequate and proper bat surveys should precede any closure project. When bats are found, proper bat exclusion and off-site mitigation should precede any hard closure project (See Strategies and Appendix A,B,C,D,E).
2) **Eradication** - State funded projects designed to protect the public from rabies transmission target the elimination of bat colonies (State Health Department). **Fix** – Education (See Strategies).
3) **Inventory, Monitoring, and Scientific Research** – Research activities can depress, scatter or extirpate populations of sensitive bat species (Perkins and Schommer 1991). **Fix** – Standardized survey protocol, new non-intrusive survey techniques and new permit requirements are provided (see Appendix A,B,C,D).
4) **Livestock Grazing** – Certain livestock grazing practices have contributed to the large-scale conversion of mesic riparian bat habitats (Swift, 1984) and xeric upland bat habitats to unproductive wildlife habitat. **Fix** – Improve stewardship of riparian and upland habitats on public and private lands throughout Nevada. Education.
5) **Pesticide Spraying – Indirect –** Non-target insecticide sprays reduce numbers and species of insects available to bats (Brown and Berry, 1991). **Direct** – Bats may be at risk of direct poisoning as a result of their diets, high metabolic rates, high food intake and high rates of fat mobilization during migration, lactation and hibernation (Clark, 1988). **Fix** – Additional research and Education (i.e. bats as an alternative to chemical insecticides).
6) **Recreational Caving –** Human disturbance during critical maternity, hibernation and leking time periods can depress, scatter and extirpate bat populations (Pierson and Rainey, 1996). **Fix** –Seasonal closures, Education and Research to determine degree of impacts (see Strategies and Appendix B,C,D).
7) **Renewed Mining in Historical Mine Sites –** Contemporary open pit gold mining often is associated with historical mining districts. Bat habitats have been destroyed when pits have come into contact with and/or totally removed historical mine workings (Brown, 1995). **Fix** – On-site bat exclusion and off-site mitigation (see Strategies and Appendix D).
8) **State Regulatory Status –** Twenty-two bat species are unprotected by statute in Nevada. In Nevada, an individual requires no hunting license to kill unprotected animals (Nevada NRS). **Fix** – Change NRS (see Appendix B).
9) **Timber Harvest –** Timber harvest impacts roosting and foraging habitats (Barclay and Brigham, 1996). **Fix** - Modify timber harvest techniques where bat roosting and foraging habitats exist and better assess bat use of

these habitats in Nevada (See Strategies and Appendix D,G,H).

10) **Toxic Material Impoundments –** Lethal concentrations of cyanide in ponds and atop ore piles associated with the processing of gold ore, killed at least 158 bats (species not identified) between 1986 and 1989 (Nevada Division of Wildlife, unpublished data). **Fix** – Precluding access to (*exclusion netting, etc*)) and chemical neutralization of cyanide.
11) **Vegetative Conversion –** Millions of acres of native shrub steppe and thousands of acres of pinyon-juniper habitats have, through the agents of fire, livestock grazing, mechanical and chemical vegetation manipulation, been permanently converted to monotypic exotic grasslands (*Bromus* and *Agropyron*). Several insect species, which bats rely on for food, such as most *Lepidopterans,* reproduce on shrubs, trees and flowering plants, and not on grasses. **Fix** - Stop the conversion to exotic grasslands and attempt to rehabilitate those areas from exotic to native rangelands.

Natural Threats

1) **Behavioral Ecology** – Their roosting behavior makes most bats highly vulnerable to disturbance. **Fix** – Protect roosts, and limit opportunities for anthropogenic disturbance.
2) **Population Ecology** – Low birth rates, high infant mortality, high roost fidelity, high longevity make most bat populations vulnerable to roost and foraging habitat disturbances. **Fix** – Protect roosts and foraging habitats and limit opportunities for anthropogenic disturbance.
3) **Habitat Threats** – The loss of roosting and foraging habitats to natural erosion and fire is a factor. **Fix** – Rehabilitate areas damaged by fires and erosion.
4) **Predation** – Minor predation of bats by snakes, birds of prey and carnivores has been documented in Nevada. **Fix** – None.



Natural Cave and Abandoned Mine Roosting Habitat

CONSERVATION STRATEGY

Introduction

Bats are distributed across the entire State from 150 m above sea level along the Colorado River to nearly 4,000 m on the flanks of Boundary Peak and Mt. Wheeler, Nevada's highest mountains. Bats use all known habitats in Nevada from the Mojave Desert to salt desert shrub, sagebrush steppe, riparian, pinyon-juniper woodland, mountain brush, aspen, subalpine coniferous forest, and alpine tundra. Local populations of some species, apparently abundant historically, appear to have declined dramatically in modern times (P.V. Bradley, unpublished data). Local populations of other species may have benefited from the activities of man. Regardless, the intent of the Conservation Strategy portion of this Plan is to use what we already know from the Conservation Assessment to guide managers in the preservation, protection, management and restoration of all bat species and their habitats in the State.

Goal

Identify, protect and restore bat habitats and viable bat populations throughout species' ranges in Nevada.

Bat Habitat Conservation Guilds

HABITAT TYPE DESCRIPTION
NATURAL CAVE, MINE SHAFT AND MINE ADIT ROOSTING HABITAT (CA)

General Distribution

Natural caves are found throughout Nevada. The highest concentration of caves are found in sedimentary deposits, particularly those deposits where limestone solution processes have carved caverns in the parent rock. Igneous deposits, primarily volcanic deposits, also provide a significant number of natural caves or hollow tubes formed by flowing lave and natural fracturing. Metamorphic parent rock types provide the lowest number of natural caves in Nevada; although fracturing occasionally produces suitable cave formation.

There are an estimated 200,000 to 300,000 historical mining fixtures in Nevada (Durbin and Coyner, 2002). Historical mines are found across the State wherever hard rock mining districts occur. Historical mine distribution does not mirror natural cave distribution and occurs in all available rock types. As compared to the surrounding landscape, caves, shafts and adits are the most rare of all wildlife habitat types in the intermountain west and probably comprise less than 0.01% of the total habitat available. Many cave and mine features are not used by bats due to a variety of factors such as internal complexity, available shelter, unsuitable microclimate, and human disturbance. Therefore, availability is much less than sheer numbers would indicate. In addition, there is new evidence that caves and mines are not equivalent in the eyes of bats. R. E. Sherwin (personal communication) and J. S. Altenbach (personal communication) are finding drastic differences in roost characteristics between mines and caves.

Physical Characteristics

Cave, shaft and adit habitats range in elevation from 150 m along the Colorado River to near 4,000 m on Boundary Peak and Wheeler Peak in northern Nevada. Precipitation varies accordingly from less than ten cm in the south to over 80 cm on the higher mountains of the north and can come in the form of rain or snow anywhere in the State. Soil types range across the spectrum from fine clays to coarse gravels.

Cave, shaft and adit habitats can be simple or complex. The longer caverns and those with a greater number of vertical and horizontal connections to the surface are generally the more complex habitats. Warm air traps or “bald headed raises” can vary from 20-30°F above outside ambient temperature in the summer. Cold air traps can vary from 20-30°F above outside ambient temperature during the winter. Multiple entrances can result in greater air flow into and through the structure affecting the internal microclimate. Geothermal heating can also affect internal microclimate.

Dominant Plant Species

With the exception of algae growth in some artificially lighted caves, plants do not occur in this habitat type. Plant composition at surface openings varies with elevation, precipitation, latitude and longitude.

Historical and Current Condition

Natural caves, mine shafts and adits found in more erosion-resistant rock types tend to be those with greater life expectancy. For example, an underground silver mine constructed in erosion-resistant limestone will generally have much greater longevity than a silver mine located in a decomposing granite rock type.

Recreational caving in natural caves and historical underground mines has increased dramatically over the last 30 years (Great Basin National Park, unpublished data). As such, increased human disturbance in the form of non-natural light sources, elevated noise levels and vandalism have altered many of these habitats. Population growth in Nevada, particularly in western and southern Nevada, has been unparalleled. Communities continue to encroach into areas containing caves and abandoned mines, creating ease in access for exploration. The expansion of the population also accounts for greater use of wildlands and more visitations to caves and abandoned mines. Vandalism is a direct product of this increased exposure to the public.

Internal survey and inventory work conducted by non-certified personnel during critical stages in the life history of bats, particularly maternity and hibernation periods, may have the same negative effect on bat populations that recreational caving has.

Human safety concerns have led to an increased emphasis on historical mine closures. Bulldozing and imploding have destroyed several thousand adits and shafts in Nevada. Scientists differ greatly in their estimate of the number of abandoned mines that provide suitable bat habitat. However, from surveys of hundreds of mining districts across the west, scientists have estimated that anywhere from <1% to >15% of adits and shafts may provide bat roosting habitat in the form of either maternity, hibernation, night and/or lek roosts (M. Rahn, personal communication; P.E. Brown, unpublished data). There is really no way of knowing the magnitude of actual loss from past closures of abandoned mines. Therefore, it is imperative that scientists err on the side of caution and that competent surveys and identification of all bat resources precede any further attempt to bulldoze, foam and/or implode closed historical mining districts.

Contemporary open-pit mining operations are often located in historical mining districts. In situations where historical adits and shafts are carved away by the expansion of an open-pit mine, these habitats are lost permanently.

Opportunities For Conservation

Gating and/or temporal closures of caves and adits can provide security for bat populations during critical life history stages**.** An approved gate design suitable for *Corynorhinus* and several *Myotis* species can be found in Appendix E. Additional approved bat gate designs are being consolidated into a single volume (BCI, 2002).

A certification process for all scientists interested in conducting bat survey and inventory work in Nevada is outlined under Scientific Collection Permit Changes in Appendix B. It is the recommendation of this plan to have the certification process codified in Nevada Sate Law and tied to the Scientific Collection Permit process.

The Nevada State Attorney General's Office gave an opinion that four-strand barbed-wire fencing with orange hazard signs is a viable alternative to "hard closure" or "permanent closure" methods such as bulldozing, foaming and/or imploding (Del Papa and Sammons 1994). If the Nevada Division of Minerals were to take this one step further and end the use of and/or recommendation for hard closure techniques to private claim holders, the threat to bat populations would be greatly reduced. Arbitrary placement of fencing material directly over an adit or shaft entrance can have deleterious impacts to resident bats. Fencing needs to be set back 10 m from the structure entrance. Appropriate fencing is less expensive and may be a preferred closure alternative over gating for some colonial *Myotis* species where trespass and vandalism are not chronic problems (Ludlow and Gore, 2000).

An opportunity exists to mitigate permanent loss of bat roost habitats. Once a mining plan of operations has identified a series of historical adits and shafts that will be destroyed by open-pit activities, the historical workings must be surveyed for four seasons to determine bat activity. If roosts are found with ten or more individuals in them, alternate roost sites with similar internal characteristics must be found and/or constructed nearby and protected with an approved bat gate. To the extent possible, placement of mitigation sites must take into account the long range forecast of the mine's plan of operations to avoid locating mitigation sites within the sphere of potential mine expansion.

To help protect bats, the location of all roosts will be kept confidential. [*Bat data will continue to be stored at both the Reno NDOW and Carson City NNHP offices. The NNHP handles data acquisition requests out of the Carson Office for all bat species. All bat data are red-flagged and distribution of such data are limited to a 36 square mile grid (Township and Range Only) and/or a 100 square kilometer grid (UTM Coordinate no smaller than the 10,000th digit..... i.e. N 4,440,000 E 440,000). Any requests for more specific location information will be routed back through NDOW and the NBWG. The Federal Cave Resources Protection Act exempts the release of more specific cave locations from the Freedom of Information Act.*]

Priority Bat Species
Obligates

Pallid Bat
Mexican Long-tongued Bat
Townsend's Big-eared Bat
Big Brown Bat
Spotted Bat
Allen's Lappet-browed Bat
California Leaf-nosed Bat
California Myotis
Small-footed Myotis
Long-eared Myotis
Little Brown Myotis
Fringed Myotis

Cave Myotis
Yuma Myotis
Big Free-tailed Bat
Brazilian Free-tailed Bat

Others

Silver-haired Bat
Long-legged Myotis
Western Pipistrelle

CONSERVATION STRATEGY CA-1. NATURAL CAVES, MINE SHAFTS, AND ADITS

Antrozous pallidus **Pallid Bat**

OBJECTIVE – Maintain a stable or increasing population trend of Pallid Bats throughout their range in Nevada through 2010.

Strategy: Secure protection for all Pallid Bat roost sites in natural caves, mine shafts and adits in the state.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate hibernation, maternity and other roost sites in caves, shafts and adits that either currently support or have historically supported Pallid Bat populations. Prioritize thermal caves and mines in northern Nevada.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect Pallid Bat populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key maternity or hibernation sites, close hibernation sites from November 1 to April 1 and maternity sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Pallid Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Pallid Bat.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Pallid Bat populations in Nevada.

Action: Plot natural caves, mine shafts and adits for Pallid Bat surveys.

Action: Conduct routine and systematic Pallid Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Pallid Bat populations have been declining in California, apparently due to roost disturbance. Nevada may have a similar situation. However, few roost sites have been identified in Nevada and no population studies have been conducted. The largest known maternity roost in Nevada is in a somewhat unstable mine adit. Location and protection of these features are critical to a stable, healthy population. Currently, the lack of comparative baseline data hampers an appropriate evaluation of trends and needs.

References

Hall (1946), Hermanson and O'Shea (1983), Lewis (1993), Lewis (1994), Licht and Leitner (1967), O'Farrell and Bradley (1977), Orr (1954), Pierson et al. (1996).

CONSERVATION STRATEGY CA-2. NATURAL CAVES, MINE SHAFTS, AND ADITS

Choeronycteris mexicana **Mexican Long-tongued Bat**

OBJECTIVE – Locate and provide protection for potential Mexican Long-tongued Bat roosts in southern Nevada by 2010.

Strategy: Secure protection for all potential Mexican Long-tongued Bat roost sites in natural caves, mine shafts, and adits in the state.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate roost sites in caves, mine shafts and adits that may support Mexican Long-tongued Bat populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key maternity or hibernation sites, close hibernation sites from November 1 to April 1 and maternity sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Mexican Long-tongued Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Mexican Long-tongued Bat.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Mexican Long-tongued Bat populations in Nevada.

Action: Plot natural caves, mine shafts and adits for Mexican Long-tongued Bat surveys.

Action: Conduct routine and systematic Mexican Long-tongued Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Mexican Long-tongued Bats roost primarily in caves and mines. This semi-tropical bat forays northward in response to availability of flowering yucca, agave, and columnar cacti. Research priorities should emphasize the identification and description of roost sites. The single recorded occurrence may be simply accidental. A recent capture in the Grand Canyon (C. Corben, personal communication) indicates the possibility of more regular occurrence in the area. Further, the recent increase in records for southern California indicates a possible northern spread of the species. The presence of many abandoned mines, coupled with presence of a variety of yucca and agave suggests the potential of further occurrences. Inadequate knowledge at present does not allow a better assessment of the potential of small, seasonally resident pockets of this species.

References

Arroyo-Cabrales et al. (1987), Constantine (1987, 1998a)

CONSERVATION STRATEGY CA-3. NATURAL CAVES, MINE SHAFTS, AND ADITS

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

OBJECTIVE – Reverse a declining population trend of Townsend's Big-eared Bats in cave habitats of eastern and northern Nevada by 2010, with particular emphasis on six priority population centers - the Snake Range, Schell Creek Range, White Pine Range, Kern Mountains, Goshute Range and Spruce Mountain.

Strategy: Secure protection for all Townsend's Big-eared Bat maternity, hibernation, temporary migration, lek and night cave roosts in the state.

Action: Delineate roost locations.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Elevate these areas to high priority status in regional fire prevention plans.

Action: Where recreational cavers come in conflict with hibernating or nursing Townsend's Big-eared Bats, implement temporal visitor use restrictions. Close caves used for hibernacula to recreational use from 1 November to 1 April. Close maternity caves from 1 April to 1 October**.** Site-specific peak activity periods may vary based on latitude and elevation. Depending on the site, a mix of strategies may be employed including: gating (Appendix E), education, law enforcement and road/trail closures.

Action: Work with private landowners where appropriate to protect natural bat roosts.

Action: The location of Townsend's Big-eared Bat roosts will be kept confidential. [*Bat data will continue to be stored at both the Reno NDOW and Carson City NNHP offices. The NNHP handles data acquisition requests out of the Carson Office for all bat species. All maternity and hibernation roost data are red-flagged and distribution of such data are limited to a 36 square mile grid (Township and Range Only) and/or a 100 square kilometer grid (UTM Coordinate no smaller than the 10,000th digit..... i.e. N 4,440,000 E 440,000). Any requests for more specific location information will be routed back through NDOW and the NBWG. The Federal Cave Resources Protection Act exempts the release of more specific cave locations from the Freedom of Information Act.*]

Action: Interact with local grottos to encourage: a) confidentiality of caves used by Townsend's Big-eared Bats*,* and b) support of bat conservation efforts.

Action: Develop conservation education materials designed to improve public awareness and stewardship of Nevada's cave resources.

Action: Mitigate the loss of any permanent bat roost by designing and constructing alternate roost sites.

OBJECTIVE – Reverse a declining population trend of Townsend's Big-eared Bats in abandoned hard rock mine habitats of Nevada by 2010, with statewide emphasis.

Strategy: Secure protection for all Townsend's Big-eared Bat maternity, hibernation, temporary migration and night adit and shaft roosts in the state.

Action: Identify adits and shafts that either currently support or have historically supported bat populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Elevate these areas to high priority status in regional fire prevention plans.

Action: Do not allow prescribed burning or vegetative alteration in pinyon-juniper or shrub steppe habitat within a 2.5 km radius of known Townsend's Big-eared Bat roosts.

Action: Gate (Appendix E) and institute year round closure on all adits and shafts where recreationists may encounter hibernating or nursing Townsend's Big-eared Bats.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Action: Work with private landowners where appropriate to protect Townsend's Big-eared Bat populations.

Action: The location of Townsend's Big-eared Bat roosts will be kept confidential.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Strategy: Increase the knowledge base of Townsend's Big-eared Bats through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Townsend's Big-eared Bats.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained. One of the largest and most consistent hibernation roosts known in the state, an extremely complex abandoned mine adit/shaft system, has large volume air flow, and has internal midwinter temperatures that hover near freezing (28-35°F) regardless of outside ambient air temperatures.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Assumptions - Research and Monitoring Needs

Priority status was determined for the Townsend's Big-eared bat in Nevada based on: a) the downward population trends documented in surrounding States of California, Oregon, Washington, New Mexico and Idaho ; b) documented roost population declines in Nevada ; and c) the well-documented sensitive nature of this species to human disturbance of roost sites. A comprehensive monitoring effort is needed in Nevada to confirm the status and trend of this species.

References

(J. S. Altenbach, personal communication), (P.V. Bradley, unpublished data), Graham (1966), Hall (1946), Humphrey and Kunz (1976), Mohr (1972), Pearson et al. (1952), Perkins (1990), Pierson and Rainey (1996), Sherwin and Strickland (2000), Sherwin et al. (2000b), Stebbings (1966), Stihler and Hall (1993), Wackenhut (1990), Western Association of Fish and Wildlife Agencies (2002).

CONSERVATION STRATEGY 4. NATURAL CAVES, MINE SHAFTS, AND ADITS

Eptesicus fuscus **Big Brown Bat**

OBJECTIVE – Maintain a stable or increasing population trend of Big Brown Bats throughout their range in Nevada through 2010.

Strategy: Secure protection for all Big Brown Bat roost sites in natural caves, mine shafts, and adits in the state.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate hibernation, maternity and other roost sites in caves, shafts and adits that either currently support or have historically supported Big Brown Bat populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect Big Brown Bat populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key maternity or hibernation sites, close hibernation sites from November 1 to April 1 and maternity sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of the Big Brown Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of the Big Brown Bat.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Big Brown Bat populations in Nevada.

Action: Plot natural caves, mine shafts, and adits for Big Brown Bat surveys.

Action: Conduct routine and systematic Big Brown Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Big Brown Bats are found throughout most of North America and appear to be common over much of their range. Although many records occur for Nevada, little is known of roost sites and seasonal habits. The first roost record for this species in Nevada was in a natural cave in 1928 near Overland Pass in the southern Ruby Mountains (Borrell and Ellis 1934). Circumstantial evidence suggests that big brown bats roost primarily in natural caves in Nevada and only secondarily in tree roosts, buildings and abandoned mines. Additional documentation of tree, mine and building roosting big brown bats is necessary to determine the extent of their reliance on these roost structures. Research priorities for big brown bats should emphasize the identification and description of all roost sites. Because of its widespread distribution and apparent abundance, population trend analyses for the Big Brown Bat could have broad application in bat management and conservation.

References

Betts (1996), Borrell and Ellis (1934), Brigham (1991), Hall (1946), Kurta and Baker (1990), Vonhof (1996), Williams (2001).

CONSERVATION STRATEGY CA-5. NATURAL CAVES, MINE SHAFTS, AND ADITS

Euderma maculatum **Spotted Bat**

OBJECTIVE – Maintain stable or increasing population trend of Spotted Bats in known ranges and locate remaining undocumented distribution in Nevada by 2010.

Strategy: Secure protection for all spotted bat roost sites in natural caves, mine shafts and adits in the state.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate hibernation, maternity and other roost sites in caves, shafts and adits that either currently support or have historically supported Spotted Bat populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect spotted bat populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key maternity or hibernation sites, close hibernation sites from November 1 to April 1 and maternity sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Spotted Bat through research and education.

Action: Initiate research studies in suitable Spotted Bat breeding habitats to identify new populations, with an emphasis on those areas with large cliffs and free water.

Action: Initiate research and produce educational materials that explore the ecology and seasonal movement patterns and habitat requirements of Spotted Bat.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Spotted Bat populations in Nevada.

Action: Plot natural caves, mine shafts and adits for Spotted Bat surveys.

Action: Conduct routine and systematic spotted bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Spotted Bats roost primarily in cliff and crevice habitats, and secondarily in caves and mines. Cave and mine roosting observations for this species have been primarily during winter hibernation. Additional documentation of cave and mine roosting Spotted Bats is necessary to determine the extent of their reliance on these roost structures. Research priorities for Spotted Bats should emphasize the identification and description of roost sites and as yet undocumented breeding range. The confirmation of this species in five counties is an improvement over 1946 (one record in Reno). However, there remains more work to be done to identify Nevada's true Spotted Bat distribution.

References

Constantine (1987), Deacon and Bradley (1962), Fenton et al. (1987), Geluso (2000), Hall (1946), Kuenzi et al. (1999), Perry et al. (1997), Poché (1981), Poché and Bailie (1974), Rabe et al. (1998a), Storz (1995), Wai-Ping and Fenton (1989), Woodsworth et al. (1981).

CONSERVATION STRATEGY CA-6. NATURAL CAVES, MINE SHAFTS, AND ADITS

Idionycteris phyllotis **Allen's Lappet-browed Bat**

OBJECTIVE – Maintain a stable or increasing population trend of Allen's Lappet-browed Bats throughout their range in southern Nevada through 2010.

Strategy: Secure protection for all Allen's Lappet-browed Bat roost sites in natural caves, mine shafts, and adits in the state.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate hibernation, maternity and other roost sites in caves, shafts and adits that either currently support or have historically supported Allen's Lappet-browed Bat populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect Allen's Lappet-browed Bat populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key maternity or hibernation sites, close hibernation sites from November 1 to April 1 and maternity sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Allen's Lappet-browed Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Allen's Lappet-browed Bat.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Allen's Lappet-browed Bat populations in Nevada.

Action: Plot natural caves, mine shafts, and adits for Allen's Lappet-browed Bat surveys.

Action: Conduct routine and systematic Allen's Lappet-browed Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Allen's Lappet-browed Bat is found only in southern Nevada from a few locations with most being concentrated in the southern portion of the Spring Mountains in Clark County. Throughout its range, the distribution appears patchy. The species appears to breed in coniferous forest and winter at lower elevations. Two populations have been found breeding at low elevations in Arizona. During breeding, use of exfoliating bark as tree roosts appears to be important with multiple roosts being used through a single season. Recent surveys in the Spring Mountains have failed to locate Allen's Lappet-browed Bats. The current status of the species is in question.

References

Czaplewski (1983), O'Farrell (2002, personal communication), O'Farrell and Bradley (1969), Rabe et al. (1998b), Simmons and O'Farrell (1977).

CONSERVATION STRATEGY CA-7. NATURAL CAVES, MINE SHAFTS, AND ADITS

Lasionycteris noctivagans **Silver-haired Bat**

OBJECTIVE – Locate and maintain a stable or increasing population trend of wintering Silver-haired Bats throughout their range in southern Nevada through 2010.

Strategy: Secure protection for all Silver-haired Bat hibernation roost sites in natural caves, mine shafts and adits in the state.

Action: Interact with local grottos to encourage: a) confidentiality of caves and mines used by Silver-haired Bats; and b) support of bat conservation efforts.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate winter hibernation sites in caves, shafts, and adits that either currently support or have historically supported Silver-haired Bat populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect silver-haired bat populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key hibernation sites, close sites from November 1 to April 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Silver-haired Bats through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Silver-haired Bats.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Silver-haired Bat populations in Nevada.

Action: Plot natural caves, mine shafts, and adits for Silver-haired Bat surveys.

Action: Conduct routine and systematic Silver-haired Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Silver-haired Bats roost almost exclusively in trees. The only time of the year that they have been documented to use alternative roosts, such as natural caves and mines, is during winter hibernation. Studies conducted to document the presence of Silver-haired Bats in the aforementioned structures should be conducted in the appropriate season.

References

Barclay (1985), Barclay et al. (1988), Bradley et al. (1965), Campbell et al. (1996), Hall (1946), Jung et al. (1999), Krutzsch (1966), Kunz (1982), Mattson et al. (1996), Parsons et al. (1986).

CONSERVATION STRATEGY CA-8. NATURAL CAVES, MINE SHAFTS, AND ADITS

Macrotus californicus **California Leaf-nosed Bat**

OBJECTIVE - Maintain stable populations of the California Leaf-nosed Bat in southern Nevada's natural caves, mine adits and mine shafts by 2010.

Strategy: Secure protection for all California Leaf-nosed Bat maternity, winter and lek roost sites in natural caves, mine shafts, and adits in the state.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate winter, maternity and other roost sites in caves, shafts and adits that either currently support or have historically supported *Macrotus californicus* populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect California Leaf-nosed Bat populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key winter sites, close these from November 1 to April 1 and maternity sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Determine the status and trend of California Leaf-nosed Bat populations in Nevada.

Action: Plot natural caves, mine shafts, and adits for California Leaf-nosed Bat surveys.

Action: Conduct routine and systematic California Leaf-nosed Bat surveys in known habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

California Leaf-nosed Bats roost in warm mines and caves, and exhibit high roost fidelity. Population trends for this species are best documented from roost exit counts conducted in a standardized protocol. Winter roosts appear to be the most limiting. The species does not hibernate or tolerate lowered body temperatures. Winter roosts must be stable and warm. Weather conditions must be sufficiently mild as to allow frequent nightly activity for foraging through the winter. Although some new roosts have been found, all historical locations have been destroyed. A recent population in the upper Moapa Valley and Meadow Valley Wash document a significant new occurrence and possible extension into Lincoln County. Proposed development in this region makes it critical to identify exact distribution and resources and provide protection. Information on the use of gated mines, and more information on foraging habitat in southern Nevada are also needed.

References

P. E. Brown (personal communication), Burt (1934), Hall (1946), O'Farrell (1970), Williams (2001).

CONSERVATION STRATEGY CA-9. NATURAL CAVES, MINE SHAFTS, AND ADITS

Myotis californicus **California Myotis**

OBJECTIVE - Locate and maintain stable populations of the California Myotis in natural caves, mine shafts, and adits throughout Nevada by 2010.

Strategy: Secure protection for all California Myotis maternity, hibernation, and roost sites in natural caves, mine shafts, and adits in the state.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate hibernation, maternity and other roost sites in caves, shafts and adits that either currently support or have historically supported California Myotis populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect California Myotis populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key maternity or hibernation sites, close hibernation sites from November 1 to April 1 and maternity sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of California Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of California Myotis.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of California Myotis populations in Nevada.

Action: Plot natural caves, mine shafts and adits for California Myotis surveys.

Action: Conduct routine and systematic California Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Historical records of California Myotis found in abandoned mines in Nevada indicate widespread use but always in low numbers. Use varies from night roosting to hibernation. Individuals move from roost to roost throughout the year but nothing is known of this dynamic. Determination of roost requirements, need for multiple roosts, and frequency of roost shifts is critical to proper conservation and management of mine and cave resources. Information on the use and acceptance of bat gates, and more information on foraging requirements is also needed. No information is known on population trends for the California Myotis. Because it is a common and widespread species, declines in population trends could provide an early warning for all species utilizing the same resources.

References

Hall (1946), Krutzsch (1954), O'Farrell and Bradley (1977), Simpson (1993), Western Bat Working Group (1998).

CONSERVATION STRATEGY CA-10. NATURAL CAVES, MINE SHAFTS, AND ADITS

Myotis ciliolabrum **Small-footed Myotis**

OBJECTIVE – Locate and maintain stable populations of the Small-footed Myotis in natural caves, mine shafts, and adits throughout Nevada by 2010.

Strategy: Secure protection for all Small-footed Myotis maternity, hibernation, and roost sites in natural caves, mine shafts, and adits in the state.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate hibernation, maternity and other roost sites in caves, shafts and adits that either currently support or have historically supported Small-footed Myotis populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect Small-footed Myotis populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key maternity or hibernation sites, close hibernation sites from November 1 to April 1 and maternity sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Small-footed Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Small-footed Myotis.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Small-footed Myotis populations in Nevada.

Action: Plot natural caves, mine shafts and adits for Small-footed Myotis surveys.

Action: Conduct routine and systematic Small-footed Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

For a seemingly common and widespread bat through most of Nevada, very little is known about the Small-footed Myotis. Reliance on caves and mines for hibernation and maternity use as well as night roosting is significant. However, few roosts have been identified. Maternity colonies appear to be small, so roosts may be many and widely scattered. A substantial hibernating group found in a deep, complex abandoned mine suggests winter congregations in fewer structures, similar to other species of myotis. Such congregations place a large proportion of the population at risk from a single disruptive event. Also, these roosts can be several hundred meters underground with the only access being a vertical shaft, making the sites extremely difficult to monitor. New passive monitoring techniques hold promise for this species.

References

J. S. Altenbach (personal communication), Barbour and Davis (1969), Hall (1946), Hoffmeister (1986), O'Farrell (2001c), Ports and Bradley (1996), Western Bat Working Group (1998).

CONSERVATION STRATEGY CA-11. NATURAL CAVES, MINE SHAFTS, AND ADITS

Myotis evotis **Long-eared Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of Long-eared Myotis throughout their range in Nevada through 2010.

Strategy: Secure protection for all Long-eared Myotis roost sites in natural caves, mine shafts, and adits in the state.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate hibernation, maternity and other roost sites in caves, shafts and adits that either currently support or have historically supported Long-eared Myotis populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect Long-eared Myotis populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key maternity or hibernation sites, close hibernation sites from November 1 to April 1 and maternity sites from April 1 to October 1. The rarity of cave maternity sites for this species makes this action particularly critical.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Long-eared Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Long-eared Myotis.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Long-eared Myotis populations in Nevada.

Action: Plot natural caves, mine shafts, and adits for Long-eared Myotis surveys.

Action: Conduct routine and systematic Long-eared Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Long-eared Myotis are widespread throughout Nevada in upper elevation woodlands and forests. However, they tend not to be abundant anywhere with the possible exception of pinyon-juniper woodlands in limestone mountains. They do not appear to form large roosts and seem to alternate roosts frequently. Population declines have been noted in the Spring Mountains of Clark County, possibly due to degradation of water sources. Caves and mines are not only used as roost sites but also may be used for foraging sites.

References

Hall (1946), Manning and Jones (1989), M .J. O'Farrell (personal communication), Ports and Bradley (1996), Vonhof and Barclay (1997).

CONSERVATION STRATEGY CA-12. NATURAL CAVES, MINE SHAFTS, AND ADITS

Myotis lucifugus **Little Brown Myotis**

***OBJECTIVE* – Maintain stable populations of the Little Brown Myotis in natural caves, mine shafts, and adits in northern Nevada by 2010.**

Strategy: Secure protection for all Little Brown Myotis maternity, hibernation, and roost sites in natural caves, mine shafts and mine adits.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate hibernation, maternity and other roost sites that either currently support or historically supported Little Brown Myotis populations, with particular emphasis on hibernation sites.

Action: Secure protection for sites with large aggregations of Little Brown Myotis, especially for maternity and hibernation sites.

Action: Incorporate these sites into pending Nevada Bat Roost Protection Act legislation (Appendix B).

Action: Work with private landowners where appropriate to protect Little Brown Myotis populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key maternity or hibernation sites, close hibernation sites from November 1 to April 1 and maternity sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Little Brown Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Little Brown Myotis.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend Little Brown Myotis populations in Nevada.

Action: Plot natural caves, mine shafts and adits for Little Brown Myotis surveys.

Action: Conduct routine and systematic Little Brown Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Although *M. lucifugus* is common in other areas of its range, it seems rare in Nevada, occurring patchily in the northern portion of the state. Local distribution and abundance is unknown. It hibernates in large aggregations elsewhere but no winter roosts have been located in Nevada. Any disturbance or destruction of bats or their hibernation sites could have profound impacts to the regional population as a whole. This species is often associated with larger bodies of water or rivers. Often, roost sites are associated with these aquatic features. Specific attention should be focused on the roost sites located near these waters as well as the protection of the water sources themselves.

References

Borrell and Ellis (1934), P. E. Brown (personal communication), Fenton and Barclay (1980), Hall (1946).

CONSERVATION STRATEGY CA-13. NATURAL CAVES, MINE SHAFTS, AND ADITS

Myotis thysanodes **Fringed Myotis**

OBJECTIVE – Locate and maintain stable populations of the Fringed Myotis in natural caves, mine shafts, and adits by 2010.

Strategy: Secure protection for all Fringed Myotis maternity, hibernation, and roost sites in natural caves, mine shafts, and adits in the state.

Action: Delineate hibernation, maternity and other roost sites in caves, shafts and adits that either currently support or have historically supported Fringed Myotis populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect Fringed Myotis populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key maternity or hibernation sites, close hibernation sites from November 1 to April 1 and maternity sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Fringed Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Fringed Myotis.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Fringed Myotis populations in Nevada.

Action: Plot natural caves, mine shafts, and adits for Fringed Myotis surveys.

Action: Conduct routine and systematic Fringed Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Prior to 1974, Fringed Myotis was known from only two locations. The only known colony, found in a salt cave outside of St. Thomas, was inundated with the formation of Lake Mead. Since 1974, there have been a number of records through the middle and upper elevations of southern Nevada. No other colonies have been located. This species is particularly sensitive to disturbance in day roosts. Systematic surveys are critical to locate and protect roost sites.

References

Deacon et al. (1964), Hall (1946), O’Farrell (2001c; 2002, unpublished data), O’Farrell and Studier (1973, 1980).

CONSERVATION STRATEGY CA-14. NATURAL CAVES, MINE SHAFTS, AND ADITS

Myotis velifer **Cave Myotis**

OBJECTIVE – Locate and maintain stable populations of the Cave Myotis in natural caves, mine shafts, and adits in southern Nevada by 2010.

Strategy: Secure protection for all Cave Myotis maternity, hibernation, and roost sites in natural caves, mine shafts, and adits in the state.

Action: Delineate hibernation, maternity and other roost sites in caves, shafts and adits that either currently support or have historically supported Cave Myotis populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect Cave Myotis populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key maternity or hibernation sites, close hibernation sites from November 1 to April 1 and maternity sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Cave Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Cave Myotis.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Cave Myotis populations in Nevada.

Action: Plot natural caves, mine shafts, and adits for Cave Myotis surveys.

Action: Conduct routine and systematic Cave Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Hall first predicted a Nevada distribution for the "Broad-toothed Myotis" along the Colorado River in 1946. Cave Myotis is known from only one location in extreme southern Nevada. At one time this roost was a maternity roost. Now only males appear to be present. The population occurs in an abandoned mine complex in a remote portion of the Lake Mead National Recreation Area. This population appears to be intimately linked with a more extensive distribution on the Arizona side of the Colorado River. The presence of numerous abandoned mines along the Colorado River in Nevada provides the infrastructure for more widespread occurrence of Cave Myotis. What information is known on population trends for the cave myotis however suggest precipitous declines in roosts along the entire Colorado River. The acquisition of current information is of high priority for Nevada. Along the lower Colorado River, only one maternity colony in California is now known. Population declines may be related to loss of the cottonwood riparian and changes in prey base. Possibly, pesticide use may have caused direct and indirect reductions. Research could be conducted into contaminant levels in old guano deposits. Information on use and acceptance of bat gates, and more information on roosting and foraging requirements are also needed.

References

P. E. Brown (personal communication), Cockrum and Musgrove (1964), Fitch et al. (1981), Hall (1946), Stager (1939).

CONSERVATION STRATEGY CA-15. NATURAL CAVES, MINE SHAFTS, AND ADITS

Myotis volans **Long-legged Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of Long-legged Myotis throughout their range in Nevada through 2010.

Strategy: Secure protection for all Long-legged Myotis roost sites in natural caves, mine shafts and mine adits in the state.

Action: Interact with local grottos to encourage: a) confidentiality of caves and mines used by Long-legged Myotis; and b) support of bat conservation efforts.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate winter hibernation and summer night roost sites in caves, shafts and adits that either currently support or have historically supported Long-legged Myotis populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect Long-legged Myotis populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key summer night roosts or hibernation sites, close hibernation sites from November 1 to April 1 and summer night roost sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Long-legged Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Long-legged Myotis.

Action: Initiate research to document the characteristics of key hibernation sites and summer night roosts, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key night roosts and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Long-legged Myotis populations in Nevada.

Action: Plot natural caves, mine shafts and adits for Long-legged Myotis surveys.

Action: Conduct routine and systematic Long-legged Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Long-legged Myotis are widespread throughout Nevada in upper elevation woodlands and forests. Trees comprise the main maternity roost but caves and mines may be used for large bachelor roosts as well as general night roosting. Information on the use and acceptance of bat gates, as well as foraging requirements are also needed. Although common, no studies have been conducted on population trends. Because it is a common and widespread species, declines in population trends could provide an early warning for all species utilizing the same resources.

References

Hall (1946), O'Farrell (personal communication), O'Farrell and Bradley (1977), Ormsbee and Mccomb (1998), Ports and Bradley (1996), Warner and Czaplewski (1984).

CONSERVATION STRATEGY CA-16. NATURAL CAVES, MINE SHAFTS, AND ADITS

Myotis yumanensis **Yuma Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of Yuma Myotis throughout their range in Nevada through 2010.

Strategy: Secure protection for all Yuma Myotis hibernation roost sites in natural caves, mine shafts and mine adits in the state.

Action: Interact with local grottos to encourage: a) confidentiality of caves and mines used by Yuma Myotis; and b) support of bat conservation efforts.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate winter hibernation sites in caves, shafts and adits that either currently support or have historically supported Yuma Myotis populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect Yuma Myotis populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key hibernation sites, close sites from November 1 to April 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Yuma Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Yuma Myotis.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Yuma Myotis populations in Nevada.

Action: Plot natural caves, mine shafts and adits for Yuma Myotis surveys.

Action: Conduct routine and systematic Yuma Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Generally, Yuma Myotis require medium to large bodies of water for foraging. Roosts are often, but not always, within the vicinity of these types of water bodies. Specific attention should be focused on the roost sites located along these areas as well as the protection of the water sources themselves.

References

Aldridge (1986), Brigham, et al. (1992), Dalquest (1947), Hall (1946), Herd and Fenton (1983).

CONSERVATION STRATEGY CA-17. NATURAL CAVES, MINE SHAFTS, AND ADITS

Nyctinomops macrotis **Big Free-tailed Bat**

OBJECTIVE - Locate and maintain a stable or increasing population trend of Big Free-tailed Bats throughout their range in southern Nevada through 2010.

Strategy: Secure protection for all big free-tailed bat roost sites in natural caves, mine shafts, and adits in the state.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate maternity and other roost sites in caves, shafts and adits that either currently support or have historically supported big free-tailed bat roosts.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect big free-tailed bat roosting sites.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Interact with local grottos to encourage: a) confidentiality of caves and mines used by Big Free-tailed Bats; and b) support of bat conservation efforts.

Action: Where recreational cavers and mine seekers come into conflict with key maternity sites, close maternity sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Big Free-tailed Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Big Free-tailed Bats.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Big Free-tailed Bat populations in Nevada.

Action: Plot natural caves, mine shafts and adits for Big Free-tailed Bat surveys.

Action: Conduct routine and systematic Big Free-tailed Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Big Free-tailed Bats have not been found to hibernate and are presumed to be seasonal migrants. Until 2000, this species was known only from a single confirmed location in the Las Vegas Valley. In 2000, intensive acoustic monitoring within the upper Moapa Valley documented significant occurrence of Big Free-tailed Bats from September through October (Williams, 2001). Inasmuch as the species is widespread throughout Utah, it is possible that populations exist in pockets through the central and eastern part of Nevada. It is a high flying species that is difficult to capture, probably resulting in an under-representation in past inventories.

References

Bradley et al. (1965), Hall (1946), Milner et al. (1990), Williams (2001).

CONSERVATION STRATEGY CA-18. NATURAL CAVES, MINE SHAFTS, AND ADITS

Pipistrellus hesperus **Western Pipistrelle**

OBJECTIVE – Maintain stable populations of the Western Pipistrelle in natural caves, mine shafts, and adits with emphasis on western and southern Nevada by 2015.

Strategy: Conserve Western Pipistrelle maternity, hibernation, and roost sites within the range of pipistrelles in Nevada.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate hibernation, maternity and other roost sites.

Action: Incorporate key sites into pending *Bat Roost Protection Act* legislation (Appendix B).

Action: Where recreational cavers and mine seekers come into conflict with key maternity or hibernation sites, close hibernation sites from November 1 to April 1 and maternity sites from April 1 to October 1.

Action: Coordinate all actions with other States in the western United States.

Action: Interact with private landowners where appropriate to protect bat roosts.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

Strategy: Increase the knowledge base of Western Pipistrelle through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Western Pipistrelle.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Western Pipistrelle populations in Nevada.

Action: Plot natural caves, mine shafts and adits for Western Pipistrelle surveys.

Action: Conduct routine and systematic Western Pipistrelle surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Western Pipistrelles are the most common and widespread species at low to middle elevations through most of the western United States. Because of their commonality and wide distribution, they are well-suited for long-term monitoring of population trends. Fluctuations in Western Pipistrelle populations could serve as an early warning of serious threats to the entire bat community. Insufficient information exists on roosting requirements.

References

Bradley and O'Farrell (1969), Cross (1965), Hall (1946), Hayward and Cross (1979), O'Farrell and Bradley (1977).

CONSERVATION STRATEGY CA-19. NATURAL CAVES, MINE SHAFTS, AND ADITS

Tadarida brasiliensis **Brazilian Free-tailed Bat**

OBJECTIVE – Maintain stable populations of the Brazilian Free-tailed Bats in natural caves, mine shafts, and adits by 2015.

Strategy: Secure protection for all Brazilian Free-tailed Bat maternity, hibernation, and roost sites in natural caves, mine shafts, and adits in the state.

Action: Within the framework of the *Federal Cave Resources Protection Act of 1988* (Appendix C), identify caves that either currently support or have historically supported bat populations.

Action: Delineate maternity, bachelor, hibernation and other roost sites in caves, shafts and adits that either currently support or have historically supported Brazilian Free-tailed Bat populations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Work with private landowners where appropriate to protect Brazilian Free-tailed Bat populations.

Action: Whether they are abandoned, active, on public and/or private, patented lands, where public funds are being expended, all hard rock mines destined for closure activities must receive proper evaluation as bat habitat prior to closure (Appendix A). Hazard signs and fencing of adits and shafts are viable and liability-free alternative closure methods (Del Papa and Sammons 1994) and much preferred to earthmoving, foaming and/or implosion techniques in Nevada.

Action: Where recreational cavers and mine seekers come into conflict with key maternity, bachelor or hibernation sites, close hibernation sites from November 1 to April 1 and maternity and summer bachelor sites from April 1 to October 1.

Action: Develop and distribute conservation education material to improve public awareness of bats and their unique habitat needs.

OBJECTIVE – When compared to the other species found in the state, the Brazilian Free-tailed Bat roosts in exceptionally large colonies. Preserve these large roosts wherever they occur through 2015.

Strategy: Specific attention should be given to the monitoring and protection of those large roosts known in the State as well as the identification of new sites, with emphasis on the survey of large cavern openings.

Action: Search limestone mountain ranges in White Pine County and eastern Elko County for large cavern openings and follow up with surveys for potential maternity / bachelor roosts from June to October.

Action: Continue long-term population monitoring of Rose Cave in White Pine County.

Action: Continue to monitor micro-climate of Rose Cave roost cavern following rehabilitation of the cave.

Action: Maintain interpretative sign at Rose Cave site.

Action: Maintain road closure at Rose Cave site.

Strategy: Changes in the relative abundance or gender ratio should be monitored and managed appropriately.

Action: Historical records suggest maternity activity at Rose Cave. Recent surveys have documented only males and non-reproductive females. Continue to monitor gender and age ratios at Rose Cave on a triennial basis.

Strategy: Increase the knowledge base of Brazilian Free-tailed Bats through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Brazilian Free-tailed Bats.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

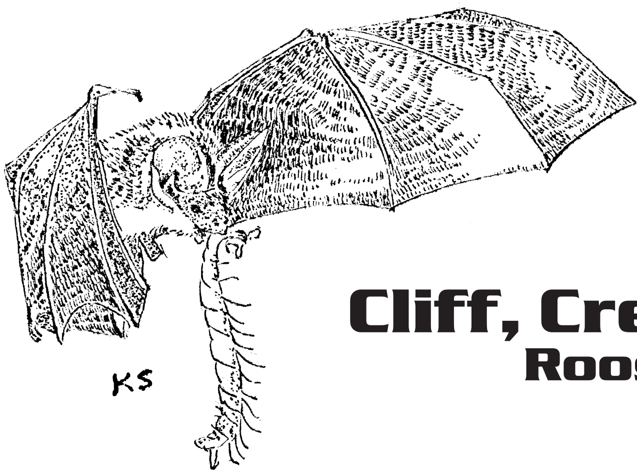
Action: Conduct annual or biennial monitoring of key maternity and bachelor sites and, if found, triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Assumptions - Research and Monitoring Needs

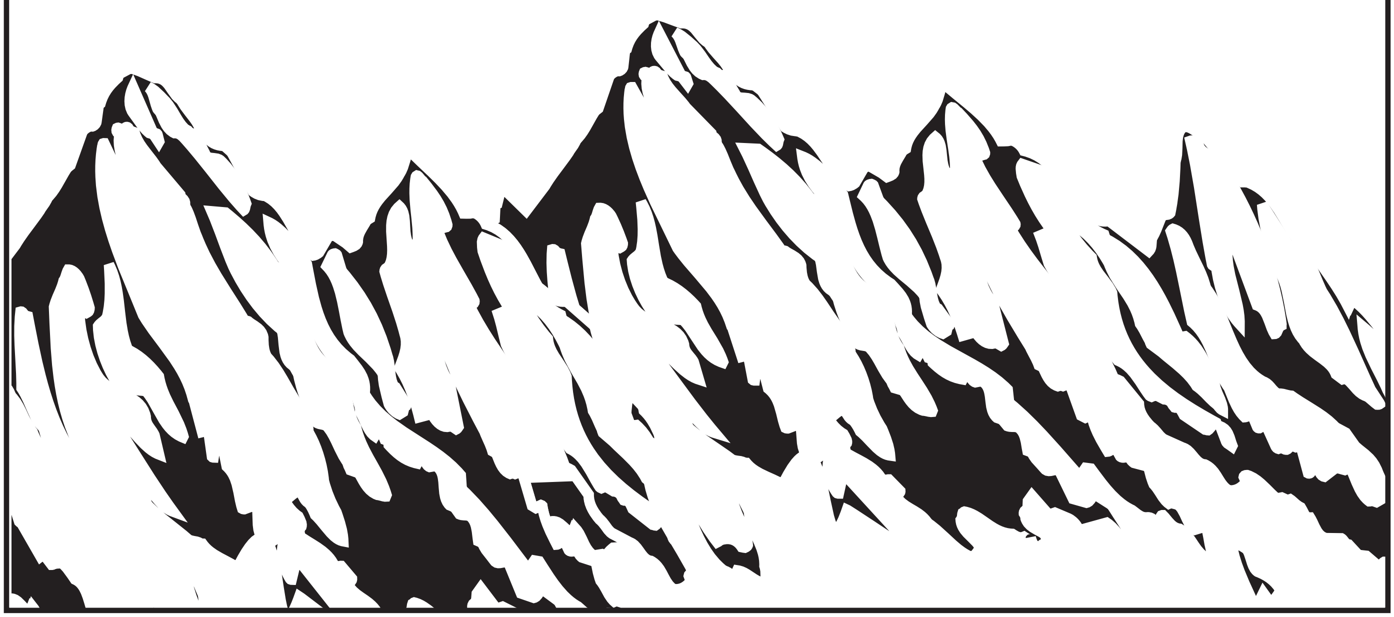
Brazilian Free-tailed Bats form the largest assemblage of any single mammal species. It is known to migrate long distances seasonally, although recent observations in southern Nevada indicate year round presence. Few roosts and no winter roosts have been located. The sensitivity of large numbers of individuals in few roosts is high. Increased human development, population growth, and recreational activities present significant threats to these roosts. The protection of roost sites for this species is complicated by their unwillingness to accept gated closures of main roost caverns. Additional information is needed on migration and foraging behavior.

References

P.V. Bradley (unpublished data), Cockrum (1969), Constantine (1967), Hall (1946), O'Farrell (1998), Wilkins (1989).



Cliff, Crevice and Talus
Roosting Habitat



HABITAT TYPE DESCRIPTION
CLIFF, CREVICE AND TALUS ROOSTING HABITAT (CL)

General Distribution

Cliff, crevice and talus roosting habitat is found throughout Nevada in all rock types. Igneous (basalt, granite), metamorphic (quartzite and marble), and sedimentary (limestone and sandstone) deposits are all common throughout the State and often provide suitable roosting habitat. Those areas where geological activity is most recent, such as lava flows, glaciation and faulting provide some of the more suitable cliff, crevice and talus roosting habitats.

Compared to the total land area available, cliff, crevice and talus roosting habitats comprise a small fraction of Nevada's total land area.

Physical Characteristics

Cliff, crevice and talus roosting habitats range in elevation from 150 m along the lower Colorado River to over 4,000 m on Boundary Peak and Wheeler Peak in northern Nevada. Precipitation varies accordingly from less than 10 cm in the south to over 80 cm on the higher mountains of the north and can come in the form of rain or snow anywhere in the State. Soil types range across the spectrum from fine clays to coarse gravels.

Cliff, crevice and talus roosting habitats are extremely variable but rather simple in nature. Cliffs and crevices can be from 6 m to over 900 m high. Talus slopes can be less than a hectare to several hundred hectares in size and are often the result of mass wasting processes associated with cliff habitats. Most cliffs, crevices and talus slopes provide suitable maternity and night roosting habitat in summer. These sights are generally too exposed to provide significant hibernation roost sites in northern Nevada. However, there is strong evidence that rock crevices provide wintering habitat in the Mojave Desert portion of southern Nevada.

Dominant Plant Species

Plant species composition varies with elevation, precipitation, latitude and longitude and incorporates the range of plant assemblages found in Nevada.

Historical and Current Condition

Recreational rock climbing has increased dramatically over the past 30 years. Increased human disturbance has altered some cliff and crevice habitats.

Talus habitats, particularly those nearer metropolitan areas, have been the focus of increased activity by rock extraction industries.

Opportunities for Conservation

Where recreational climbing and cliff and crevice roosting habitats coincide, there may exist opportunities to manage climbing through temporal or spatial restrictions to provide adequate security for bat populations. Partnerships with climbing groups may be formed to provide biologists with locations of roosting bats and potential applied research opportunities.

To help protect bats, the location of all roosts will be kept confidential. [*Bat data will continue to be stored at both the Reno NDOW and Carson City NNHP offices. The NNHP handles data acquisition requests out of the Carson Office for all bat species. All bat data are red-flagged and distribution of such data are limited to a 36 square mile grid (Township and Range Only) and/or a 100 square kilometer grid (UTM Coordinate no smaller than the 10,000th digit..... i.e. N 4,440,000 E 440,000). Any requests for more specific location information will be routed back through NDOW and the NBWG].*

Priority Bat Species

Obligates

- Pallid Bat
- Spotted Bat
- Western Mastiff Bat
- Silver-haired Bat
- California Myotis
- Small-footed Myotis
- Long-eared Myotis
- Little Brown Myotis
- Big Free-tailed Bat
- Western Pipistrelle
- Brazilian Free-tailed Bat

Others

- Townsend's Big-eared Bat
- Long-legged Myotis
- Yuma Myotis

CONSERVATION STRATEGY CL-1. CLIFFS, CREVICES, AND TALUS

Antrozous pallidus **Pallid Bat**

OBJECTIVE – Secure protection for at risk potential and known Pallid Bat roosts in cliff, crevice, and talus habitat in the State through 2010.

Strategy: Protect Pallid Bat roosting locations in Nevada, with emphasis on locations susceptible to anthropogenic disturbances.

Action: Delineate key roost locations, in particular, areas subject to human disturbance. Identify important sites at risk.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Pursue special land designation for top priority sites i.e. "Areas of Critical Environmental Concern", "Research Natural Area", "Natural Resource Area", etc.

Action: Minimize human disturbances around roost sites.

Action: Interact with recreational climbers to encourage: a) confidentiality of cliff and crevice roosts used by Pallid Bats; and b) support of bat conservation efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close nursery or other roost areas to climbing from April 1 to October 1.

Strategy: Specific attention should be given to the use of boulders as roost sites for this species. This includes using them for maternity roosts.

Action: Conservation should focus on the suite of roosts used by this species within its ecological neighborhood (including the boulder field, day roost, night roost, and foraging/water areas).

Strategy: Increase the knowledge base of the Pallid Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Pallid Bat.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Pallid Bat populations in Nevada.

Action: Plot cliff, crevice and talus areas for Pallid Bat surveys.

Action: Conduct routine and systematic Pallid Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Pallid Bat populations have been declining in California, apparently due to roost disturbance. Pallid Bats use boulders for roost sites, including maternity roosts. Few of these types of significant roosts have been identified in Nevada. Location and protection of these features are critical to a stable, healthy population. Currently, the lack of comparative baseline data hampers an appropriate evaluation of trends and needs.

References

Hall (1946), Hermanson and O'Shea (1983), Lewis (1993), Lewis (1994), Licht and Leitner (1967), O'Farrell and Bradley (1977), Orr (1954), Pierson et al. (1996).

CONSERVATION STRATEGY CL-2. CLIFFS, CREVICES, AND TALUS

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

OBJECTIVE – Reverse a declining population trend of Townsend's Big-eared Bats in Nevada by2010.

Strategy: Secure protection for all known Townsend's Big-eared Bat maternity and night roosts located in talus, cliff and crevice habitats in the state.

Action: Delineate roost locations.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B).

Action: Elevate these areas to high priority status in regional fire prevention plans.

Action: Where recreational rock climbers come in conflict with roosting Townsend's Big-eared Bats, implement temporal and/or spatial visitor use restrictions. Close nursery or night roosts in cliff and crevice habitats to climbing from 1 April to 1 October. Site specific peak activity periods may vary.

Action: Reroute all proposals for rock extraction activities to talus slopes which are certified Townsend's Big-eared Bat free. Survey conducted in one year doesn't guarantee that the same talus will be Townsend's Big-eared Bat free in subsequent years.

Strategy: Increase the knowledge base of the Townsend's Big-eared Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Townsend's Big-eared Bats.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Assumptions - Research and Monitoring Needs

Priority status was determined for the Townsend's Big-eared bat in Nevada based on: a) the downward population trends documented in surrounding States of California, Oregon, Washington, New Mexico and Idaho ; b) documented roost population declines in Nevada ; and c) the well-documented sensitive nature of this species to human disturbance of roost sites. A far more broad-scaled and complete monitoring effort is needed in Nevada to truly discern the status and trend of this species.

References

(J. S. Altenbach, personal communication), Bradley (2000a), Graham (1966), Humphrey and Kunz (1976), Mohr (1972), Pearson et al. (1952), Perkins (1990), Pierson and Rainey (1996),) Stebbings (1966), Stihler and Hall (1993), Wackenhut (1990).

CONSERVATION STRATEGY CL-3. CLIFFS, CREVICES, AND TALUS

Euderma maculatum **Spotted Bat**

OBJECTIVE – Secure protection for at risk potential and known Spotted Bat roosts in cliff, crevice, and talus habitat in the State through 2010.

Strategy: Protect Spotted Bat roosting locations in Nevada, with emphasis on locations susceptible to anthropogenic disturbances.

Action: Delineate key roost locations, in particular, areas subject to human disturbance. Identify important sites at risk.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Pursue special land designation for top priority sites i.e. "Areas of Critical Environmental Concern", "Research Natural Area", "Natural Resource Area", etc.

Action: Minimize human disturbances around roost sites.

Action: Interact with recreational climbers to encourage: a) confidentiality of cliff and crevice roosts used by *E. maculatum*; and b) support of bat conservation efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close nursery or other roost areas to climbing from April 1 to October 1.

Strategy: Increase the knowledge base of the Spotted Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Spotted Bat.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Spotted Bat populations in Nevada.

Action: Plot cliff, crevice and talus areas for Spotted Bat surveys.

Action: Conduct routine and systematic spotted bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

As with most species of bats, there is complete lack of specific cliff and talus roosting information for Spotted Bats in Nevada. Research priorities for Spotted Bats should emphasize the identification and description of roost sites.

References

Constantine (1987), Deacon and Bradley (1962), Doering and Keller (1998), Fenton et al. (1987), Geluso (2000), Kuenzi et al. (1999), Perry et al. (1997), Poché (1981), Poché and Bailie (1974), Rabe et al. (1998a), Storz (1995), Wai-Ping and Fenton (1989), Woodsworth et al. (1981).

CONSERVATION STRATEGY CL-4. CLIFFS, CREVICES, AND TALUS

Eumops perotis **Western Mastiff Bat**

OBJECTIVE – Secure protection for at risk potential Western Mastiff Bat roosts in cliff, crevice, and talus habitat in the State through 2010.

Strategy: Protect Western Mastiff Bat roosting locations in Nevada, with emphasis on locations susceptible to anthropogenic disturbances.

Action: Delineate key roost locations, in particular, areas subject to human disturbance. Identify important sites at risk.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Pursue special land designation for top priority sites i.e. "Areas of Critical Environmental Concern", "Research Natural Area", "Natural Resource Area", etc.

Action: Minimize human disturbances around roost sites.

Action: Interact with recreational climbers to encourage: a) confidentiality of cliff and crevice roosts used by *E. perotis*; and b) support of bat conservation efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close nursery or other roost areas to climbing from April 1 to October 1.

Strategy: Increase the knowledge base of the Western Mastiff Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Western Mastiff Bat.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Western Mastiff Bat populations in Nevada.

Action: Plot cliff, crevice and talus areas for Western Mastiff Bat surveys.

Action: Conduct routine and systematic Western Mastiff Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Western Mastiff Bat is known from only one record in the Las Vegas Valley. Although this record may reflect an accidental occurrence, inadequate surveys in more remote areas of southern Nevada do not allow a more accurate assessment of occurrence. Recent studies in California indicate the species is more widespread than previously thought.

References

Bradley and O'Farrell (1967),Dalquest (1946), Krutzsch (1955), Pierson and Rainey (1995).

CONSERVATION STRATEGY CL-5. CLIFFS, CREVICES, AND TALUS

Lasionycteris noctivagans **Silver-haired Bat**

OBJECTIVE – Locate and maintain a stable or increasing winter population trend of Silver-haired Bats in cliff, crevice, and talus roosting habitat throughout their range in southern Nevada through 2010.

Strategy: Protect Silver-haired Bat cliff roosting locations in southern Nevada, with emphasis on locations susceptible to anthropogenic disturbances.

Action: Delineate key roost locations, in particular, areas subject to human disturbance. Identify important sites at risk.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Pursue special land designation for top priority sites i.e. "Areas of Critical Environmental Concern", "Research Natural Area", "Natural Resource Area", etc.

Action: Minimize human disturbances around roost sites.

Action: Interact with recreational climbers to encourage: a) confidentiality of cliff and crevice roosts used by *L. noctivagans* and b) support of bat conservation efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close hibernation roost areas to climbing from November 1 to April 1.

Strategy: Increase the knowledge base of the Silver-haired Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Silver-haired Bat.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Silver-haired Bat populations in Nevada.

Action: Plot cliff, crevice and talus areas for Silver-haired Bat surveys.

Action: Conduct routine and systematic Silver-haired Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Silver-haired Bats roost almost exclusively in trees. The only time of the year that they have been documented to use alternative roosts, such as rock crevices, is during winter hibernation. Studies conducted to document the presence of Silver-haired Bat s in the aforementioned structures should be conducted in the appropriate season.

References

Barclay (1985), Barclay et al. (1988), Bradley et al. (1965), Campbell et al. (1996), Jung et al. (1999), Krutzsch (1966), Kunz (1982), Mattson et al. (1996), Parsons et al. (1986).

CONSERVATION STRATEGY CL-6. CLIFFS, CREVICES, AND TALUS

Myotis californicus **California Myotis**

OBJECTIVE – Maintain stable populations of the California Myotis in cliff, crevice, and talus roosting habitat by 2010.

Strategy: Protect California Myotis roosting locations in Nevada, with emphasis on locations susceptible to anthropogenic disturbances.

Action: Delineate key roost locations, in particular, areas subject to human disturbance. Identify important sites at risk.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Pursue special land designation for top priority sites i.e. “Areas of Critical Environmental Concern”, “Research Natural Area”, “Natural Resource Area”, etc.

Action: Minimize human disturbances around roost sites.

Action: Interact with recreational climbers to encourage: a) confidentiality of cliff and crevice roosts used by California Myotis; and b) support of bat conservation efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close nursery or other roost areas to climbing from April 1 to October 1.

Strategy: Increase the knowledge base of the California Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of California Myotis.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of California Myotis populations in Nevada.

Action: Plot cliff, crevice and talus areas for California Myotis surveys.

Action: Conduct routine and systematic California Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

As with most crevice using bats species, virtually nothing is known about what portion of the population uses such roosts or any of the physical characteristics required for such a roost. Individuals move from roost to roost throughout the year but nothing is known of this dynamic. Determination of roost requirements, need for multiple roosts, and frequency of roost shifts is critical to proper conservation and management of cliff and talus resources. No information is known on population trends for the California Myotis. Because it is a common and widespread species, declines in population trends could provide an early warning for all species utilizing the same resources.

References

Hall (1946), Krutzsch (1954), O'Farrell and Bradley (1977), Simpson (1993), Western Bat Working Group (1998).

CONSERVATION STRATEGY CL-7. CLIFFS, CREVICES, AND TALUS

Myotis ciliolabrum **Small-footed Myotis**

OBJECTIVE – Maintain stable populations of the Small-footed Myotis in cliff, crevice, and talus roosting habitat by 2010.

Strategy: Protect Small-footed Myotis roosting locations in Nevada, with emphasis on locations susceptible to anthropogenic disturbances.

Action: Delineate key roost locations, in particular, areas subject to human disturbance. Identify important sites at risk.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Pursue special land designation for top priority sites i.e. "Areas of Critical Environmental Concern", "Research Natural Area", "Natural Resource Area", etc.

Action: Minimize human disturbances around roost sites.

Action: Interact with recreational climbers to encourage: a) confidentiality of cliff and crevice roosts used by Small-footed Myotis; and b) support of bat conservation efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close nursery or other roost areas to climbing from April 1 to October 1.

Strategy: Increase the knowledge base of the Small-footed Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Small-footed Myotis.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Small-footed Myotis populations in Nevada.

Action: Plot cliff, crevice and talus areas for Small-footed Myotis surveys.

Action: Conduct routine and systematic Small-footed Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

For a seemingly common and widespread bat through most of Nevada, very little is known about the Small-footed Myotis. Few roosts have been identified although primary reliance appears to be on caves and mines. Maternity colonies appear to be small, and as such, roosts may be many and widely scattered. Elsewhere, Small-footed Myotis have been found using crevices and holes in rock faces. Because it is a common and widespread species, declines in population trends could provide an early warning for all species utilizing the same resources.

References

Barbour and Davis (1969), Hall (1946), Hoffmeister (1986), O'Farrell (2001c), Tuttle and Heaney (1974).

CONSERVATION STRATEGY CL-8. CLIFFS, CREVICES, AND TALUS

Myotis evotis **Long-eared Myotis**

OBJECTIVE – Maintain stable populations of the Long-eared Myotis in cliff, crevice, and talus roosting habitat by 2010.

Strategy: Protect Long-eared Myotis roosting locations in Nevada, with emphasis on locations susceptible to anthropogenic disturbances.

Action: Delineate key roost locations, in particular, areas subject to human disturbance. Identify important sites at risk.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Pursue special land designation for top priority sites i.e. "Areas of Critical Environmental Concern", "Research Natural Area", "Natural Resource Area", etc.

Action: Minimize human disturbances around roost sites.

Action: Interact with recreational climbers to encourage: a) confidentiality of cliff and crevice roosts used by *M. evotis*; and b) support of bat conservation efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close nursery or other roost areas to climbing from April 1 to October 1.

Strategy: Increase the knowledge base of the Long-eared Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Long-eared Myotis.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Long-eared Myotis populations in Nevada.

Action: Plot cliff, crevice and talus areas for Long-eared Myotis surveys.

Action: Conduct routine and systematic Long-eared Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Long-eared Myotis are widespread throughout Nevada in upper elevation woodlands and forests. However, they tend not to be abundant anywhere. They do not form large roosts and appear to alternate roosts frequently. Population declines have been noted in the Spring Mountains of Clark County, possibly due to degradation of water sources. Little is known about the cliff and crevice roosting behavior of this species in Nevada.

References

Hall (1946), Manning and Jones (1989), O'Farrell 2002, personal communication), Ports and Bradley (1996), Vonhof and Barclay (1997).

CONSERVATION STRATEGY CL-9. CLIFFS, CREVICES, AND TALUS

Myotis lucifugus **Little Brown Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of Little Brown Myotis in cliff and crevice roosts throughout their range in Nevada through 2010.

Strategy: Protect Little Brown Myotis cliff and talus roosting locations in Nevada, with emphasis on locations susceptible to anthropogenic disturbances.

Action: Delineate key roost locations, in particular, areas subject to human disturbance. Identify important sites at risk.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Pursue special land designation for top priority sites i.e. “Areas of Critical Environmental Concern”, “Research Natural Area”, “Natural Resource Area”, etc.

Action: Minimize human disturbances around roost sites.

Action: Interact with recreational climbers to encourage: a) confidentiality of cliff and crevice roosts used by Little Brown Myotis; and b) support of bat conservation efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close nursery or other roost areas to climbing from April 1 to October 1.

Strategy: Increase the knowledge base of the Little Brown Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Little Brown Myotis.

Action: Initiate research to document the characteristics of key cliff and crevice roost sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Little Brown Myotis populations in Nevada.

Action: Plot cliff, crevice and talus areas for Little Brown Myotis surveys.

Action: Conduct routine and systematic Little Brown Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Although Little Brown Myotis is common in other areas of its range, it seems rarer in Nevada, occurring patchily in the northern portion of the state. Local distribution and abundance is unknown. It hibernates in large aggregations elsewhere but no winter roosts have been located in Nevada. Any disturbance or destruction of bats or their hibernation sites could have profound impacts to the regional population as a whole. This species is often associated with larger bodies of water or rivers. Often, roost sites are associated with these aquatic features. Specific attention should be focused on the roost sites located along these areas as well as the protection of the water sources themselves.

References

P. E. Brown (personal communication), Fenton and Barclay (1980), Hall (1946).

CONSERVATION STRATEGY CL-10. CLIFFS, CREVICES, AND TALUS

Myotis volans **Long-legged Myotis**

OBJECTIVE** – **Maintain stable populations of the Long-legged Myotis in cliff, crevice, and talus roosting habitat by 2010.

Strategy: Protect Long-legged Myotis roosting locations in Nevada, with emphasis on locations susceptible to anthropogenic disturbances.

Action: Delineate key roost locations, in particular, areas subject to human disturbance. Identify important sites at risk.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Pursue special land designation for top priority sites i.e. "Areas of Critical Environmental Concern", "Research Natural Area", "Natural Resource Area", etc.

Action: Minimize human disturbances around roost sites.

Action: Work with private landowners to protect Long-legged Myotis populations.

Action: Interact with recreational climbers to encourage: a) confidentiality of cliff and crevice roosts used by Long-legged Myotis; and b) support of bat conservation efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close nursery or other roost areas to climbing from April 1 to October 1.

Strategy: Increase the knowledge base of the Long-legged Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Long-legged Myotis.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Long-legged Myotis populations in Nevada.

Action: Plot cliff, crevice and talus areas for Long-legged Myotis surveys.

Action: Conduct routine and systematic Long-legged Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Long-legged Myotis are widespread throughout Nevada in upper elevation woodlands and forests. Trees comprise the main maternity roost habitats, but crevices and cliff faces have been found that provide alternate roosting habitat. Although common, no studies have been conducted on population trends. Because it is a common and widespread species, declines in population trends could provide an early warning for all species utilizing the same resources.

References

Hall (1946), M. J. O'Farrell (personal communication), O'Farrell and Bradley (1977), Ormsbee and Mccomb (1998), Ports and Bradley (1996), Warner and Czaplewski (1984).

CONSERVATION STRATEGY CL-11. CLIFFS, CREVICES, AND TALUS

Myotis yumanensis **Yuma Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of Yuma Myotis in cliff and crevice habitats throughout their range in Nevada through 2010.

Strategy: Protect Yuma Myotis roosting locations in Nevada, with emphasis on locations susceptible to anthropogenic disturbances.

Action: Delineate key roost locations, in particular, areas subject to human disturbance. Identify important sites at risk.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Pursue special land designation for top priority sites i.e. "Areas of Critical Environmental Concern", "Research Natural Area", "Natural Resource Area", etc.

Action: Minimize human disturbances around roost sites.

Action: Interact with recreational climbers to encourage: a) confidentiality of cliff and crevice roosts used by Yuma Myotis; and b) support of bat conservation efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close nursery or other roost areas to climbing from April 1 to October 1.

Strategy: Increase the knowledge base of the Yuma Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Yuma Myotis.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Yuma Myotis populations in Nevada.

Action: Plot cliff, crevice and talus areas for Yuma Myotis surveys.

Action: Conduct routine and systematic Yuma Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Generally, Yuma Myotis require medium to large bodies of water for foraging. Roosts are often, but not always, within the vicinity of these types of water bodies. Specific attention should be focused on the cliff and crevice roost sites located near bodies of water as well as the protection of the water sources themselves.

References

Aldridge (1986), Brigham, et al. (1992), Dalquest (1947), Hall (1946), Herd and Fenton (1983).

CONSERVATION STRATEGY CL-12. CLIFFS, CREVICES, AND TALUS

Nyctinomops macrotis **Big Free-tailed Bat**

OBJECTIVE – Maintain a stable or increasing population trend of Big Free-tailed Bats throughout their range in Nevada through 2010.

Strategy: Protect potential and known Big Free-tailed Bat roosts in cliff, talus, and crevice habitat in southern Nevada.

Action: Delineate key roost locations, in particular, areas subject to human disturbance.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Pursue special land designation for top priority sites i.e. “Areas of Critical Environmental Concern”, “Research Natural Area”, “Natural Resource Area”, etc.

Action: Interact with recreational climbers to encourage: a) confidentiality of cliff and crevice roosts used by Big Free-tailed Bats; and b) support of bat conservation efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close nursery or other roost areas to climbing from April 1 to October 1.

Strategy: Increase the knowledge base of the Big Free-tailed Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Big Free-tailed Bats.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Big Free-tailed Bat populations in Nevada.

Action: Plot cliff, crevice and talus areas for Big Free-tailed Bat surveys.

Action: Conduct routine and systematic Big Free-tailed Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Big Free-tailed Bats have not been found to hibernate and are presumed to be seasonal migrants. This species is only known to occur in the southern portion of the state, and has only been documented in Nevada during Fall migration. Until 2000, this species was known only from a single confirmed location in the Las Vegas Valley. In 2000, intensive acoustic monitoring within the upper Moapa Valley documented significant occurrence of Big Free-tailed Bat from September through October. Inasmuch as the species is widespread throughout Utah, it is possible that populations exist in pockets through the central and eastern part of Nevada as well. It is a high flying species that is difficult to capture, probably resulting in an under-representation in past inventories.

References

Bradley et al. (1965), Hall (1946), Milner et al. (1990), Williams (2001).

CONSERVATION STRATEGY CL-13. CLIFFS, CREVICES AND TALUS

Pipistrellus hesperus **Western Pipistrelle**

OBJECTIVE – Sustain secure populations of the Western Pipistrelle in cliff, crevice and talus roosting habitat by 2010.

Strategy: Protect Western Pipistrelle maternity and night roosts along cliff, talus, and crevice habitat within its range in Nevada.

Action: Delineate key roost locations in particular areas subject to human disturbance.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close nursery or other roost areas to climbing from April 1 to October 1.

Strategy: Increase the knowledge base of the Western Pipistrelle through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Western Pipistrelle.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Western Pipistrelle populations in Nevada.

Action: Plot cliff, crevice and talus areas for Western Pipistrelle surveys.

Action: Conduct routine and systematic Western Pipistrelle surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Hall (1946) first predicted Western Pipistrelle use of cliff and crevice roosting habitat in 1931. Pips are still the most common and widespread species at low to middle elevations through most of the western United States. Because of their commonality and wide distribution, they are well-suited for long-term monitoring of population trends. Fluctuations in Western Pipistrelle populations could serve as an early warning of serious threats to the entire community. Insufficient information exists on cliff roosting requirements.

References

Bradley and O'Farrell (1969), Cross (1965), Hall (1946), Hayward and Cross (1979), O'Farrell and Bradley (1977).

CONSERVATION STRATEGY CL-14. CLIFFS, CREVICES AND TALUS

Tadarida brasiliensis **Brazilian Free-tailed Bat**

OBJECTIVE – Sustain secure populations of the Brazilian Free-tailed Bat in cliff, crevice and talus roosting habitat by 2010.

Strategy: Protect Brazilian Free-tailed Bat maternity and night roosts along cliff, talus, and crevice habitat within its range in Nevada.

Action: Delineate key roost locations in particular areas subject to human disturbance.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts.

Action: Where recreational climbing may conflict with key roost areas, implement use restrictions and close nursery or other roost areas to climbing from April 1 to October 1.

Strategy: Increase the knowledge base of the Brazilian Free-tailed Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of the Brazilian Free-tailed Bat.

Action: Initiate research to document the characteristics of key hibernation sites, so that those characteristics can be effectively maintained.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Brazilian Free-tailed Bat populations in Nevada.

Action: Plot natural cliff, crevice and talus areas for Brazilian Free-tailed Bat surveys.

Action: Conduct routine and systematic Brazilian Free-tailed Bat surveys in likely habitat to inventory and document long-term population trends.

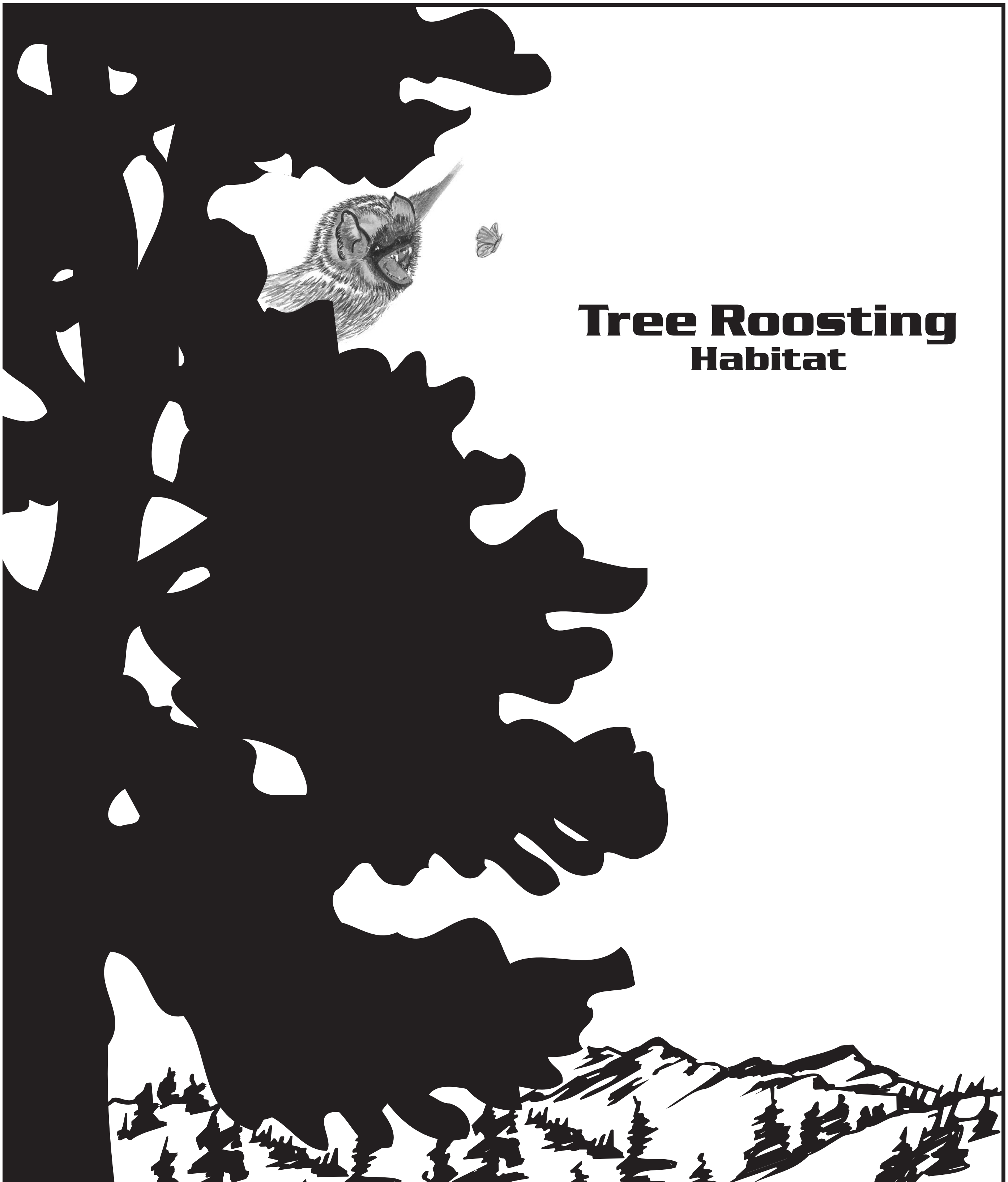
Assumptions - Research and Monitoring Needs

The most well-known roosts for Brazilian Free-tailed Bats occur in caves and bridges in Nevada. However, cliff and crevice roosting habitats may hold a significant portion of the population during portions of the year. There is a great need to understand this alternate roosting habitat.

References

Adam and Hayes (2000), Brittingham and Williams (2000), Clark et al. (1996), Cockrum (1969), Constantine (1967), Hall (1946), Hoff et al. (1993), Keeley and Tuttle (1999), O'Farrell (1998), Romano et al. (1999), Thies et al. (1996), Wilkins (1989).

Tree Roosting Habitat



HABITAT TYPE DESCRIPTION
TREE ROOSTING HABITAT (TR)

General Distribution

Tree roosting habitats are found throughout the State in two primary locations: riparian areas across all elevations and mountain/valley regions above 1,500 m. Riparian woodland areas that offer suitable roosting habitat for bats are found at elevations as low as 150 m along the Colorado River, to high elevation springs in mountainous regions that reach 3,000 m or more.

Riparian woodland areas

Riparian woodland habitats in Nevada are those that are associated with major river systems, streams, springs, or seeps occurring below 2,500 m in the state. While there are an estimated 15,470 springs or seeps in Nevada (Mark O'Brian, personal communication) (Geographic Names Information System), there are six primary river systems: the Humboldt, Snake, Truckee, Carson, Walker, and Colorado Rivers and their tributaries. Total riparian habitat in Nevada is estimated at 110,800 hectares (Nevada GAP Analysis). Woodland riparian habitats comprise only a small fraction of the total riparian habitat available.

Dominant woody plant species in riparian woodland habitats include cottonwoods (*Populus fremontii, P. angustifolia*), willows (*Salix* spp), water birch (*Betula occidentalis*), thinleaf alder (*Alnus tenuifolia*) and buffaloberry (*Shepherdia argentea*). In addition to these, in southern Nevada velvet ash (*Fraxinus velutina*), desert willow (*Chilopsis linearis*), seep willow (*Baccharis salicifolia*) and mesquite (*Prosopis glandulosa and P. pubescens*) are also common inhabitants in desert washes and riparian habitat. Bats are known to roost in cottonwoods and palm trees. Observations of bats roosting in other riparian tree species in the State is lacking due to insufficient surveys.

California fan palms (*Washingtonia filifera*) have been introduced along the Muddy River, and today exist primarily at the headwaters in the upper Moapa Valley. Tamarisk (*Tamarix ramosissima*) is an aggressive exotic tree found in Nevada's river systems throughout the entire state. Russian olive (*Elaeagnus angustifolia*) is another successful exotic tree that has invaded the riparian communities of Nevada, and is most prevalent in the Great Basin.

Upland woodland areas

Mountain and valley regions above 1,500 m in the State are inhabited by a variety of tree species that provide roosting resources for bats. Dominant species include Joshua tree (*Yucca brevifolia*), singleleaf pinyon pine (*Pinus monophylla*), juniper spp. (*Juniperus osteosperma and J. scopulorum*) and mountain mahogany (*Cercocarpus ledifolius*) on more xeric sites from 1,500 to 3,000 m. Higher elevation, more mesic sites are dominated by larger pines (*Pinus longaeva, P. flexilis, P. ponderosa, P. jefferyi, P. albicaulis*), fir (*Abies concolor, A. lasiocarpa, Pseudotsuga menziesii*) and spruce (*Picea englemannii*) from 1,500 m to tree line. In the Great Basin, aspen (*Populus tremuloides*) is found in patches between 1,800 m and 2,500 m, primarily where soil moisture is favorable. Bats are known to roost in singleleaf pinyon pine, juniper, and various large pine species. Observations of bats roosting in aspen in Nevada are limited. However, it is suspected that exfoliating bark is a significant roost habitat for some species. Further study is needed.

Historical and Current Condition

Riparian areas are among the most disturbed habitats in the southwestern U.S.. Almost two decades ago, Swift (1984) estimated that riparian habitats have been reduced by more than 80% in the arid west and mid-west. Cottonwood trees alone are estimated to have been reduced 70-95% from their historical distributions only a century ago (Braatne et al., 1996). Riparian areas are extremely susceptible to anthropogenic disturbances, including urban and agricultural development, recreation, and livestock grazing.

Forested upland habitats above 1,500 m in the State are in varying degrees of health. Fire suppression, inappropriate livestock grazing practices, exotic plant and animal introductions and historical mining practices including the destruction of tens of thousands of hectares for charcoal production have contributed to the current landscape condition.

Opportunities for Conservation

Where riparian areas occur, opportunities to manage or curtail disturbance must be taken. The popularity of these habitats in combination with their fragile state should be taken into consideration in conservation management planning efforts. Where historical riparian areas no longer exist, management efforts should be taken to restore habitats or mitigate for their loss.

In forested uplands, management techniques should be altered to accommodate appropriate fire and timber management techniques, limitation of livestock grazing, and control and management of exotic species introductions. Restoration projects should be directed at obtaining healthy woodland communities and obtaining historical acreages of woodlands in Nevada. Forest plans should address bat habitat conservation (e.g. old growth, snags per acre, foraging habitat, bat diversity, etc.).

To help protect bats, the location of all roosts will be kept confidential. [*Bat data will continue to be stored at both the Reno NDOW and Carson City NNHP offices. The NNHP handles data acquisition requests out of the Carson Office for all bat species. All bat data are red-flagged and distribution of such data are limited to a 36 square mile grid (Township and Range Only) and/or a 100 square kilometer grid (UTM Coordinate no smaller than the 10,000th digit..... i.e. N 4,440,000 E 440,000). Any requests for more specific location information will be routed back through NDOW and the NBWG.*

Priority Bat Species

Obligates

- Silver-haired bat
- Western red bat
- Hoary bat
- Western yellow bat

Others

- Pallid bat
- Townsend's Big-eared Bat
- Big Brown bat
- Allen's Lappet-browed Bat
- California Myotis
- Small footed Myotis
- Long-eared Myotis
- Little Brown Myotis
- Fringed Myotis
- Long-legged Myotis
- Yuma Myotis
- Brazilian Free-tailed Bat

CONSERVATION STRATEGY TR-1. TREE ROOSTING HABITAT

Antrozous pallidus **Pallid Bat**

OBJECTIVE – Maintain stable or increasing populations of Pallid Bats throughout their range in woodland habitats in Nevada through 2010.

Strategy: Maintain existing habitats used by roosting Pallid Bats.

Action: Delineate roost locations and determine the features that offer suitable roosting habitat (e.g. snags, tree species, age of timber stand, etc.)

Action: Secure protection for woodland areas used by roosting Pallid Bats.

Strategy: Maintain and restore low- and mid-elevation riparian woodland areas used by migrating Pallid Bats in Nevada.

Action: Identify historical locations of low- and mid-elevation riparian woodland habitats in Nevada.

Action: Implement conservation plans to restore all historical riparian woodland areas.

Action: Delineate roost locations and determine the features that offer suitable roosting habitat (e.g. snags, tree species, age of timber stand, etc.)

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management-planning efforts, particularly riparian restoration plans.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Pallid Bats.

Strategy: Restore historical woodlands to mitigate for the loss of woodlands in Nevada.

Action: Identify historical locations of woodland habitats in Nevada.

Action: Implement conservation plans to restore historical woodland areas.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Pallid Bats.

Strategy: Increase the knowledge base of the Pallid Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Pallid Bats.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Pallid Bat populations in Nevada.

Action: Plot low elevation riparian woodland and high elevation woodland areas for Pallid Bat surveys.

Action: Conduct routine and systematic Pallid Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Pallid Bats may roost in tree hollows in either riparian woodland or in other upland woodlands. Foraging in and adjacent to riparian habitats appears to be important. Populations elsewhere have been declining over the past decade. Recent studies in the Spring Mountains in Clark County yielded few records of what should be a more common species.

References

Hall (1946), Hermanson and O'Shea (1983), Orr (1954), Pierson et al. (1996), Williams (2001).

CONSERVATION STRATEGY TR-2. TREE ROOSTING HABITAT

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

OBJECTIVE – Maintain stable or increasing populations of Townsend's Big-eared Bats throughout their range in Nevada through 2010.

Strategy: Maintain Nevada's largest trees and oldest forests. Maintain existing habitats used by roosting Townsend's Big-eared Bats.

Action: Delineate those forests that may provide large cavernous night-roosts.

Action: Preserve all old-growth forests that may provide large cavernous night-roosts.

Assumptions - Research and Monitoring Needs

In California, Townsend's Big-eared Bats are known to roost in large trees that provide cave-like conditions. It is assumed that trees, particularly those on the eastern front of the Sierra Nevada and subalpine coniferous forests of the Great Basin may provide similar habitats in Nevada. Further research is needed.

References

Fellers and Pierson (2002).

CONSERVATION STRATEGY TR-3. TREE ROOSTING HABITAT

Eptesicus fuscus **Big Brown Bat**

OBJECTIVE – Maintain stable or increasing populations of Big Brown Bats throughout their range in woodlands of Nevada through 2010.

Strategy: Maintain existing habitats used by roosting Big Brown Bats.

Action: Delineate roost locations and determine the features that offer suitable roosting habitat (e.g. snags, tree species, age of timber stand, etc.)

Action: Secure protection for woodland areas used by roosting Big Brown Bats.

Strategy: Maintain and restore low- and mid-elevation riparian woodland areas used by migrating Big Brown Bats in Nevada.

Action: Identify historical locations of low- and mid-elevation riparian woodland habitats in Nevada.

Action: Implement conservation plans to restore all historical riparian woodland areas.

Action: Delineate roost locations and determine the features that offer suitable roosting habitat (e.g. snags, tree species, age of timber stand, etc.)

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management-planning efforts, particularly riparian restoration plans.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Big Brown Bats.

Strategy: Restore historical woodlands to mitigate for the loss of woodlands in Nevada.

Action: Identify historical locations of woodland habitats in Nevada.

Action: Implement conservation plans to restore historical woodland areas.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Big Brown Bats.

Strategy: Increase the knowledge base of the Big Brown Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Big Brown Bat.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Big Brown Bat populations in Nevada.

Action: Plot low elevation riparian woodland and high elevation woodland areas for Big Brown Bat surveys.

Action: Conduct routine and systematic Big Brown Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Big Brown Bats are found throughout most of North America and appear to be common over much of their range. Although many records occur for Nevada, little is known of woodland roosting and seasonal habits. Because of their widespread distribution and apparent abundance, population trends for Big Brown Bats would have broad application in bat management and conservation.

References

Betts (1996), Brigham (1991), Hall (1946), Kurta and Baker (1990), Vonhof (1996), Williams (2001).

CONSERVATION STRATEGY TR-4. TREE ROOSTING HABITAT

Idionycteris phyllotis **Allen's Lappet-browed Bat**

OBJECTIVE – Maintain stable or increasing populations of Allen's Lappet-browed Bats throughout their range in southern Nevada woodlands through 2010.

Strategy: Maintain existing habitats used by roosting Allen's Lappet-browed Bats.

Action: Delineate roost locations and determine the features that offer suitable roosting habitat (e.g. snags, tree species, age of timber stand, etc.)

Action: Secure protection for woodland areas used by roosting Allen's Lappet-browed Bats.

Strategy: Maintain and restore low- and mid-elevation riparian woodland areas used by migrating Allen's Lappet-browed Bats in Nevada.

Action: Identify historical locations of low- and mid-elevation riparian woodland habitats in Nevada.

Action: Implement conservation plans to restore all historical riparian woodland areas.

Action: Delineate roost locations and determine the features that offer suitable roosting habitat (e.g. snags, tree species, age of timber stand, etc.)

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management-planning efforts, particularly riparian restoration plans.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Allen's Lappet-browed Bats.

Strategy: Restore historical woodlands to mitigate for the loss of woodlands in Nevada.

Action: Identify historical locations of woodland habitats in Nevada.

Action: Implement conservation plans to restore historical woodland areas.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Allen's Lappet-browed Bats.

Strategy: Increase the knowledge base of Allen's Lappet-browed Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Allen's Lappet-browed Bat.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Allen's Lappet-browed Bat populations in Nevada.

Action: Plot low elevation riparian woodland and high elevation woodland areas for Allen's Lappet-browed Bat surveys.

Action: Conduct routine and systematic Allen's Lappet-browed Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Allen's Lappet-browed Bat is found only in southern Nevada from a few locations with most being concentrated in the southern portion of the Spring Mountains in Clark County. Throughout its range, the distribution appears patchy. The species appears to breed in coniferous forest and winter at lower elevations. Two populations have been found breeding at low elevations in Arizona. During breeding, use of exfoliating bark as tree roosts appears to be important with multiple roosts being used through a single season. Recent surveys in the Spring Mountains have failed to locate Allen's Lappet-browed Bats. The current status of the species is in question.

References

Czaplewski (1983), O'Farrell (2002, personal communication), O'Farrell and Bradley (1969), Rabe et al. (1998b), Simmons and O'Farrell (1977).

CONSERVATION STRATEGY TR-5. TREE ROOSTING HABITAT

Lasionycteris noctivagans **Silver-haired Bat**

OBJECTIVE – Maintain stable or increasing populations of Silver-haired Bats throughout their range in Nevada woodlands through 2010.

Strategy: Maintain existing habitats used by roosting Silver-haired Bats.

Action: Delineate roost locations and determine the features that offer suitable roosting habitat (e.g. snags, tree species, age of timber stand, leaf litter, etc.).

Action: Secure protection for woodland areas used by roosting Silver-haired Bats.

Strategy: Maintain and restore low- and mid-elevation riparian woodland areas used by migrating Silver-haired Bats in Nevada.

Action: Identify historical locations of low- and mid-elevation riparian woodland habitats in Nevada.

Action: Implement conservation plans to restore all historical riparian woodland areas.

Action: Delineate roost locations and determine the features that offer suitable roosting habitat (e.g. snags, tree species, age of timber stand, leaf litter, etc.).

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management-planning efforts, particularly riparian restoration plans.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Silver-haired Bats.

Strategy: Restore historical woodlands to mitigate for the loss of woodlands in Nevada.

Action: Identify historical locations of woodland habitats in Nevada.

Action: Implement conservation plans to restore historical woodland areas.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Silver-haired Bats.

Strategy: Increase the knowledge base of the Silver-haired Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Silver-haired Bat.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Silver-haired Bat populations in Nevada.

Action: Plot low elevation riparian woodland and high elevation woodland areas for Silver-haired Bat surveys.

Action: Conduct routine and systematic Silver-haired Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Silver-haired Bats have been one of the most abundant species documented in surveys during migration. Most records are from spring and fall migration although there is a possibility that summer residents occur at higher elevations, particularly in northern Nevada. Although not confined to riparian woodlands, the majority of records indicate reliance upon these habitat corridors during migration. Occurrence of Silver-haired Bats in prior years within the upper Moapa Valley is in stark contrast to their absence throughout 2000 while intensive sampling occurred.

References

Barclay et al. (1988), Betts (1996), Bradley (2000b), Bradley et al. (1965), Hall (1946), Izor (1979), Kunz (1982), Mattson et al. (1996), Perkins and Cross (1988), Sanborn (1953), Vonhof (1996), Williams (2001).

CONSERVATION STRATEGY TR-6. TREE ROOSTING HABITAT

Lasiurus blossevillii **Western Red Bat**

OBJECTIVE – Obtain an upward population trend for red bats in Nevada's riparian woodlands by 2010.

Strategy: Identify and maintain existing populations of Fremont cottonwood (*Populus fremontii*) and narrowleaf cottonwood (*P. angustifolia*) trees in Nevada.

Action: Protect existing stands of cottonwood trees from overgrazing, gravel mining and urbanization.

Action: Delineate roost locations and determine features that offer suitable roosting habitat (e.g. snags, tree species, age of timber stand, leaf litter, etc.)

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management-planning efforts, particularly riparian restoration plans.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Western Red Bats.

Strategy: Maintain and restore low- and mid-elevation riparian woodland areas used by migrating Western Red Bats in Nevada.

Action: Identify historical locations of low- and mid-elevation riparian woodland habitats in Nevada.

Action: Implement conservation plans to restore all historical riparian woodland areas.

Action: Delineate roost locations and determine the features that offer suitable roosting habitat (e.g. snags, tree species, age of timber stand, leaf litter, etc.)

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management-planning efforts, particularly riparian restoration plans.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Western Red Bats.

Strategy: Reduce a declining population trend of Western Red Bats in Nevada.

Action: Identify historical locations of cottonwood galleries within current and historical riparian areas of Nevada's water sources.

Action: Develop conservation education materials designed to improve public awareness and stewardship of Nevada's riparian habitats.

Action: Promote the re-establishment and conservation management of cottonwood trees in riparian areas where cottonwood has been extirpated in Nevada.

Action: Promote and demonstrate the importance of existing and potential cottonwood galleries in Nevada's riparian habitats.

Strategy: Increase the knowledge base of the Red Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Western Red Bat.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Western Red Bat populations in Nevada.

Action: Plot low elevation riparian woodland and high elevation woodland areas for Western Red Bat surveys.

Action: Conduct routine and systematic Western Red Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Data are limited due to the difficulty in sampling Western Red Bats, but there appears to be a serious decline in population level throughout its range. Although multiple factors are suspected, the drastic decline of cottonwood tree galleries in the western U.S is probably the prime factor affecting this obligate tree-roosting species. Recent widespread use of acoustic methods for surveying have increased the knowledge of occurrence of the Western Red Bat in Nevada. Although the species was thought to be a short-term seasonal migrant for the state, preliminary evidence indicates some protracted use throughout the summer months. The importance of leaf litter as roosting habitat is suggested from work conducted on the Eastern Red Bat.

References

Hall (1946), Moorman et al. (1999), O'Farrell (2001a, b), Saugey et al. (1998), Shump and Shump (1982), Williams (2001).

CONSERVATION STRATEGY TR-7. TREE ROOSTING HABITAT

Lasiurus cinereus **Hoary Bat**

OBJECTIVE – Maintain stable or increasing populations of hoary bats throughout their range in Nevada woodlands through 2010.

Strategy: Maintain existing forest habitats used by roosting Hoary Bats.

Action: Delineate roost locations and determine features that offer suitable roosting habitat (e.g. snags, tree species, age of timber stand, etc.)

Action: Secure protection for woodland areas used by roosting Hoary Bats.

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts, particularly timber harvest plans and riparian restoration plans.

Strategy: Maintain and restore low- and mid-elevation riparian woodland areas used by migrating Hoary Bats in Nevada.

Action: Identify historical locations of low- and mid-elevation riparian woodland habitats in Nevada.

Action: Implement conservation plans to restore all historical riparian woodland areas.

Action: Delineate roost locations and determine the features that offer suitable roosting habitat (e.g. snags, tree species, age of timber stand, etc.)

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management-planning efforts, particularly riparian restoration plans.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Hoary Bats.

Strategy: Restore historical woodlands to mitigate for the loss of woodlands in Nevada.

Action: Identify historical locations of woodland habitats in Nevada.

Action: Implement conservation plans to restore historical woodland areas.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Hoary Bats.

Strategy: Increase the knowledge base of the Hoary Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of the Hoary Bat.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Hoary Bat populations in Nevada.

Action: Plot low elevation riparian woodland and high elevation woodland areas for Hoary Bat surveys.

Action: Conduct routine and systematic Hoary Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

A possible summer resident at some localities throughout the state, Hoary Bats also migrate through the State in spring and fall using riparian corridors and other wooded areas. As with other migrating obligate tree-roosting species, they are difficult to sample. Recent work in the upper Moapa Valley indicates that Hoary Bats are present in the State for longer periods than previously thought and that remaining riparian corridors may be essential as migration stops. Further degradation or loss of these key habitats could have deleterious effects for the species throughout the western United States.

References

Barclay (1985), Bradley et al. (1965), Hall (2000), Hall (1946), Hickey (1992), Hickey et al. (1996), Jung et al. (1999), Rakestraw et al. (1998), Ports and Bradley (1996), Shump and Shump (1982b), Williams (2001).

CONSERVATION STRATEGY TR-8. TREE ROOSTING HABITAT

Lasiurus xanthinus **Western Yellow Bat**

OBJECTIVE – Maintain stable populations of Western Yellow Bats throughout their range in southern Nevada through 2010.

Strategy: Secure protection for all currently existing high quality dense monotypic stands of California fan palms (*Washingtonia filifera*) in southern Nevada.

Action: Delineate California palm stand locations in southern Nevada.

Action: In all sites where no conflict exists with critical habitat management of the endangered Moapa Spine Dace, incorporate all Western Yellow Bat roost sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B). Provide for the conservation of roost habitats in all land management-planning efforts, particularly riparian restoration plans.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Western Yellow Bats.

Strategy: At existing stands of California palms on managed lands, achieve good to excellent condition of understory (dead palm fronds).

Action: Delineate all poor/fair condition California palm habitat in southern Nevada.

Action: Determine population concentrations of roosting sites in California palm stands in southern Nevada.

Action: Overlay priority Western Yellow Bat concentrations with palm habitats.

Action: Within the framework of public habitat management, modify management to attain good to excellent habitat condition in all poor/fair condition California palm habitats.

Strategy: Increase the knowledge base of the Western Yellow Bat through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of the Western Yellow Bat.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Western Yellow Bat populations in southern Nevada.

Action: Plot low elevation riparian woodland areas for Western Yellow Bat surveys.

Action: Conduct routine and systematic Western Yellow Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

The recent documentation of Western Yellow Bats in southern Nevada represents the first State record for this species and a significant range extension. The increase in distribution is likely attributable to the increase in decorative palms within and surrounding urban development in the southwestern United States. The establishment of a stable year round population in southern Nevada is significant. Although present throughout the year, it appears that a major portion of the breeding population migrates for the winter. Nothing is known of the route or destination. Maintenance of a viable corridor and foraging areas will be critical to the success of Western Yellow Bats in Nevada.

References

Constantine (1998), Kurta and Lehr (1995), M. J. O'Farrell, J. A. Williams, and B. Lund (personal communication), Williams (2001).

CONSERVATION STRATEGY TR-9. TREE ROOSTING HABITAT

Myotis californicus **California Myotis**

OBJECTIVE - Maintain stable populations of the California Myotis in tree roosting habitat by 2010.

Strategy: Protect California Myotis roosts in tree roosting habitat in the state.

Action: Delineate roost locations and determine the features that make good roosting habitat (e.g. snags, tree species, age of timber stand, etc.)

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management-planning efforts, particularly timber harvest plans.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of California Myotis.

Strategy: Increase the knowledge base of the California Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of California Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of California Myotis populations in Nevada.

Action: Identify forests with suitable features for bat roosting for California Myotis surveys.

Action: Conduct routine and systematic California Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

As with many species, historical records of California Myotis found in tree roosts is exceedingly rare. Further research is needed. Because it is a common and widespread species, declines in population trends could provide an early warning for all species utilizing the same resources.

References

Hall (1946), Krutzsch (1954), O'Farrell and Bradley (1977), Simpson (1993), Western Bat Working Group (1998).

CONSERVATION STRATEGY TR-10. TREE ROOSTS

Myotis ciliolabrum **Small-footed Myotis**

OBJECTIVE - Maintain stable populations of the Small-footed Myotis in tree roosting habitat by 2010.

Strategy: Protect Small-footed Myotis roosts in tree roosting habitat in the state.

Action: Delineate roost locations and determine the features that make good roosting habitat (e.g. snags, tree species, age of timber stand, etc.)

Action: Incorporate these sites into pending *Nevada Bat Roost Protection Act* legislation (Appendix B) and land management planning efforts, particularly timber harvest plans.

Action: Manage lands that contain roosting habitat in such a way that provides adequate roosting habitat to maintain stable populations of Small-footed Myotis.

Strategy: Increase the knowledge base of the Small-footed Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Small-footed Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Small-footed Myotis populations in Nevada.

Action: Identify forests with suitable features for bat roosting for Small-footed Myotis surveys.

Action: Conduct routine and systematic Small-footed Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

As with many species, historical records of *M. ciliolabrum* found in tree roosts is exceedingly rare. We do know now that the Small-footed Myotis is tolerant of boreal forest habitats, contrary to what Hall suggested in 1946. However, further research is needed into the role that tree roosts play in their ecology. Because it is a common and widespread species, declines in population trends could provide an early warning for all species utilizing the same resources.

References

Barbour and Davis (1969), Hall (1946), Hoffmeister (1986), O'Farrell (2001c).

CONSERVATION STRATEGY TR-11. TREE ROOSTING HABITAT

Myotis evotis **Long-eared Myotis**

OBJECTIVE - Maintain stable populations of the Long-eared Myotis in coniferous forest habitats throughout Nevada by 2010.

***Strategy*:** Protect Long-eared Myotis maternity and day roosts in tree habitat within its range in Nevada.

Action: Delineate key roost locations in pinyon/ juniper forests.

Action: Incorporate key roost sites into pending Nevada Bat Roost Protection Act legislation (Appendix B).

Action: Elevate key roost sites to high priority status in regional fire prevention plans.

Action: Provide Federal and State agencies with information on bat habitat needs and *Improvement Practices*, which could be used to benefit the species.

Action: Develop a Position Statement from the Nevada Bat Working Group that outlines preferred roosting and foraging habitat for the Long-eared Myotis. The position statement can be provided to land-use agencies when comments to forest harvest plans are solicited.

Action: Avoid all "old growth" pinyon-juniper woodland (trees with > 46 cm dbh) and forest habitats in tree removal operations (especially those trees in a later seral stage of decay).

Action: Discourage prescribed burning or vegetative alteration in pinyon-juniper or shrub steppe habitat within a 2.5 km radius of known bat roosts.

Strategy: Increase the knowledge base of the Long-eared Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of the long-eared Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Long-eared Myotis populations in Nevada.

Action: Identify additional forest habitats with suitable features for bat roosting for Long-eared Myotis surveys.

Action: Conduct routine and systematic Long-eared Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Long-eared Myotis are widespread throughout Nevada in upper elevation woodlands and forests. However, with the possible exception of pinyon-juniper forest habitats in limestone mountain ranges of White Pine County and eastern Elko County, they tend not to be abundant anywhere. They do not form large roosts and appear to alternate roosts frequently. Population declines have been noted in the Spring Mountains of Clark County, possibly due to degradation of water sources. Additional information is needed on the specific needs of the long-eared myotis as they relate to the structure and condition of pinyon-juniper forests in Nevada.

References

Chung-MacCoubrey (1996), Hall (1946), Manning and Jones (1989), M. J. O'Farrell (personal communication), Ports and Bradley (1996), Vonhof and Barclay (1997).

CONSERVATION STRATEGY TR-12. TREE ROOSTING HABITAT

Myotis lucifugus **Little Brown Myotis**

OBJECTIVE - Maintain stable populations of the Little Brown Myotis in coniferous forest habitats of northern Nevada by 2010.

***Strategy*:** Protect Little Brown Myotis maternity and day roosts in tree habitat within its range in Nevada.

Action: Delineate key roost locations in pinyon/ juniper and subalpine coniferous forest habitats.

Action: Incorporate key roost sites into pending Nevada Bat Roost Protection Act legislation (Appendix B).

Action: Elevate key roost sites to high priority status in regional fire prevention plans.

Action: Provide Federal and State agencies with information on bat habitat needs and *Improvement Practices*, which could be used to benefit the species.

Action: Develop a Position Statement from the Nevada Bat Working Group that outlines preferred roosting and foraging habitat for the Little Brown Myotis. The position statement can be provided to land-use agencies when comments to forest harvest plans are solicited.

Strategy: Increase the knowledge base of the Little Brown Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Little Brown Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Little Brown Myotis populations in Nevada.

Action: Identify forests with suitable features for bat roosting for Little Brown Myotis surveys.

Action: Conduct routine and systematic Little Brown Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Although Little Brown Myotis is common in other areas of its range, it seems more rare in Nevada, occurring patchily in the northern portion of the state. Local distribution and abundance is unknown. It hibernates in large aggregations elsewhere but no winter roosts have been located in Nevada. Any disturbance or destruction of bats or their roost sites could have profound impacts to the regional population as a whole. This species is often associated with larger bodies of water or rivers. Often, roost sites are associated with these aquatic features. Specific attention should be focused on the roost sites located along these areas as well as the protection of the water sources themselves.

References

P. E. Brown (personal communication), Fenton and Barclay (1980), Hall (1946).

CONSERVATION STRATEGY TR-13. TREE ROOSTING HABITAT

Myotis thysanodes **Fringed Myotis**

OBJECTIVE – Restore and maintain stable populations of the Fringed Myotis in coniferous forest habitats by 2010.

***Strategy*:** Protect Fringed Myotis maternity and day roosts in tree habitat within its range in Nevada.

Action: Delineate key roost locations in pinyon/ juniper forests.

Action: Incorporate key roost sites into pending Nevada Bat Roost Protection Act legislation (Appendix B).

Action: Elevate key roost sites to high priority status in regional fire prevention plans.

Action: Provide Federal and State agencies with information on bat habitat needs and *Improvement Practices*, which could be used to benefit the species.

Action: Develop a Position Statement from the Nevada Bat Working Group that outlines preferred roosting and foraging habitat for the Fringed Myotis. The position statement can be provided to land-use agencies when comments to forest harvest plans are solicited.

Strategy: Increase the knowledge base of the Fringed Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Fringed Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Fringed Myotis populations in Nevada.

Action: Identify forests with suitable features for bat roosting for Fringed Myotis surveys.

Action: Conduct routine and systematic Fringed Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Prior to 1974, Fringed Myotis was known from only two locations. The only known colony, found in a salt cave outside of St. Thomas, was inundated with the formation of Lake Mead. Since 1974, there have been a number of records through the middle and upper elevations of southern Nevada. No other colonies have been located. This species is particularly sensitive to disturbance in day roosts. Systematic surveys are critical to locate and protect roost sites.

References

Deacon et al. (1964), Hall (1946), O'Farrell (2001c; 2002, unpublished data), O'Farrell and Studier (1973, 1980).

CONSERVATION STRATEGY TR-14. TREE ROOSTING HABITAT

Myotis volans **Long-legged Myotis**

OBJECTIVE - Maintain stable populations of the Long-legged Myotis in coniferous forest habitats by 2010.

***Strategy*:** Protect Long-legged Myotis maternity and day roosts in tree habitat within its range in Nevada.

Action: Delineate key roost locations in pinyon/ juniper forests.

Action: Incorporate key roost sites into pending Nevada Bat Roost Protection Act legislation (Appendix B).

Action: Elevate key roost sites to high priority status in regional fire prevention plans.

Action: Provide Federal and State agencies with information on bat habitat needs and *Improvement Practices*, which could be used to benefit the species.

Action: Develop a Position Statement from the Nevada Bat Working Group that outlines preferred roosting and foraging habitat for the Long-legged Myotis. The position statement can be provided to land-use agencies when comments to forest harvest plans are solicited.

Strategy: Increase the knowledge base of the Long-legged Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Long-legged Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Long-legged Myotis populations in Nevada.

Action: Identify forests with suitable features for bat roosting for Long-legged Myotis surveys.

Action: Conduct routine and systematic Long-legged Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Long-legged Myotis are widespread throughout Nevada in upper elevation woodlands and forests. Trees comprise the main maternity roosts. Although common, no studies have been conducted on population trends. Because it is a common and widespread species, declines in population trends could provide an early warning for all species utilizing the same resources.

References
Hall (1946), O'Farrell and Bradley (1977), Ormsbee and Mccomb (1998), Ports and Bradley (1996), Warner and Czaplewski (1984).

CONSERVATION STRATEGY TR-15. TREE ROOSTING HABITAT

Myotis yumanensis **Yuma Myotis**

OBJECTIVE - Maintain stable populations of the Yuma Myotis in coniferous forest habitats by 2010.

***Strategy*:** Protect Yuma Myotis maternity and day roosts in tree habitat within its range in Nevada.

Action: Delineate key roost locations in pinyon/ juniper forests.

Action: Incorporate key roost sites into pending Nevada Bat Roost Protection Act legislation (Appendix B).

Action: Elevate key roost sites to high priority status in regional fire prevention plans.

Action: Provide Federal and State agencies with information on bat habitat needs and *Improvement Practices*, which could be used to benefit the species.

Action: Develop a Position Statement from the Nevada Bat Working Group that outlines preferred roosting and foraging habitat for the Long-legged Myotis. The position statement can be provided to land-use agencies when comments to forest harvest plans are solicited.

Strategy: Increase the knowledge base of the Yuma Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Yuma Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Yuma Myotis populations in Nevada.

Action: Identify additional forest habitats with suitable features for bat roosting for Yuma Myotis surveys.

Action: Conduct routine and systematic Yuma Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Generally, Yuma Myotis require medium to large bodies of water for foraging. Roosts are often, but not always, within the vicinity of these types of water bodies. Specific attention should be focused on the tree roost sites located along these areas as well as the protection of the water sources themselves.

References
Aldridge (1986), Brigham, et al. (1992), Dalquest (1947), Hall (1946), Herd and Fenton (1983).

CONSERVATION STRATEGY TR-16. TREE ROOSTING HABITAT

Tadarida brasiliensis **Brazilian Free-tailed Bat**

OBJECTIVE - Maintain stable populations of the Brazilian Free-tailed Bat in coniferous forest habitats by 2010.

***Strategy*:** Protect Brazilian Free-tailed Bat maternity and day roosts in hollow tree habitats within its range in Nevada.

Action: Delineate key roosts in hollow trees.

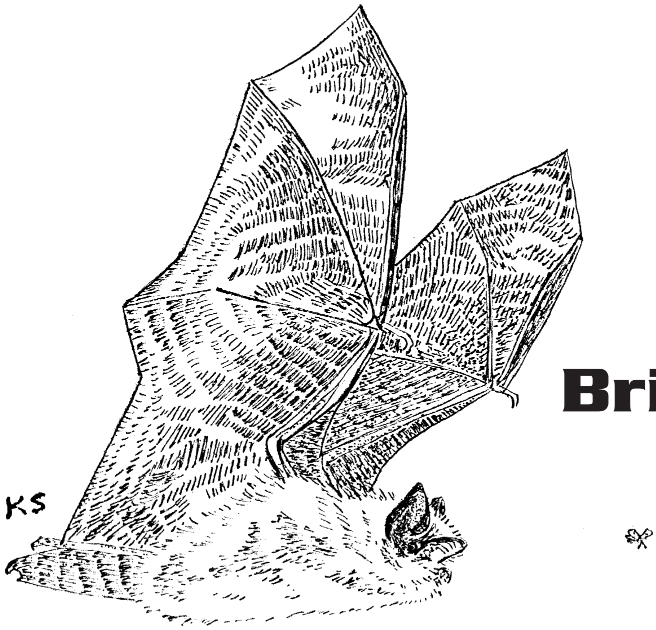
Action: Incorporate key roost sites into pending Nevada Bat Roost Protection Act legislation (Appendix B).

Assumptions - Research and Monitoring Needs

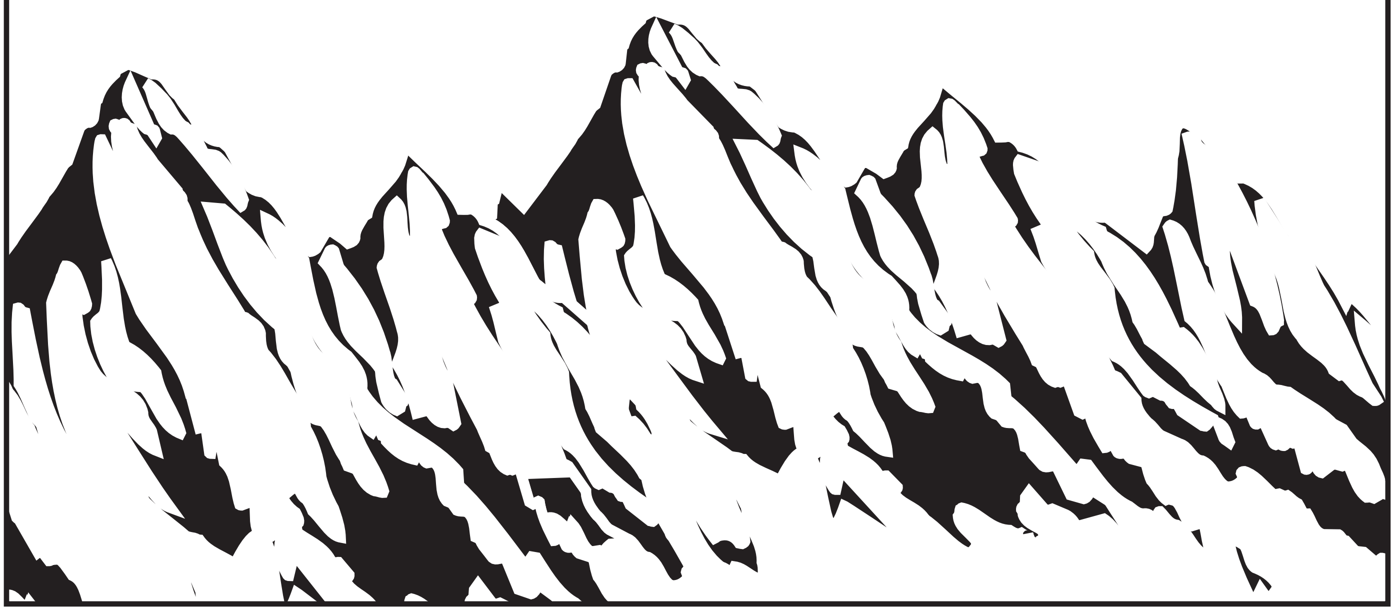
Brazilian Free-tailed Bats form the largest assemblages of any single mammal species. They are known to migrate long distances seasonally, although recent observations indicate year-round presence in southern Nevada. Few roosts and no winter roosts have been located in trees. Increased human development, population growth, and recreational activities present significant threats to this species because of its propensity to roost in large numbers in only a few roosts.

References

Cockrum (1969), Constantine (1967), Hall (1946), O'Farrell (1998), Wilkins (1989).



Bridge and Building Roosting Habitat



HABITAT TYPE DESCRIPTION
BRIDGE AND BUILDING ROOSTING HABITAT (BB)

Bridges and buildings provide analog cliff and cave roosting bat habitats throughout the State. Several occur in urban areas. Several more occur in rural settings. Any well-rounded bat conservation plan should include the maintenance of current bridge and building roost sites and an inventory of potential bridge and building habitat. In northern Nevada, seven bridges have been found to support bat populations ranging from several hundred to several thousand individuals and up to five species at one site (M. Rahn, unpublished data). In southern Nevada, two bridges are known to house large colonies, although one has suffered a major decline subsequent to bridge redesign (M. J. O'Farrell, personal communication). Cooperatively constructing "bat-friendly" bridges with the Nevada Department of Transportation (NDOT) could result in enhanced bat use throughout the State (Appendix F). Monitoring of those sites could determine the success of this strategy. Significant roost sites in building structures should be inventoried and monitored. Where appropriate, pursue conservation easements with owners to provide protection for roosting bats. Education will play an important role in the success and implementation of any bat conservation strategies relating to buildings and bridges.

Priority Bat Species

Obligates

None

Others

Pallid Bat
Townsend's Big-eared Bat
Big Brown Bat
Spotted Bat
California Myotis
Long-eared Myotis
Little Brown Myotis
Fringed Myotis
Cave Myotis
Long-legged Myotis
Yuma Myotis
Big Free-tailed Bat
Western Pipistrelle
Brazilian Free-tailed Bat

CONSERVATION STRATEGY BB-1. BRIDGE AND BUILDING ROOSTING HABITAT

Antrozous pallidus **Pallid Bat**

OBJECTIVE – Maintain a stable or increasing population trend of Pallid Bats throughout their range in Nevada through 2010.

Strategy: Conserve roosting populations of Pallid Bats in building structures.

Action: Identify key urban/rural structures with roosting populations of Pallid Bats.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of Pallid Bats and other bats including creation of alternate roost sites.

Action: Conservation should focus on the suite of roosts used by this species within its ecological neighborhood (including the boulder fields, day roosts, night roosts, and foraging/water areas).

Strategy: Protect current and potential roosting populations of Pallid Bats in bridge structures.

Action: Identify key bridges with roosting populations of Pallid Bats.

Action: Coordinate with local agencies to protect populations of Pallid Bats at bridge sites.

Action: Collaborate with the Nevada Division of Transportation to encourage 'bat friendly' bridges prior to new bridge construction or retrofitting of existing structures.

Strategy: Increase the knowledge base of Pallid Bats through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Pallid Bats.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Pallid Bat populations in Nevada.

Action: Identify bridges and buildings with suitable features for bat roosting for Pallid Bat surveys.

Action: Conduct routine and systematic Pallid Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Pallid Bat populations have been declining in California, apparently due to roost disturbance. Few bridge/building roost sites have been identified in Nevada and fewer population studies have been conducted at these sites. However, buildings and bridges can be used for night or day roosting and represent important resources for a healthy population. Currently, the lack of comparative baseline data hampers an appropriate evaluation of trends and needs.

References

Hall (1946), Hermanson and O'Shea (1983), Lewis (1993), Lewis (1994), Licht and Leitner (1967), O'Farrell and Bradley (1977), Orr (1954), Pierson et al. (1996).

CONSERVATION STRATEGY BB-2. BRIDGE AND BUILDING ROOSTING HABITAT

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

OBJECTIVE – Maintain a stable or increasing population trend of Townsend's Big-eared Bats throughout their range in Nevada through 2010.

Strategy: Conserve roosting populations of Townsend's Big-eared Bats in building structures.

Action: Identify key urban/rural structures with roosting populations of Townsend's Big-eared Bats.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of Townsend's Big-eared Bats and other bats including creation of alternate roost sites.

Strategy: Protect current and potential roosting populations of Townsend's Big-eared Bats in bridge structures.

Action: Identify key bridges with roosting populations of Townsend's Big-eared Bats.

Action: Coordinate with local agencies to protect populations of Townsend's Big-eared Bats at bridge sites.

Action: Collaborate with the Nevada Division of Transportation to encourage 'bat friendly' bridges prior to new bridge construction or retrofitting of existing structures.

Strategy: Increase the knowledge base of Townsend's Big-eared Bats through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Townsend's Big-eared Bats.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Townsend's Big-eared Bat populations in Nevada.

Action: Identify bridges and buildings with suitable features for bat roosting for Townsend's Big-eared Bat surveys.

Action: Conduct routine and systematic Townsend's Big-eared Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Priority status was determined for the Townsend's Big-eared bat in Nevada based on: a) the downward population trends documented in surrounding States of California, Oregon, Washington, New Mexico and Idaho ; b) documented roost population declines in Nevada ; and c) the well-documented sensitive nature of this species to human disturbance of roost sites. A far more broad-scaled and complete monitoring effort is needed in Nevada to confirm the status and trend of this species and to document its reliance on buildings and possibly bridges as alternate roost site.

References

(J. S. Altenbach, personal communication), Graham (1966), Humphrey and Kunz (1976), Mohr (1972), Pearson et al. (1952), Perkins (1990), Pierson and Rainey (1996), Stebbings (1966), Stihler and Hall (1993), Wackenhut (1990).

CONSERVATION STRATEGY BB-3. BRIDGE AND BUILDING ROOSTING HABITAT

Eptesicus fuscus **Big Brown Bat**

OBJECTIVE – Maintain a stable or increasing population trend of Big Brown Bats throughout their range in Nevada through 2010.

Strategy: Conserve roosting populations of the Big Brown Bats in building structures.

Action: Identify key urban/rural structures with roosting populations of Big Brown Bats.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of Big Brown Bats and other bats including creation of alternate roost sites.

Strategy: Protect current and potential roosting populations of Big Brown Bats in bridge structures.

Action: Identify key bridges with roosting populations of Big Brown Bats.

Action: Coordinate with local agencies to protect populations of Big Brown Bats at bridge sites.

Action: Collaborate with the Nevada Division of Transportation to encourage 'bat friendly' bridges prior to new bridge construction or retrofitting of existing structures.

Action: Collaborate with local planning officials to maintain rural foraging habitats adjacent all bridge roosts.

Strategy: Increase the knowledge base of Big Brown Bats through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Big Brown Bats.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Big Brown Bat populations in Nevada.

Action: Identify bridges and buildings with suitable features for bat roosting for Big Brown Bat surveys.

Action: Conduct routine and systematic Big Brown Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Big Brown Bats are found throughout most of North America and appear to be common over much of their range. Although many records occur for Nevada, little is known of roost sites and seasonal habits. Because of their widespread distribution and apparent abundance, population trends for Big Brown Bats would have broad application in bat management and conservation.

References

Betts (1996), Brigham (1991), Hall (1946), Kurta and Baker (1990), Menzel et al. (2001), Vonhof (1996), Williams (2001).

CONSERVATION STRATEGY BB-4. BRIDGE AND BUILDING ROOSTING HABITAT

Euderma maculatum **Spotted Bat**

OBJECTIVE – Maintain a stable or increasing population trend of Spotted Bats throughout their range in Nevada through 2010.

Strategy: Conserve roosting populations of Spotted Bats in/on building structures.

Action: Identify key urban/rural structures with considerable roosting populations of Spotted Bats.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of spotted bats.

Strategy: Increase the knowledge base of Spotted Bats through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Spotted Bats.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Spotted Bat populations in Nevada.

Action: Identify buildings with suitable features for roosting Spotted Bat surveys.

Action: Conduct routine and systematic Spotted Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Spotted Bats roost primarily in cliff and crevice habitats, secondarily in caves and mines, and are periodically found in/on buildings. Additional documentation of building roosting Spotted Bats is necessary to determine the extent of their reliance on these roost structures. Research priorities for Spotted Bats should emphasize the identification and description of roost sites.

References

Constantine (1987), Deacon and Bradley (1962), Fenton et al. (1987), Geluso (2000), Kuenzi et al. (1999), Perry et al. (1997), Poché (1981), Poché and Bailie (1974), Rabe et al. (1998a), Storz (1995), Wai-Ping and Fenton (1989), Woodsworth et al. (1981).

CONSERVATION STRATEGY BB-5. BRIDGE AND BUILDING ROOSTING HABITAT

Myotis californicus **California Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of California Myotis throughout their range in western and southern Nevada through 2010.

Strategy: Conserve roosting populations of the California Myotis in building structures.

Action: Identify key urban/rural structures with roosting populations of California Myotis.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of California Myotis and other bats including creation of alternate roost sites.

Strategy: Protect current and potential roosting populations of California Myotis in bridge structures.

Action: Identify key bridges with roosting populations of California Myotis.

Action: Coordinate with local agencies to protect populations of California Myotis at bridge sites.

Action: Collaborate with the Nevada Division of Transportation to encourage 'bat friendly' bridges prior to new bridge construction or retrofitting of existing structures.

Strategy: Increase the knowledge base of California Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of California Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of California Myotis populations in Nevada.

Action: Identify bridges and buildings with suitable features for bat roosting for California Myotis surveys.

Action: Conduct routine and systematic California Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

California Myotis use buildings for day roosting and buildings and presumably bridges for night roosting. Individuals move from roost to roost throughout the year but nothing is known of this dynamic. Determination of roost requirements, need for multiple roosts, and frequency of roost shifts is critical to proper conservation and management of important building and bridge roost sites. No information is known on population trends for the California Myotis. Because it is a common and widespread species, declines in population trends could provide an early warning for all species utilizing the same resources.

References

Hall (1946), Krutzsch (1954), O'Farrell and Bradley (1977), Simpson (1993), Western Bat Working Group (1998).

CONSERVATION STRATEGY BB-6. BRIDGE AND BUILDING ROOSTING HABITAT

Myotis ciliolabrum **Small-footed Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of Small-footed Myotis throughout their range in Nevada through 2010.

Strategy: Conserve roosting populations of the Small-footed Myotis in building structures.

Action: Identify key urban/rural structures with roosting populations of Small-footed Myotis.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of Small-footed Myotis and other bats including creation of alternate roost sites.

Strategy: Protect current and potential roosting populations of Small-footed Myotis in bridge structures.

Action: Identify key bridges with roosting populations of Small-footed Myotis.

Action: Coordinate with local agencies to protect populations of Small-footed Myotis at bridge sites.

Action: Collaborate with the Nevada Division of Transportation to encourage 'bat friendly' bridges prior to new bridge construction or retrofitting of existing structures.

Strategy: Increase the knowledge base of Small-footed Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Small-footed Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Small-footed Myotis populations in Nevada.

Action: Identify bridges and buildings with suitable features for bat roosting for Small-footed Myotis surveys.

Action: Conduct routine and systematic Small-footed Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

One of the first records of building use by Small-footed Myotis comes from Hall (1946). Since that time, little use of buildings by this species has been detected. Because it is a common and widespread species, declines in population trends could provide an early warning for all species utilizing the same resources.

References

Hall (1946), Ports and Bradley (1996).

CONSERVATION STRATEGY BB-7. BRIDGE AND BUILDING ROOSTING HABITAT

Myotis evotis **Long-eared Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of Long-eared Myotis throughout their range in Nevada through 2010.

Strategy: Conserve roosting populations of the Long-eared Myotis in building structures.

Action: Identify key urban/rural structures with roosting populations of Long-eared Myotis.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with ‘safe’ evacuation of Long-eared Myotis and other bats including creation of alternate roost sites.

Strategy: Protect current and potential roosting populations of Long-eared Myotis in bridge structures.

Action: Identify key bridges with roosting populations of Long-eared Myotis.

Action: Coordinate with local agencies to protect populations of Long-eared Myotis at bridge sites.

Action: Collaborate with the Nevada Division of Transportation to encourage 'bat friendly' bridges prior to new bridge construction or retrofitting of existing structures.

Strategy: Increase the knowledge base of Long-eared Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Long-eared Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Long-eared Myotis populations in Nevada.

Action: Identify bridges and buildings with suitable features for bat roosting for Long-eared Myotis surveys.

Action: Conduct routine and systematic Long-eared Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Hall first documented use of a building by this species in central Nevada (1946) but little is known as to how common this behavior is.

References

Hall (1946).

CONSERVATION STRATEGY BB-8. BRIDGE AND BUILDING ROOSTING HABITAT

Myotis lucifugus **Little Brown Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of Little Brown Myotis throughout their range in northern Nevada through 2010.

Strategy: Conserve roosting populations of the Little Brown Myotis in building structures.

Action: Identify key urban/rural structures with roosting populations of Little Brown Myotis.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of Little Brown Myotis and other bats including creation of alternate roost sites.

Strategy: Protect current and potential roosting populations of Little Brown Myotis in bridge structures.

Action: Identify key bridges with roosting populations of Little Brown Myotis.

Action: Coordinate with local agencies to protect populations of Little Brown Myotis at bridge sites.

Action: Collaborate with the Nevada Division of Transportation to encourage 'bat friendly' bridges prior to new bridge construction or retrofitting of existing structures.

Strategy: Increase the knowledge base of Little Brown Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Little Brown Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Little Brown Myotis populations in Nevada.

Action: Identify bridges and buildings with suitable features for bat roosting for Little Brown Myotis surveys.

Action: Conduct routine and systematic Little Brown Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

A recently excluded roost of 280 bats in an occupied log residence adjacent the South Fork Reservoir in southern Elko County was likely this species, although species identification was not confirmed. Given their affinity for large bodies of water, specific attention should be focused on Little Brown Myotis roost sites located near these waters as well as the protection of the water sources themselves.

References

P.V Bradley, P. E. Brown (personal communication), Fenton and Barclay (1980), Hall (1946).

CONSERVATION STRATEGY BB-9. BRIDGE AND BUILDING ROOSTING HABITAT

Myotis thysanodes **Fringed Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of Fringed Myotis throughout their range in Nevada through 2010.

Strategy: Conserve roosting populations of the Fringed Myotis in building structures.

Action: Identify key urban/rural structures with roosting populations of Fringed Myotis.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of Fringed Myotis and other bats including creation of alternate roost sites.

Strategy: Increase the knowledge base of Fringed Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Fringed Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Fringed Myotis populations in Nevada.

Action: Identify buildings with suitable features for bat roosting for Fringed Myotis surveys.

Action: Conduct routine and systematic Fringed Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Prior to 1974, Fringed Myotis was known from only two locations. The only known colony, found in a salt cave outside of St. Thomas, was inundated with the formation of Lake Mead. Since 1974, a number of records have come from the middle and upper elevations of southern Nevada. No other colonies have been located. Elsewhere in its range, this species can form building maternity colonies in excess of 1,000 adults. This species is particularly sensitive to disturbance in day roosts. Systematic surveys are critical to locate and protect roost sites.

References

Deacon et al. (1964), Hall (1946), O'Farrell (2001c; 2002, unpublished data), O'Farrell and Studier (1973, 1980).

CONSERVATION STRATEGY BB-10. BRIDGE AND BUILDING ROOSTING HABITAT

Myotis velifer **Cave Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of Cave Myotis throughout their range in Nevada through 2010.

Strategy: Conserve roosting populations of the Cave Myotis in building structures.

Action: Identify key urban/rural structures with roosting populations of Cave Myotis.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of Cave Myotis and other bats including creation of alternate roost sites.

Strategy: Protect current and potential roosting populations of Cave Myotis in bridge structures.

Action: Identify key bridges with roosting populations of Cave Myotis.

Action: Coordinate with local agencies to protect populations of Cave Myotis at bridge sites.

Action: Collaborate with the Nevada Division of Transportation to encourage 'bat friendly' bridges prior to new bridge construction or retrofitting of existing structures.

Strategy: Increase the knowledge base of Cave Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Cave Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Cave Myotis populations in Nevada.

Action: Identify bridges and buildings with suitable features for bat roosting for Cave Myotis surveys.

Action: Conduct routine and systematic Cave Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Cave Myotis are known from only one location in extreme southern Nevada. The population occurs in an abandoned mine complex in a remote portion of the Lake Mead National Recreation Area. It appears to be intimately linked with more extensive distribution on the Arizona side of the Colorado River. Although there are currently no known building or bridge colonies in Nevada, the presence of buildings and bridges along the Colorado River in Nevada provides the infrastructure for more widespread occurrence of Cave Myotis.

References

P.E. Brown (personal communication), Cockrum and Musgrove (1964), Davis and Cockrum (1963), Fitch et al. (1981), Stager (1939).

CONSERVATION STRATEGY BB-11. BRIDGE AND BUILDING ROOSTING HABITAT

Myotis volans **Long-legged Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of Long-legged Myotis throughout their range in Nevada through 2010.

Strategy: Conserve roosting populations of the Long-legged Myotis in building structures.

Action: Identify key urban/rural structures with roosting populations of Long-legged Myotis.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of Long-legged Myotis and other bats including creation of alternate roost sites.

Strategy: Increase the knowledge base of Long-legged Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Long-legged Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Long-legged Myotis populations in Nevada.

Action: Identify buildings with suitable features for bat roosting for Long-legged Myotis surveys.

Action: Conduct routine and systematic Long-legged Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Long-legged Myotis are widespread throughout Nevada in upper elevation woodlands and forests, but little is known about roosting behavior in buildings or on bridges. Trees comprise the main maternity roost. Although common, no studies have been conducted on population trends. Because it is a common and widespread species, declines in population trends could provide an early warning for all species utilizing the same resources.

References

Hall (1946), O'Farrell and Bradley (1977), Ormsbee and Mccomb (1998), Ports and Bradley (1996), Warner and Czaplewski (1984).

CONSERVATION STRATEGY BB-12. BRIDGE AND BUILDING ROOSTING HABITAT

Myotis yumanensis **Yuma Myotis**

OBJECTIVE – Maintain a stable or increasing population trend of Yuma Myotis throughout their range in Nevada through 2010.

Strategy: Conserve roosting populations of the Yuma Myotis in building structures.

Action: Identify key urban/rural structures with roosting populations of Yuma Myotis.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of Yuma Myotis and other bats including creation of alternate roost sites.

Strategy: Protect current and potential roosting populations of Yuma Myotis in bridge structures.

Action: Identify key bridges with roosting populations of Yuma Myotis.

Action: Coordinate with local agencies to protect populations of Yuma Myotis at bridge sites.

Action: Collaborate with the Nevada Division of Transportation to encourage 'bat friendly' bridges prior to new bridge construction or retrofitting of existing structures.

Strategy: Increase the knowledge base of Yuma Myotis through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Yuma Myotis.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Yuma Myotis populations in Nevada.

Action: Identify bridges and buildings with suitable features for bat roosting for Yuma Myotis surveys.

Action: Conduct routine and systematic Yuma Myotis surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Generally, Yuma Myotis require medium to large bodies of water for foraging. Roosts are often, but not always, within the vicinity of these types of water bodies. Specific attention should be focused on the roost sites located along these areas as well as the protection of the water sources themselves. Bridges, particularly those over water, are commonly used as night roosts for Yuma Myotis. Substantial maternity colonies have also been found in older buildings.

References

Aldridge (1986), Brigham, et al. (1992), Dalquest (1947), Hall (1946), Herd and Fenton (1983).

CONSERVATION STRATEGY BB-13. BRIDGE AND BUILDING ROOSTING HABITAT

Nyctinomops macrotis **Big Free-tailed Bat**

OBJECTIVE – Maintain a stable or increasing population trend of Big Free-tailed Bats throughout their range in Nevada through 2010.

Strategy: Conserve roosting populations of the Big Free-tailed Bats in building structures.

Action: Identify key urban/rural structures with roosting populations of Big Free-tailed Bats.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of Big Free-tailed Bats and other bats including creation of alternate roost sites.

Strategy: Protect current and potential roosting populations of Big Free-tailed Bats in bridge structures.

Action: Identify key bridges with roosting populations of Big Free-tailed Bats.

Action: Coordinate with local agencies to protect populations of Big Free-tailed Bats at bridge sites.

Action: Collaborate with the Nevada Division of Transportation to encourage 'bat friendly' bridges prior to new bridge construction or retrofitting of existing structures.

Strategy: Increase the knowledge base of Big Free-tailed Bats through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Big Free-tailed Bats.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Big Free-tailed Bat populations in Nevada.

Action: Identify bridges and buildings with suitable features for bat roosting for Big Free-tailed Bat surveys.

Action: Conduct routine and systematic Big Free-tailed Bat surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

The reliance on building and bridge roost sites by Big Free-tailed Bats is not well known. Until 2000, this species was known only from a single confirmed location in the Las Vegas Valley. In 2000, intensive acoustic monitoring within the upper Moapa Valley documented significant occurrence of Big Free-tailed Bats from September through October. Inasmuch as the species is widespread throughout Utah, it is possible that populations exist in pockets through the central and eastern part of Nevada and potential roost sites should be systematically inventoried.

References

Bradley et al. (1965), Hall (1946), Milner et al. (1990), Williams (2001).

CONSERVATION STRATEGY BB-14. BRIDGE AND BUILDING ROOSTING HABITAT

Pipistrellus hesperus **Western Pipistrelle**

OBJECTIVE – Maintain stable populations of the Western Pipistrelle in bridge and building roosting habitats by

Strategy: Conserve roosting populations of the Western Pipistrelle in building structures.

Action: Identify key urban/rural structures with roosting populations of Western Pipistrelles.

Action: Coordinate with local entities to secure (where possible) protection of the aforementioned areas.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of Western Pipistrelles and other bats including creation of alternate roost sites.

Strategy: Protect current and potential roosting populations of Western Pipistrelles in bridge structures.

Action: Identify key bridges with roosting populations of Western Pipistrelles.

Action: Coordinate with local agencies to protect populations of Western Pipistrelles at bridge sites.

Action: Collaborate with the Nevada Division of Transportation to encourage 'bat friendly' bridges prior to new bridge construction or retrofitting of existing structures.

Strategy: Increase the knowledge base of Western Pipistrelles through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Western Pipistrelles.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Strategy: Determine the status and trend of Western Pipistrelle populations in Nevada.

Action: Identify bridges and buildings with suitable features for bat roosting for Western Pipistrelle surveys.

Action: Conduct routine and systematic Western Pipistrelle surveys in likely habitat to inventory and document long-term population trends.

Assumptions - Research and Monitoring Needs

Western Pipistrelles are the most common and widespread species at low to middle elevations through most of the western United States and can often be found in association with buildings and bridges. A large colony of pips (223) was documented in association with buildings just over the Nevada line in Death Valley National Park. However, insufficient information exists on roosting requirements. Fluctuations in Western Pipistrelle populations could serve as an early warning of serious threats to the entire community. Because of their commonality and wide distribution, they are well suited for long-term monitoring of population trends.

References

C. Baldino (personal communication), Bradley and O'Farrell (1969), Cross (1965), Hall (1946), Hayward and Cross (1979), O'Farrell and Bradley (1977).

CONSERVATION STRATEGY BB-15. BRIDGE AND BUILDING ROOSTING HABITAT

Tadarida brasiliensis **Brazilian Free-tailed Bat**

OBJECTIVE - Maintain stable populations of the Brazilian Free-tailed Bats in bridge and building roosting habitats in Nevada by 2015.

Strategy: Conserve roosting populations of the Brazilian Free-tailed Bat in building structures.

Action: Identify key urban/rural structures with roosting populations of Brazilian Free-tailed Bats.

Action: Coordinate with local entities to ensure that abandoned/condemned structures with freetail roosts receive permanent protection (where possible) under the Nevada Bat Roost Protection Act.

Action: Where protection of these resources is not an option, assist local entities with 'safe' evacuation of Brazilian Free-tailed Bats and other bats including creation of alternate roost sites.

Action: If very large colonies of bats are to be excluded, explore mitigation methods such as retrofitting existing structures for bats, erecting artificial bat boxes, and/or building new structures that are bat-friendly.

Action: Evaluate new proposed construction projects for impacts on urban Brazilian free-tailed bat populations.

Strategy: Protect current and potential roosting populations of Brazilian Free-tailed Bats in bridge structures.

Action: Provide wildlife viewing interpretation and conduct annual out-flight census work at McCarran site in Reno.

Action: Develop other bat watching opportunities to promote the appreciation of urban bats. Where feasible, increase awareness of urban bats through interpretive brochures and working closely with local Chambers of Commerce, tourist groups, etc.

Action: Identify other key bridges with roosting populations of Brazilian Free-tailed Bats.

Action: Coordinate with local agencies to protect populations of Brazilian Free-tailed Bats at bridge sites.

Action: Collaborate with the Nevada Division of Transportation to encourage 'bat friendly' bridges prior to new bridge construction or retrofitting of existing structures.

Action: Develop and implement an educational program for local animal control and public health officials.

Action: Educate adjacent land owners and managers of the effects of their actions on local bat populations through workshops, brochures, and training. Encourage agricultural landowners to construct bat boxes as part of an integrated pest control plan.

Strategy: Increase the knowledge base of Brazilian Free-tailed Bats through research and education.

Action: Initiate research and produce educational materials that explore the ecology, distribution, seasonal movement patterns and habitat requirements of Brazilian Free-tailed Bats.

Action: Conduct annual or biennial monitoring of key maternity sites and triennial monitoring of key hibernation sites without disturbance to resident bats. Coordinate monitoring with other agencies and conservation groups to minimize disturbance and eliminate duplication of effort.

Action: Initiate research studies to quantify the economic value of urban bats to encourage local communities to protect and enhance existing populations.

Strategy: Determine the status and trend of Brazilian Free-tailed Bat populations in Nevada.

Action: Identify bridges and buildings with suitable features for bat roosting for Brazilian Free-tailed Bat surveys.

Action: Conduct routine and systematic Brazilian Free-tailed Bat surveys in likely habitat to inventory and document long-term population trends.

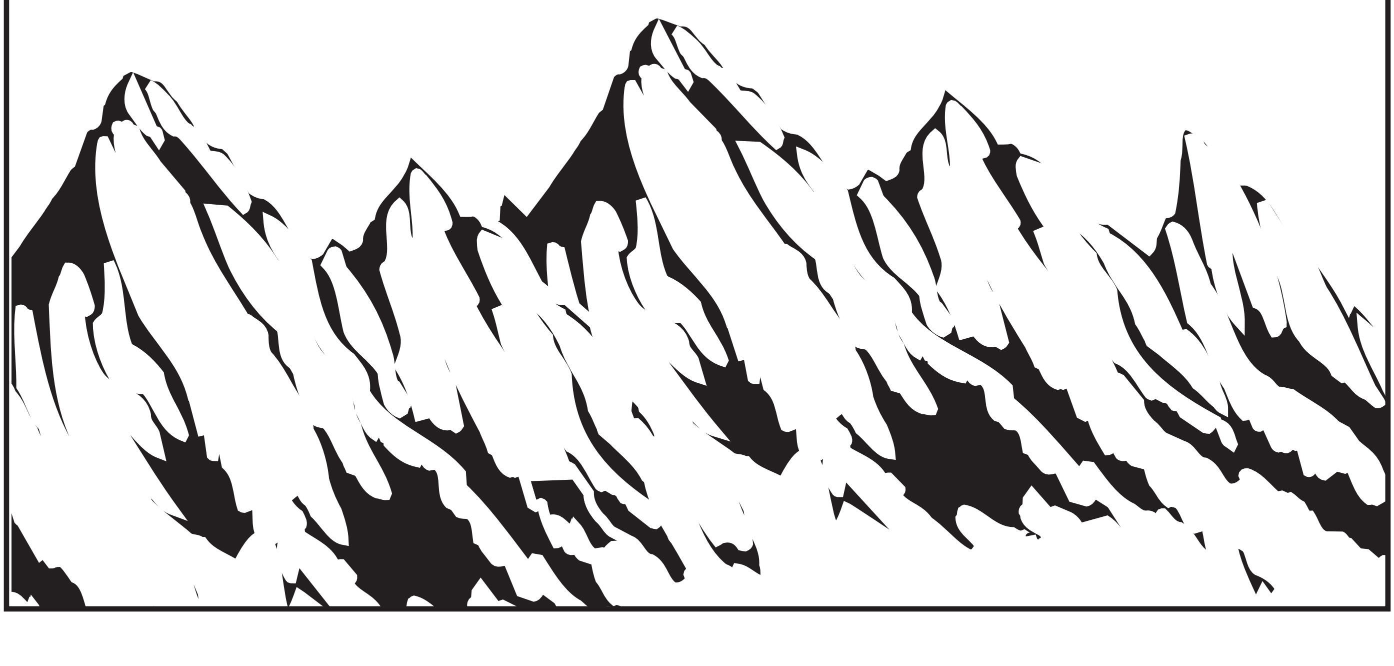
Assumptions - Research and Monitoring Needs

Brazilian Free-tailed Bats form the largest assemblages of any single mammal species and can be found in high concentrations in some urban areas. For example, a very large colony occupies a bridge in Austin, Texas. Few roosts have been documented in bridges and buildings in Nevada. However, the known roosts in these structures are extremely large (a bridge in Reno and an abandoned building in McGill) and are, by definition, very sensitive. Although this species is one of the most common species encountered in the urban environment, basic ecological study is often lacking. Specifically, adjacent habitat use, distance to foraging, roost occupancy at various life stages, migration staging, and impacts by the local public are lacking for key roosting sites in Nevada. Annual monitoring and a public education program should be initiated at all key sites.

References

Adam and Hayes (2000), Brittingham and Williams (2000), Clark et al. (1996), Cockrum (1969), Constantine (1967), Hall (1946), Hoff et al. (1993), J. Jeffers (personal communication), J. E. Newmark (personal communication), Keeley and Tuttle (1999), NatureServe (2001), O'Farrell (1998), Roberts et al. (1997), Romano et al. (1999), Texas Parks and Wildlife (2000), Thies et al. (1996), Wilkins (1989).

Water Source
Foraging Habitat



HABITAT TYPE DESCRIPTION
WATER SOURCE FORAGING AND WATERING HABITAT (WS)

General Description

Water sources within desert environments are critical for several wildlife species, including bats. Bats, birds and large ungulates come from distances of up to several kilometers to meet physiological water requirements. Water sources in Nevada's deserts are essentially magnets for bats, and at least partially determine the distribution and abundance of Nevada's bat species. Water sources in Nevada available to bats are either natural (e.g., springs, streams, rivers, ponds and some lakes) or artificial (e.g., troughs, spring boxes, reservoirs, some lakes and urban pools).

Insectivorous bats concentrate their activities around riparian habitats associated with water sources as riparian areas support high concentrations of insect prey (Brigham and Fenton 1991; Grindal et al 1999). Grindal et al. (1999) found that bat activity was 40 times greater in riparian habitat at all elevations than in upland areas. Ports and Bradley (1996) found high elevation tree roosting bat species in eastern Nevada used habitats of coniferous and/or deciduous trees associated with open water in the form of beaver ponds, stock tanks, perennial streams and springs for foraging and drinking. Hall (2000) conducted acoustic road surveys in four different areas from Mojave Desert to Great Basin Desert habitat on the Nevada Test Site, and found that almost all bat activity occurred at water sources.

Physiologically, bats are necessarily drawn to water for maintenance of water balance during key times of the year. At the hottest and driest time of the year throughout Nevada, bats are in pregnancy and lactation. Energy and water demands are quadrupled during late pregnancy and lactation (Studier et al., 1973). During the winter, a number of species are periodically active (O'Farrell and Bradley, 1969). These species have special adaptations that allow activity at low ambient and body temperatures (Bradley and O'Farrell, 1969; Hirshfeld and O'Farrell, 1976; Nelson et al., 1977; O'Farrell and Bradley, 1977; O'Farrell and Schreiweiss, 1978). The proximate cause of winter activity is water balance and the need for periodic drinking for survival through the winter (O'Farrell and Bradley, 1977).

Springs/Riparian

Ephemeral and perennial water must be accessible to bats. Springs are among the most widespread of the water source types, and are defined as groundwater that flows to the surface with small standing pools or sheeting flow. The majority of bats utilize both developed and undeveloped springs. Most springs serve as vital resources for bats. As bats drink on the wing, springs with accessible water offer drinking resources. Regardless of water accessibility, most springs rated in good to excellent condition sustain riparian vegetation resulting in a far richer insect fauna than surrounding upland areas. Bats congregate around these riparian areas due to the rich foraging base. Those spring riparian habitats rated in poor to fair condition sustain an insect forage base more reminiscent of surrounding upland habitats. Springs are a critical winter resource for several species of bats including, but not limited to, Western Pipistrelle, California Myotis, Townsend's Big-eared Bats, Fringed Myotis and Pallid Bats (O'Farrell and Bradley, 1970, 1977; O'Farrell et al., 1967; M. J. O'Farrell (personal communication)]. Springs should be maintained in good ecological condition and managed at their point of origin. When springs are developed into stock tanks, water must be kept available for in-flight drinking. Covers, lattice work, or similar structures can make artificial water sources unavailable to bats in flight.

Stream/Riparian

Riparian streams, both small and large, and including large irrigation channels (e.g., those found in the Fallon/Fernley area) offer both water and foraging habitat for bats. Flowing channels of water, both ephemeral and perennial, offer valuable drinking sources for most bat species. Hoary Bats, Western Red Bats and Silver-haired

Bats, among others, require stream riparian systems for roosting, drinking and foraging. Regardless of water accessibility, most stream riparian habitats rated in good to excellent condition sustain riparian vegetation resulting in a richer insect fauna than surrounding upland areas. Bats congregate around these riparian areas due, in part, to the rich foraging base. Those stream riparian habitats rated in poor to fair condition sustain an insect forage base more reminiscent of surrounding upland habitats. Although data are inadequate to fully understand the dynamics and importance of riparian stream systems for bats, preliminary information indicates a richer, more diverse fauna than previously known (Williams, 2001).

Lakes and Reservoirs

As with any water source, lakes, ponds, and reservoirs are important to all bats. In particular, Yuma Myotis and Little Brown Myotis require large ponds, reservoirs, and lakes for foraging habitat, and are typically found foraging 10-20 cm above the water surface (M. J. O'Farrell, personal communication).

Priority Bat Species

Obligates

- Pallid Bat
- Mexican Long-tongued Bat
- Townsend's Big-eared Bat
- Big Brown Bat
- Spotted Bat
- Western Mastiff Bat
- Allen's Lappet-browed Bat
- Silver-haired Bat
- Western Red Bat
- Hoary Bat
- Western Yellow Bat
- California Leaf-nosed Bat
- California Myotis
- Small-footed Myotis
- Long-eared Myotis
- Little Brown Myotis
- Fringed Myotis
- Cave Myotis
- Long-legged Myotis
- Yuma Myotis
- Big Free-tailed Bat
- Western Pipistrelle
- Brazilian Free-tailed Bat

CONSERVATION STRATEGY WS-1. WATER SOURCE FORAGING AND WATERING HABITAT

OBJECTIVE – Maintain clean, available water sources for all resident and migratory bat populations throughout the State by 2010.

Strategy: Rehabilitate and maintain all historical water sources in the State that bats frequent.

Action: Identify and plot all springs, streams and lakes that bats frequent or have frequented in the past.

Action: Maintain bat access to these watering sites throughout the year, where appropriate.

Action: Coordinate with local entities to ensure that waters are kept flowing to developed springs or stream riparian habitats during critical time periods, with emphasis on parturition, lactation and possibly, winter water stress periods.

Action: Negotiate conservation easements for bat water rights, where appropriate.

Action: Manage for clean water sources at all aforementioned sites by eliminating point source and non-point source pollutants, reducing upland erosion and maintaining stable bank-armoring vegetation on all stream banks.

Action: Where liquids are ponded that are toxic to bats (e.g. cyanide ponds and ore dumps in gold processing operations, or oil field ponds), eliminate the chance of access to the ponds by bats.

CONSERVATION STRATEGY WS-2. WATER SOURCE FORAGING AND WATERING HABITAT

OBJECTIVE – Maintain high quality foraging habitat adjacent all spring and stream water sources for resident and migratory bat populations throughout the State by 2020.

Strategy: Restore, rehabilitate, maintain and/or enhance all historical riparian habitat at spring heads and along stream corridors throughout Nevada.

Action: Identify and plot all springs and streams that bats frequent or have frequented in the past.

Action: Manage for good to excellent condition of all aforementioned riparian habitats.

CONSERVATION STRATEGY WS-3. WATER SOURCE FORAGING AND WATERING HABITAT

OBJECTIVE – Use water sources in the design of a statewide all-bat monitoring project through 2020.

Strategy: As part of a statewide all-bat monitoring project, employ a survey grid system at 100 km intervals to identify long-term bat population and species composition trends throughout the state.

Action: Array at least 60 spring and/or stream riparian survey sites (one near each grid intersection) across Nevada.

Action: In choosing sites, stratify water source locations to provide an equal effort in all bat habitat types and elevational zones. Place additional emphasis on unique sites (e.g. large size, habitat heterogeneity, etc).

Action: In choosing between sites, also take into account the availability of historical bat data for candidate sites, the long-term viability of the water sources and whether or not sites may provide a representative sample of the region.

Action: Survey water source grid sites four times per year, maintaining consistency in survey dates over time. Employ low impact/ low disturbance survey techniques, including passive acoustical monitoring systems.

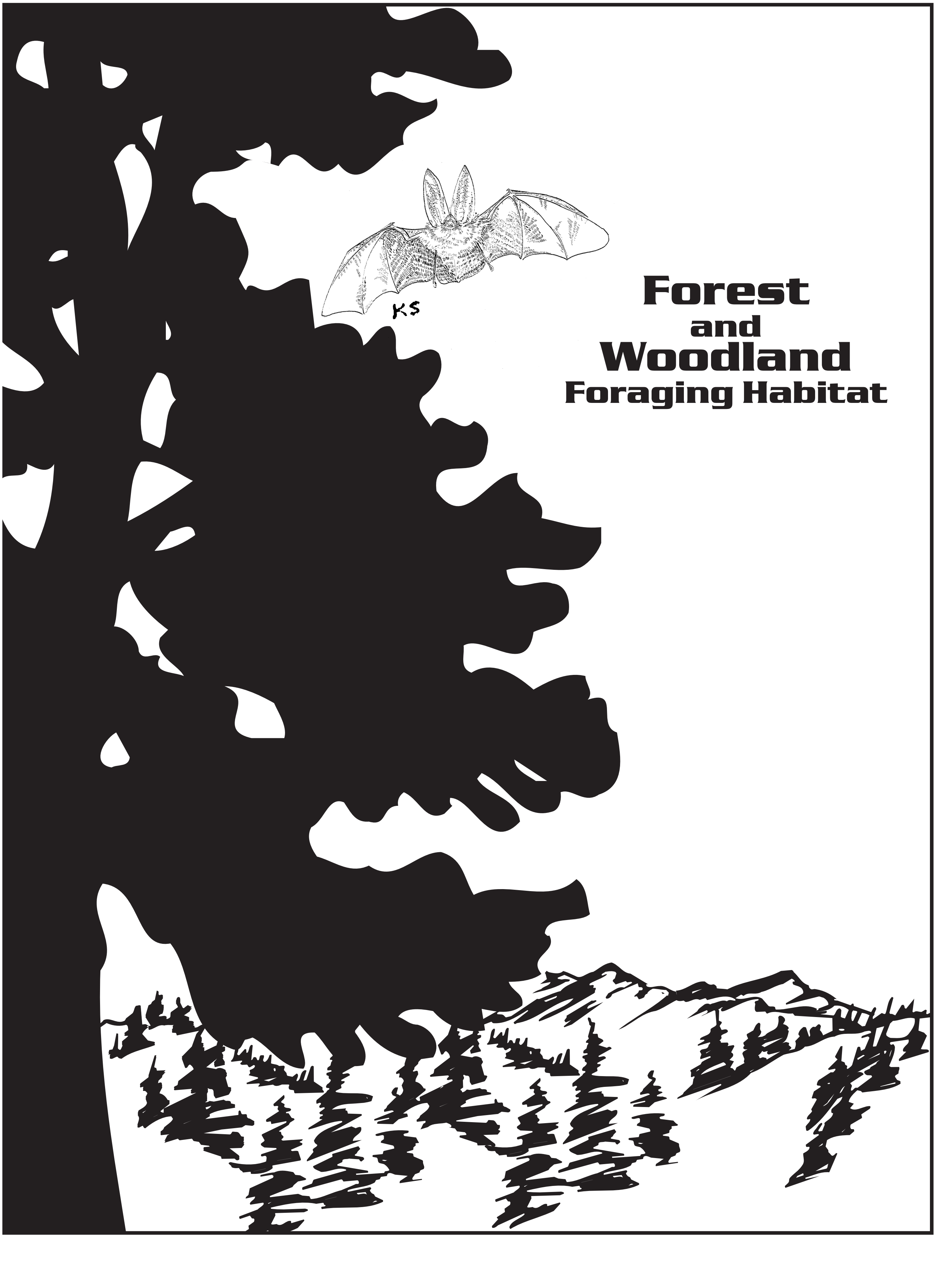
Assumptions - Research and Monitoring Needs

It is assumed that most of Nevada's bats are water source obligates and that clean, available water and productive riparian habitats benefit most of Nevada's bat species. Further research is needed to better define species/ habitat relationships.

References

Grindal et al. (1999), Hall (1946), Hall (2000), Bradley and O'Farrell (1969), Brigham and Fenton (1991), Hirshfeld and O'Farrell (1976), Nelson et al. (1977), Ports and Bradley (1996), O'Farrell and Bradley (1969, 1970, 1977), O'Farrell and Schreiweiss (1978), Studier et al. (1973), O'Farrell et al. (1967), M. J. O'Farrell (personal communication), Williams (2001).

Forest and Woodland Foraging Habitat



HABITAT TYPE DESCRIPTION
FOREST AND WOODLAND FORAGING HABITAT (FW)

General Description

Cottonwood, Willow and Alder

Gallery cottonwood, willow and alder woodlands are primarily found along drainage systems with perennial water sources. Tree species within this habitat type can vary greatly from south to north and east to west in Nevada. However, most appear to provide comparable bat foraging habitat analogs throughout the state. All species of bats that roost in these types of woodlands, including Western Red Bats, Hoary Bats and Silver-haired Bats require these habitats for foraging as well. This type of woodland riparian habitat provides roosting and possibly foraging habitat for several other bat species, including California Myotis, Long-eared Myotis, Little Brown Myotis, Long-legged Myotis, Big Brown Bats and Townsend's Big-eared Bats which may rely on these types of trees as secondary roosting habitats (Bradley, 2000a; Ports and Bradley, 1996). Woodland riparian habitat corridors are also critical resources for annual migrations of all three lasiurine species, as well as for the Silver-haired Bat. Patches of cottonwoods and willows have been shown to furnish diverse and rich foraging sites for many species of bats (M. J. O'Farrell, personal communication).

Mesquite Bosque

Mesquite bosque habitat can be found along wash systems in the southern portion of the state. Spotted Bats, Western Red Bats and California Myotis spend significant amounts of foraging time in this habitat (Williams, 2001).

Coniferous Forests and Woodlands

Coniferous woodlands of pinyon, juniper and mahogany as well as larger forests of pine, fir and spruce are found from 1,500 m to treeline near 3,500 m. Tree species within this habitat type can vary greatly from south to north and east to west in Nevada. However, most appear to provide comparable bat foraging habitat analogs throughout the state. Long-legged Myotis and Long-eared Myotis appear to be dependent on pinyon-juniper, mountain mahogany, white fir and subalpine fir habitats for both roosting and foraging. The Hoary Bat has been observed roosting in Utah juniper trees in Nevada (J. A. Williams, personal communication) and has been observed spending a considerable amount of foraging/roosting time in Rocky Mountain juniper in east-central Nevada (P.V. Bradley, unpublished data), and in a mixed subalpine fir/aspen habitat type in extreme northern Nevada (M. A. Ports, unpublished data). Female Townsend's Big-eared Bats concentrated their foraging activities within conifer forests of Utah juniper, Rocky Mountain juniper, mountain mahogany, little leaf mahogany, white fir, Englemann spruce, and bristlecone pine in August in east-central Nevada. Some individuals showed a high fidelity for foraging areas, returning night after night to the same pinyon juniper stand, sometimes 10 km from their maternity roost. This same telemetry data indicated no use of bajada shrub lands of sagebrush, salt desert shrub or valley bottom wetlands or agricultural lands (Bradley, 2000a). Two Townsend's Big-eared Bats were observed foraging in treeline krumholz bristlecone pine and Engelmann spruce, some 1,600 m above their maternity roost at the pinyon-juniper/sagebrush ecotone. Bats that forage within the vegetation canopy, such as the Fringed Myotis and the Townsend's Big-eared Bat have more elastic and greater puncture resistant wing membranes (Studier, 1972).

Priority Bat Species

Obligates

Townsend's Big-eared Bat
Spotted Bat
Allen's Lappet-browed Bat
Silver-haired Bat
Western Red Bat
Hoary Bat
Western Yellow Bat
California Myotis
Small-footed Myotis
Long-eared Myotis
Long-legged Myotis
Fringed Myotis
Western Mastiff Bat

Others

Big Brown Bat
Little Brown Myotis
Big Free-tailed Bat.

CONSERVATION STRATEGY FW-1. FOREST AND WOODLAND FORAGING HABITAT

OBJECTIVE – Maintain, enhance and/or restore forest/woodland bat foraging habitats throughout the State by 2020.

Strategy: Rehabilitate and maintain all historical riparian woodland foraging corridors, statewide.

Action: Identify and plot all existing and extirpated woodland corridors that bats frequent or may have frequented in the past.

Action: Manage corridors for good to excellent condition by controlling livestock grazing and recreational use, as well as relocating new gravel mining operations and urbanization out of woodland corridor floodplains.

Strategy: Maintain all remnant mesquite bosque foraging habitats in southern Nevada.

Action: Identify and plot all existing bosques.

Action: Control recreation and relocate new gravel mining operations and urbanization away from remnant mesquite bosque foraging habitats.

Action: Control or remove livestock grazing and feral horse/burrow grazing in bosques.

Strategy: Maintain a healthy mix of coniferous forest/woodland foraging habitats across the state.

Action: Encourage the establishment of native plant communities following fire by seed application and by setting strict post-fire controls on livestock and feral horse grazing across the state.

Action: Restore woodlands that have been converted to exotic invasive annual grasslands.

Action: Where invasive exotic grasses and forbs are not an issue, encourage a natural fire regime to provide all seral stages of forest/woodland communities.

Action: Where invasive exotic grasses and forbs like cheatgrass and tumble mustard have converted thousands of acres of sagebrush steppe (usually *Artemisia tridentata wyomingensis* below 30 cm rainfall) into unproductive rangeland, suppress all wild land fires. Work in conjunction with land managers and insist on proper rehabilitation and temporary grazing closures on fire climax cheatgrass ranges.

Action: Provide a 10 km radius buffer zone around Townsend's Big-eared Bat, Long-eared Myotis, Small-footed Myotis and Long-legged Myotis maternity and night roosts in pinyon-juniper woodland and subalpine coniferous forest designed to protect woodland foraging habitats near roosts. These buffers should be afforded high priority fire suppression in regional fire plans. Woodland management programs such as mechanical and chemical removal of forest canopy should also be limited at these sites for the duration of roost occupancy.

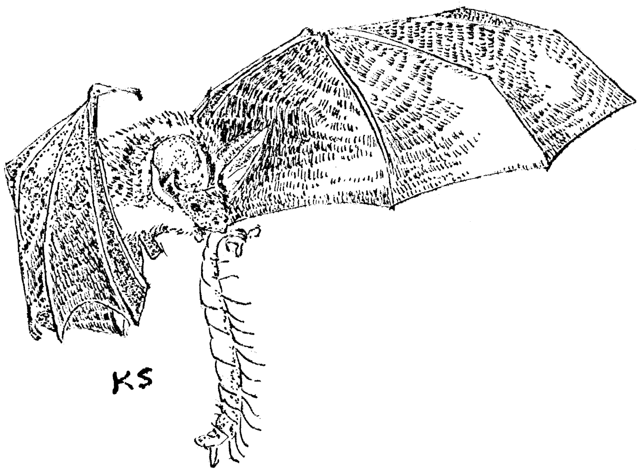
Action: Leave at least 90% of the existing forest/woodland canopy in every watershed to provide foraging habitat for all woodland foraging obligates in habitats where bats are likely to occur.

Assumptions - Research and Monitoring Needs

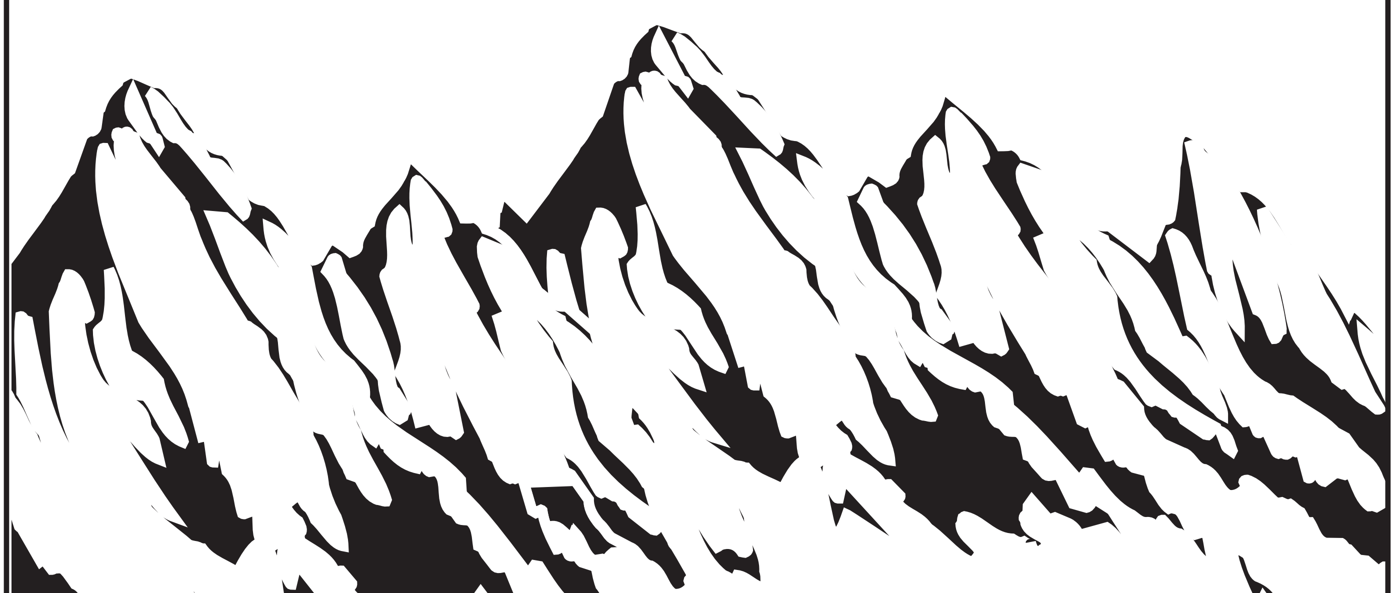
It is assumed that observations made of several bat species foraging in Nevada's woodlands is representative of a larger phenomenon. Further research is needed to better define species/ habitat relationships.

References

Bradley (2000a), Chung-MacCoubrey (2001), Pierson et al. (1999), Ports and Bradley (1996), M. J. O'Farrell (personal communication), Studier (1972), Williams (2001).



Desert Wash
Foraging Habitat



HABITAT TYPE DESCRIPTION
DESERT WASH FORAGING HABITAT (DW)

General Description

Desert Wash Foraging Habitat

Desert washes represent dry riparian conditions. Vegetation in desert washes varies with general habitat, elevation and latitude, but usually contain a mix of shrubs and small trees. Ephemeral water sources become available with seasonal rain. Bats will take advantage of these ephemeral water sources but rely on desert washes primarily as foraging sites. The structure and richness of desert washes tends to be greater than surrounding habitats. Additionally, edge effect creates richer foraging habitat. Certain species (e.g., California Leaf-nosed Bats and Pallid Bats) concentrate the majority of their foraging time within these habitats (P. E. Brown, personal communication; M. J. O'Farrell, personal communication; Williams, 2001). Several other species spend a considerable amount of time in desert washes in winter (Ruffner et al. (1979).

As with riparian habitats, desert washes are declining in acreage and quality. Common environmental threats are associated with rapidly growing urban development throughout the southwest. Urban sprawl accounts for direct loss of desert wash habitat either through flood control, channelization, or by filling and building. Secondarily, increased population growth contributes to increased OHV traffic and consequent habitat degradation and destruction. Renewed mining has accounted for significant removal or contamination of desert wash habitat.

Priority Species
Obligates

Pallid Bat
California Leaf-nosed Bat

Others

Spotted Bat
Allen's Lappet-browed Bat
California Myotis
Fringed Myotis
Western Pipistrelle
Brazilian Free-tailed Bat

CONSERVATION STRATEGY DW-1. DESERT WASH FORAGING HABITAT

OBJECTIVE – Maintain, enhance and/or restore desert wash foraging habitats for California Leaf-nosed Bats, Spotted Bats, California Myotis, Brazilian Free-tailed Bats and Pallid Bats throughout their range in Nevada by 2015.

Strategy: Rehabilitate and maintain all historical desert wash foraging corridors.

Action: Identify and plot all remaining good condition desert wash foraging habitats and manage for long-term good to excellent condition of these sites, with emphasis on washes in close proximity to known bat roosts.

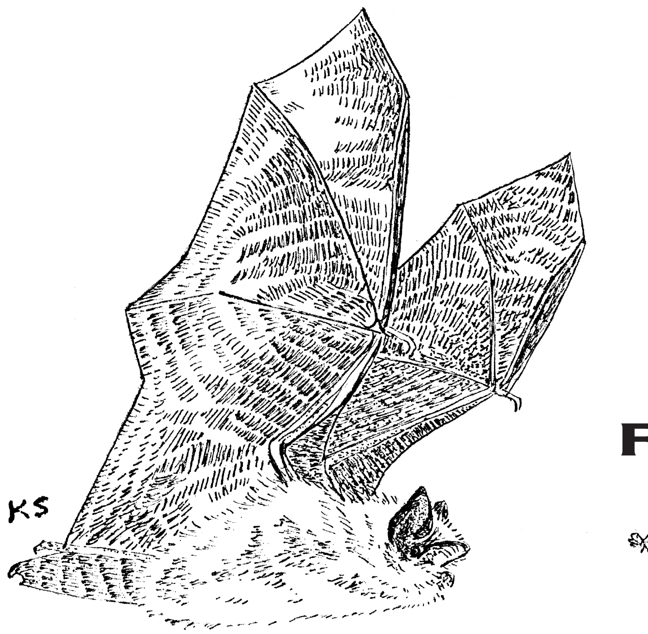
Action: Recover desert washes foraging habitats found in poor condition from excessive OHV use, past mining operations or other reasons.

Assumptions - Research and Monitoring Needs

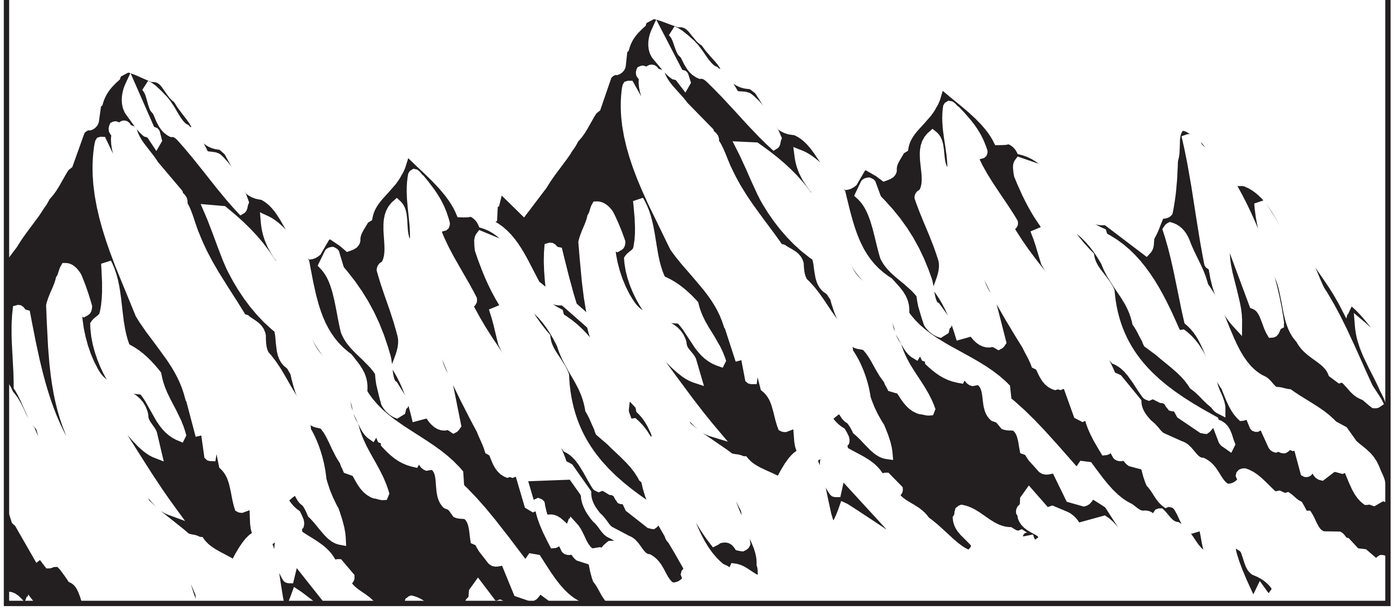
Radio-telemetry studies of California Leaf-nosed Bats in the California desert have shown that they forage on large insects in desert wash vegetation. Where washes have been disturbed by mining activities close to the roost, populations of California Leaf-nosed Bats declined (Brown et al., 1993). Washes, especially close to known bat roosts, need to be protected from human disturbance. It is assumed that additional species forage in desert wash habitats. However, further research is needed to better define species/ habitat relationships.

References

Brown et al. (1993), M. J. O'Farrell (personal communication), O'Farrell and Bradley (1970), Ruffner et al. (1979), Williams (2001).



Other
Foraging Habitats



HABITAT TYPE DESCRIPTION
OTHER FORAGING HABITATS (OFH)

General Description

Large stands of continuous shrub or forest habitats have not been studied in detail. From a capture method standpoint, such habitats are difficult, at best, to sample. There are no specific areas that can be determined to concentrate bat activity. Therefore, few areas present a situation in which to effectively sample bats when using traditional survey methods. Surveys using new acoustical methods in pure forest stands reveal sparse bat activity, primarily from animals simply moving through the habitat (M. J. O'Farrell, personal communication). Telemetry has proven to be another successful method for identifying foraging habitats used by Nevada's larger bat species (Bradley, 2000a).

Mobile acoustic surveys through desert scrub have shown little concentrated bat activity (Hall, 2000; M. J. O'Farrell, personal communication). Obviously, bats must cross such areas to reach water or riparian habitats and anecdotal observations provide some evidence of casual foraging. However, nothing is known about the percentage of time spent foraging in such habitat or whether specific movement corridors exist as opposed to broadcast filtering through the habitat.

Associated with human activities are a wide variety of non-native habitats, both urban and non-urban. Agricultural areas have been observed to contain concentrated foraging activity by a variety of bats, such as Pallid Bats, Spotted Bats, Big Free-tailed Bats, Brazilian Free-tailed Bats and Western (M. J. O'Farrell, personal communication; J. A. Williams, personal communication). Quantitative studies are lacking with respect to the importance among species of this habitat type. Although a beneficial aspect is apparent, increased exposure to pesticides could be deleterious (Clark, 1988).

Urban areas may or may not provide a wide range of foraging resources for bats. Most data are from areas in the central and eastern United States as few studies have been conducted in the west. Some bats use bright lights that attract insects as foraging areas, although insect control and use of energy-saving yellow street lights appear to adversely affect urban use by bats. There has been an apparent loss of bat activity in Las Vegas in older areas of the city (M. J. O'Farrell, personal communication). Currently, activity appears to be concentrated at the edge of the city. This edge is rapidly moving into native habitat with an unknown effect on bat activity. Certain features common with urban development appear to be of some attraction (e.g., golf courses, parks and sports fields). However, not all appear to be used by bats. Further research is needed to assess bat use of urban foraging habitats.

CONSERVATION STRATEGY OFH-1. OTHER FORAGING HABITAT

OBJECTIVE – Conserve and protect new bat foraging habitats when identified throughout Nevada in perpetuity.

Strategy: Maintain all new bat foraging habitats in good to excellent condition.

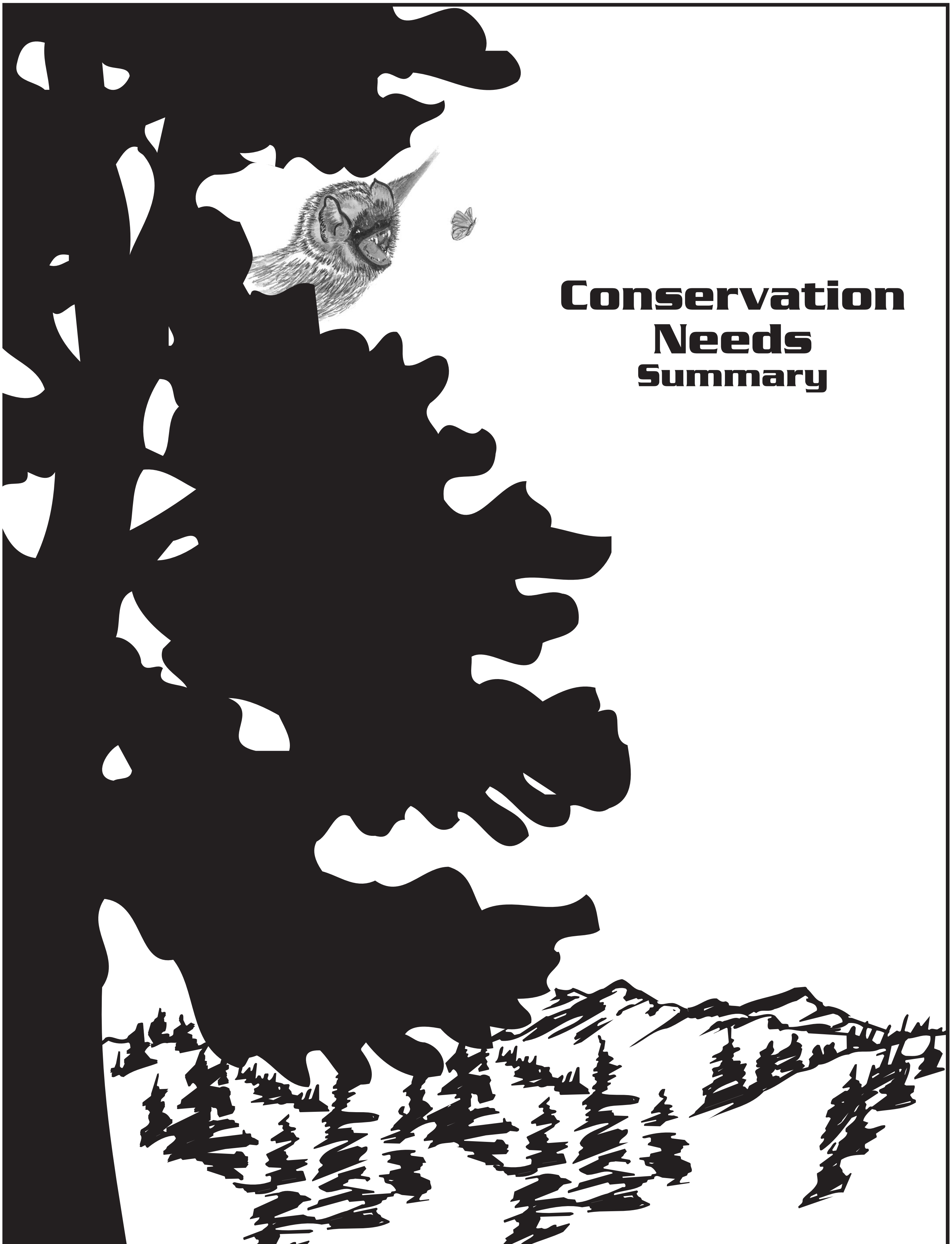
Action: Identify and plot previously undocumented bat foraging habitats and manage for long-term good to excellent condition of these sites.

Action: Recover new bat foraging habitats found in poor condition.

References

Bradley (2000a), Hall (2000), M. J. O'Farrell (personal communication), J. A. Williams (personal communication).

Conservation Needs
Summary



CONSERVATION NEEDS SUMMARY

Abandoned Mines - Mines are an endangered habitat in Nevada due to closure for hazard abatement, renewed mining and collapse due to structural instability. Although often referred to as "unnatural habitat" by land managers, mines by definition are habitat since bats have selected them as roosts. Even where caves are present, mines may be a more attractive habitat to some bat species (R. E. Sherwin, personal communication). Closure of abandoned mines without considering bats can result in bat mortality and loss of roosting habitat.

Human disturbance is a threat to mine-roosting bats. An increasing number of people are entering mines for recreation and mineral and artifact collecting. To keep both bats and people safe, mines should be closed with bat-compatible gates. These may need to be constructed to allow access to other mine inhabitants as well, such as desert tortoises. For vertical shafts, perimeter fencing (set 10 meters back from shaft) or cupola gates are recommended. Agencies may also want to consider closing and revegetating dirt roads that only lead to abandoned mines.

Some mines cannot be gated because the entrances are too large or unstable. These sites should be fenced if possible. If human safety is an important consideration because the mine is located close to cities or recreation areas, then bats should be excluded during a non-critical season (Brown et al., 2001), prior to hard closure. Other mines in the vicinity should be gated as replacement habitat.

Mines scheduled for closure and/or destruction by renewed mining must be surveyed by qualified biologists. Survey methods will vary by season and structure types, and should include internal surveys where safe, and external surveys using acoustic detection, night-vision, and/or capture equipment. Bats can exhibit high temporal and seasonal variation in roost use, and move frequently between roosts. Multiple surveys within and across seasons are essential to determine the significance of mine structures to bats for hibernation, maternity, night roost and lek roost activities.

Recreation - Recreational caving has resulted in population declines of some cave-roosting species in Nevada. A combination of seasonal closures, sign interpretation, education, road closures, and gating have resulted in favorable population responses by Townsend's Big-eared Bats in northern Nevada (P.V. Bradley, personal communication).

Federal and State agencies have several objectives to conserve the health, diversity, integrity, and beauty of the ecosystem. One of the main objectives is to manage and protect cave resources, as set forth in the Federal Cave Resources Protection Act (1988), while providing recreational opportunities and public safety. As an example, the Spring Mountains National Recreation Area (SMNRA) currently limits rock climbing within 100 yards of known sensitive bird species nests and will include bat roosting habitat as it becomes known or if the need to protect that habitat is identified. Specific climbing routes may be signed as necessary to inform recreationists of seasonal closures (USFS, 1996).

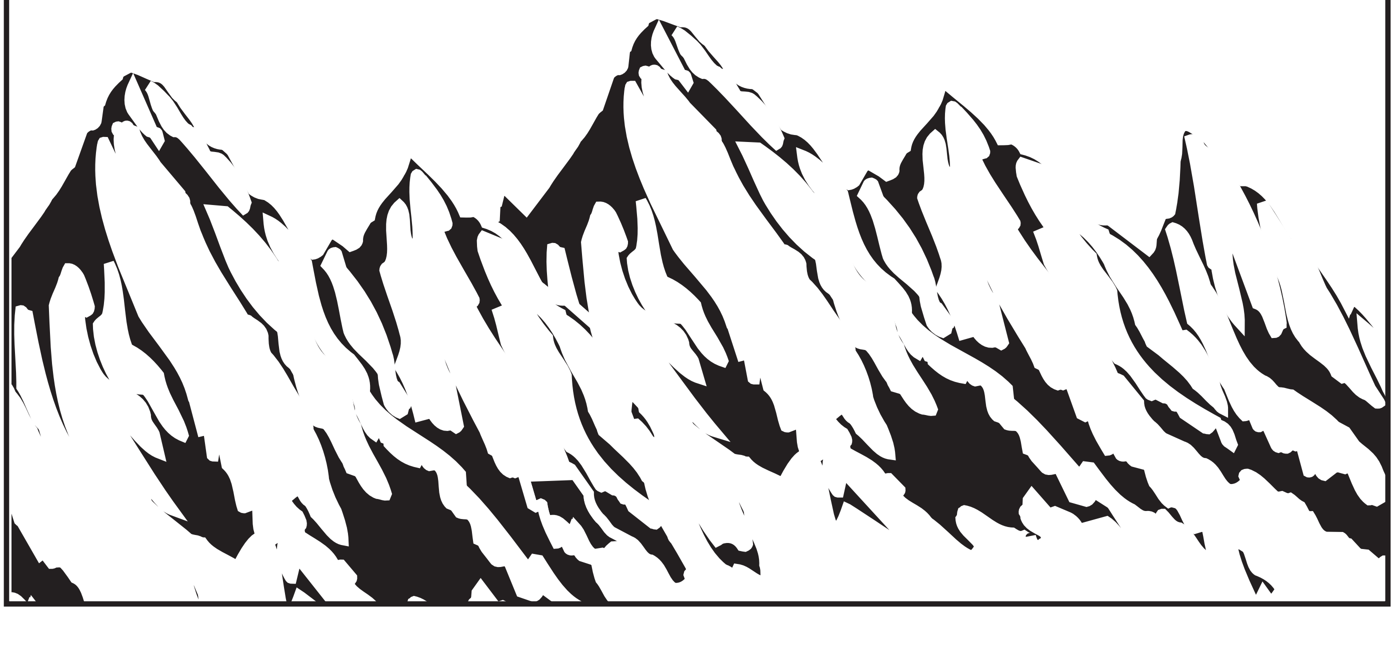
The SMNRA is also working cooperatively with climbing organizations, commercial guides, and local clubs to disperse various types of environmental educational information. Additionally, in working cooperatively with these interest groups and researchers, the Forest Service has been conducting a substantial amount of inventory and monitoring to document habitat of unique biological values to bat species, locations of forage and roost sites, and the timing of use at each site. All land agencies with rock climbing resources should follow suit.

Vegetation Conversion - Large scale vegetation conversion, particularly conversion of riparian woodlands to floodplain uplands through inappropriate livestock grazing practices, herbicide application, gravel mining, and mechanical channelization have likely had a significant negative impact on bat populations in the west. For example, anecdotal evidence suggests that the Western Red Bat, a riparian woodland obligate, was more abundant in Nevada prior to the loss and/or deterioration of riparian cottonwood/willow gallery forests. Riparian management is straightforward in Nevada. Livestock grazing should be controlled, herbicide application should avoid native riparian woodlands, gravel operations should be located away from riparian floodplains and the practice of mechanical channelization of stream banks should end. The immediate benefits of these actions to a raft of wildlife species far out way any perceived, short-term losses to commodity interests.

Pinyon-juniper, an extremely valuable foraging and roosting habitat for several bat species, must be managed responsibly in order to maintain a healthy bat fauna. All pinyon-juniper management should ensure that buffers are retained around all bat roosts and that a significant percentage of forest canopy be maintained in each watershed.

Research Activities - All research activities must be conducted responsibly and with the best interest of the bat populations in mind. Protocol and permitting requirements should be adhered to, with no exceptions.

Research Needs
Summary



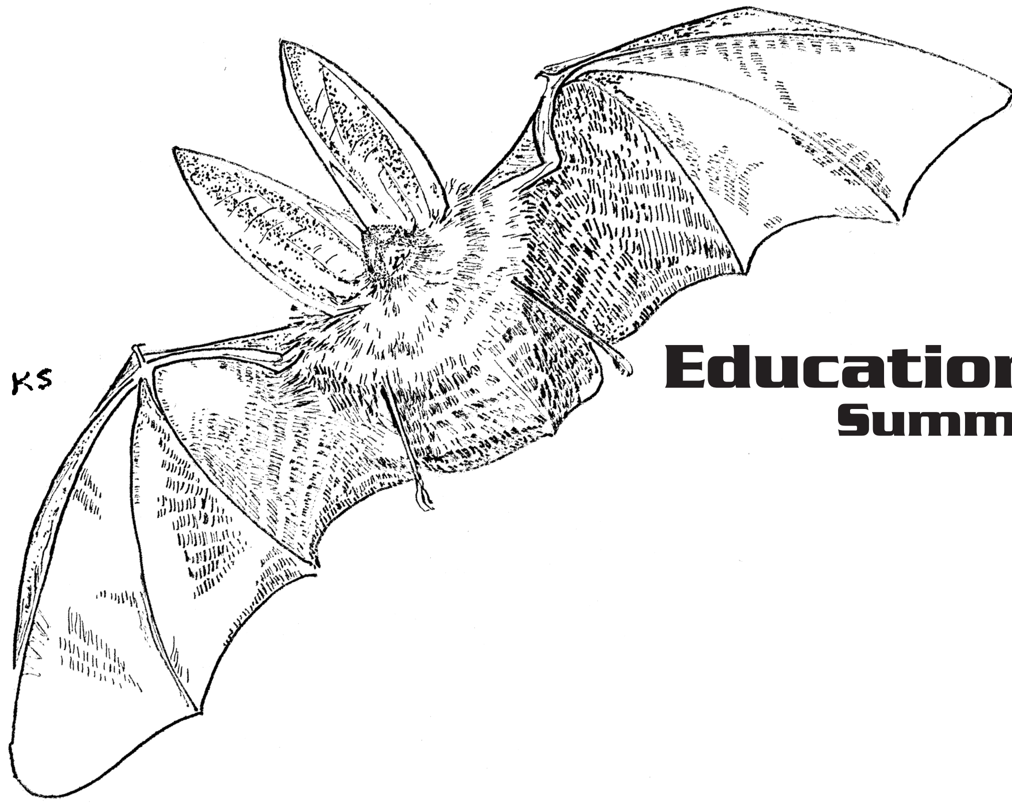
RESEARCH NEEDS SUMMARY

Much of the information still needed to determine the best methods of conserving Nevada's bats can be gathered from increased inventories and routine monitoring.

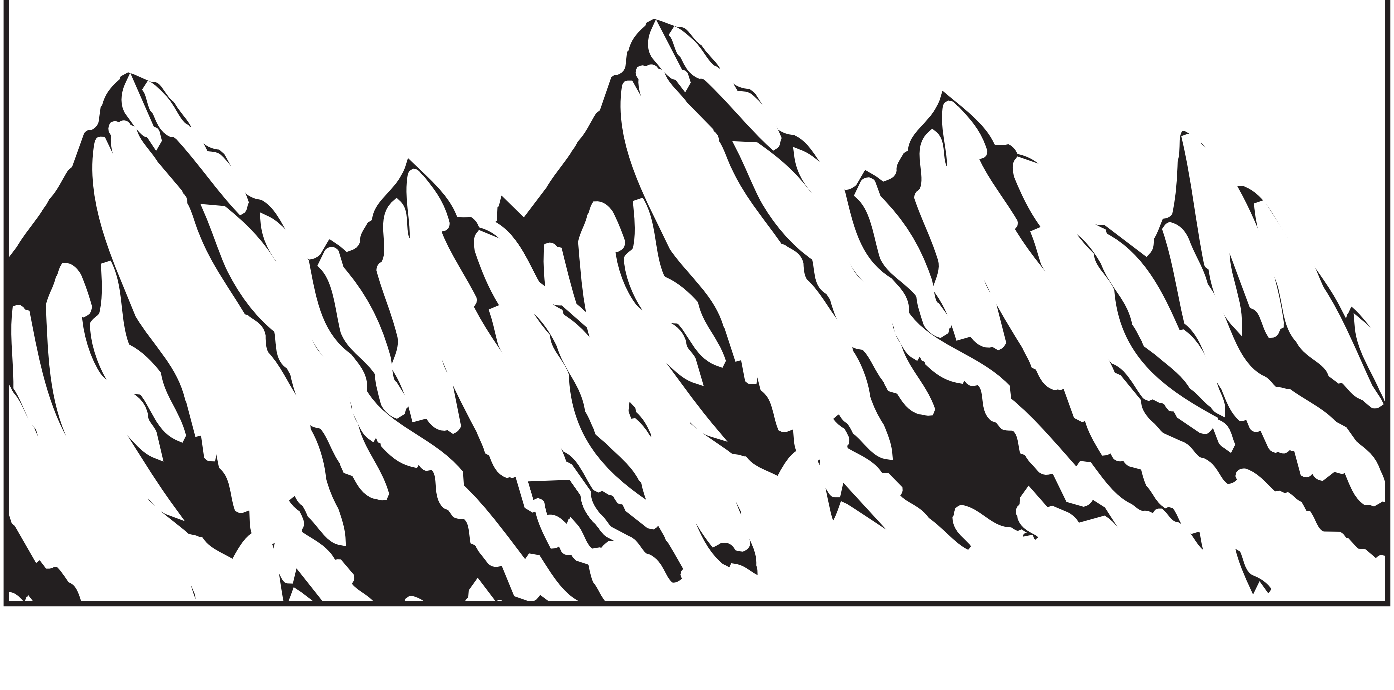
Inventories throughout the state, in a variety of habitats will offer further insight into the habitat specificity of bats in Nevada. Thorough inventories will possibly identify additional foraging habitat. Additionally, inventories would provide roost site delineation. There are several areas within the State that are nearly, or completely uninventoried (Figure 24 – Page 58), and these areas should be subject to routine inventories in the future. Areas in the State where moderate to high levels of bat activity are identified should be monitored on a routine and long-term basis.

Routine monitoring that includes at least capture and acoustic detection methods of select locations that prove to be productive bat habitat will provide insight into migration timing and routes, short and long-term fluctuations in roost fidelity and population changes, seasonal timing of sexual congregations, reproductive timing and habitat preference. General inventory data is also gained from monitoring.

Roosting and foraging habitat delineation is necessary to more thoroughly identify critical resources for bats. Long-term acoustical and live-capture monitoring of bats will offer insight into population fluctuations, timing of migration, annual migration routes, and habitat dependency. Research should focus on habitat investigations, population inventories, and monitoring. Long-term monitoring stations should be established at priority sites, with special emphasis on riparian habitats and water sources (see Water Source Section), as well as at cave and historical mine sites. Established protocols that simultaneously sample multiple locations across the landscape will offer the opportunity to make valuable comparisons between sites. Radio telemetry can also be a powerful tool in determining foraging habitat and roosting strategies that may otherwise remain inscrutable.



Education Needs
Summary

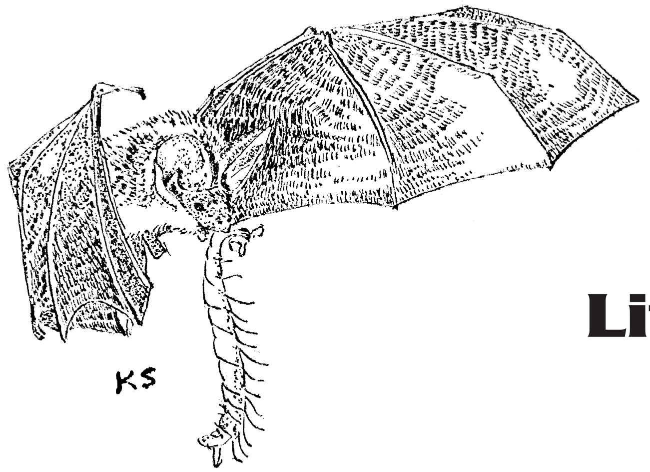


EDUCATION NEEDS SUMMARY

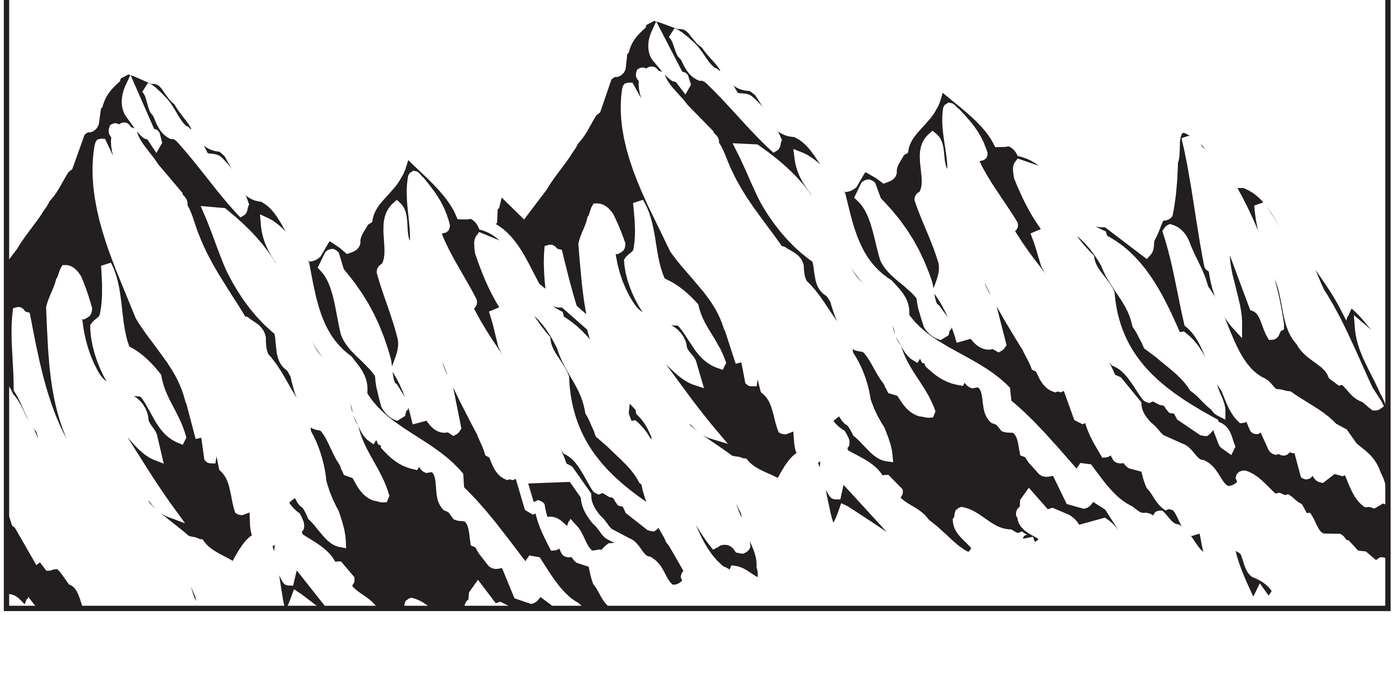
Conservation Education – Several recent technological advances have made it easier to provide good quality bat educational materials to the public. The following is a list of potential activities that would increase public awareness of the benefits of bats to Nevada's ecosystems:

1) Website literature.
2) Internet wildlife video cam viewing.
3) Bat brochures.
4) Field tour bat monitoring of spring sites, bridge sites, etc.
5) Bat posters.
6) School presentations.
7) Civic presentations.
8) Nevada bat video.

Abandoned Mine Closure Notices – Copies of closure plans need to be sent to all local land managers when private or public parties are directed to close abandoned mines. Bat-friendly closure techniques should be employed whenever possible. If hard closure techniques are the only option, notification by the Nevada Division of Minerals (NDOM) to a qualified bat biologist should be received a minimum of one year in advance of closures, to provide adequate time for complete multi-season surveys of project sites, and if need be, development of habitat mitigation options.



Literature Cited



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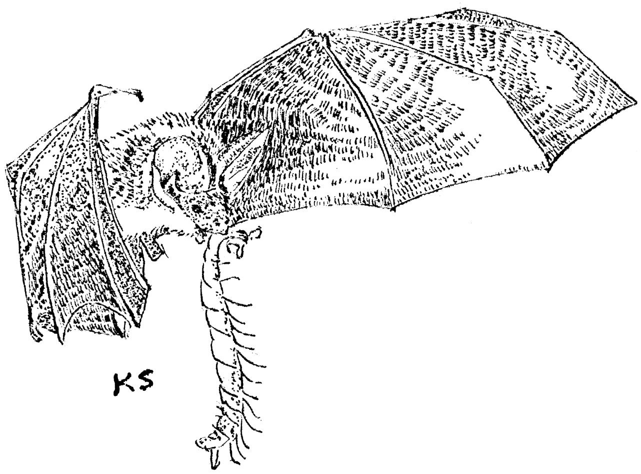
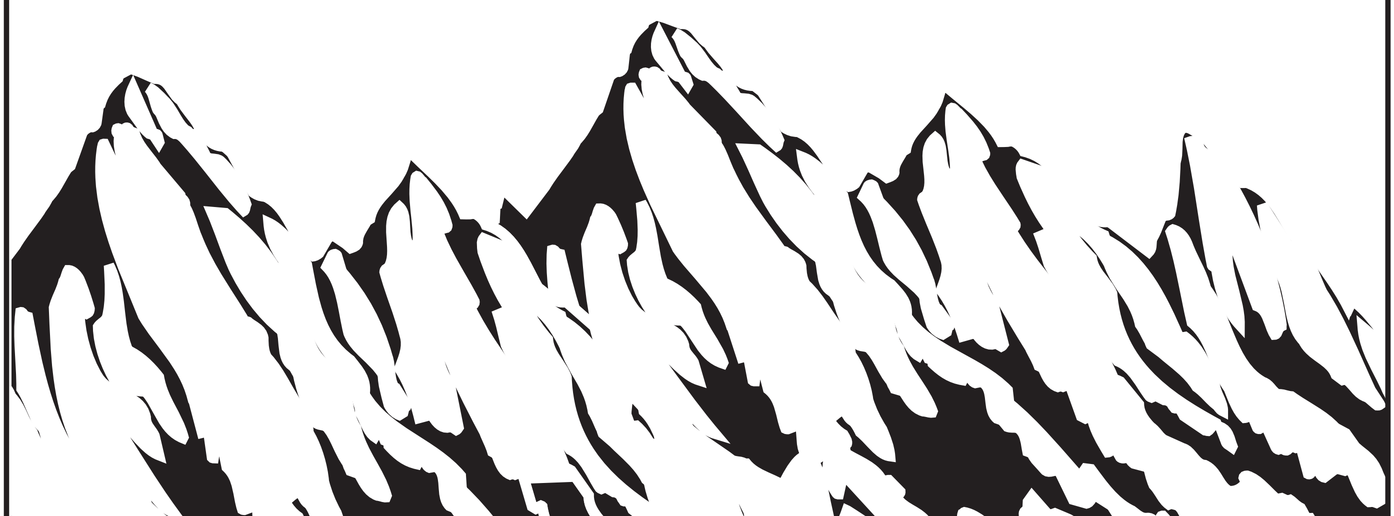


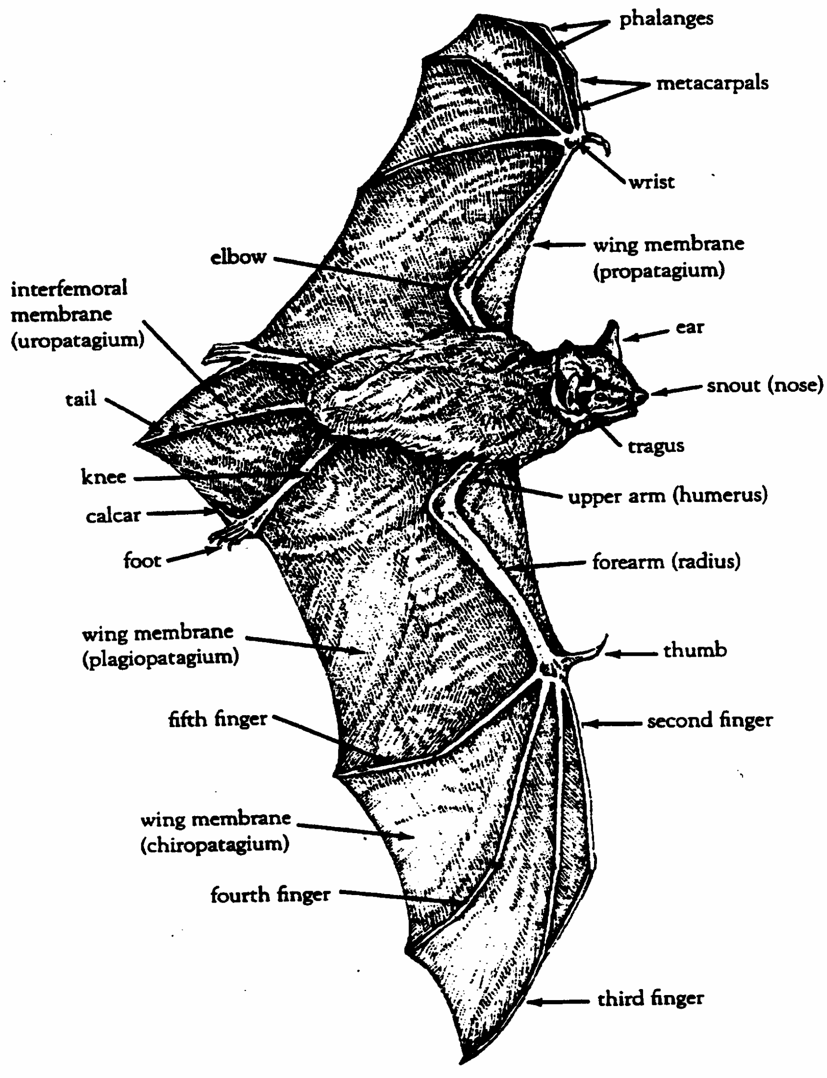
Appendices



APPENDIX A

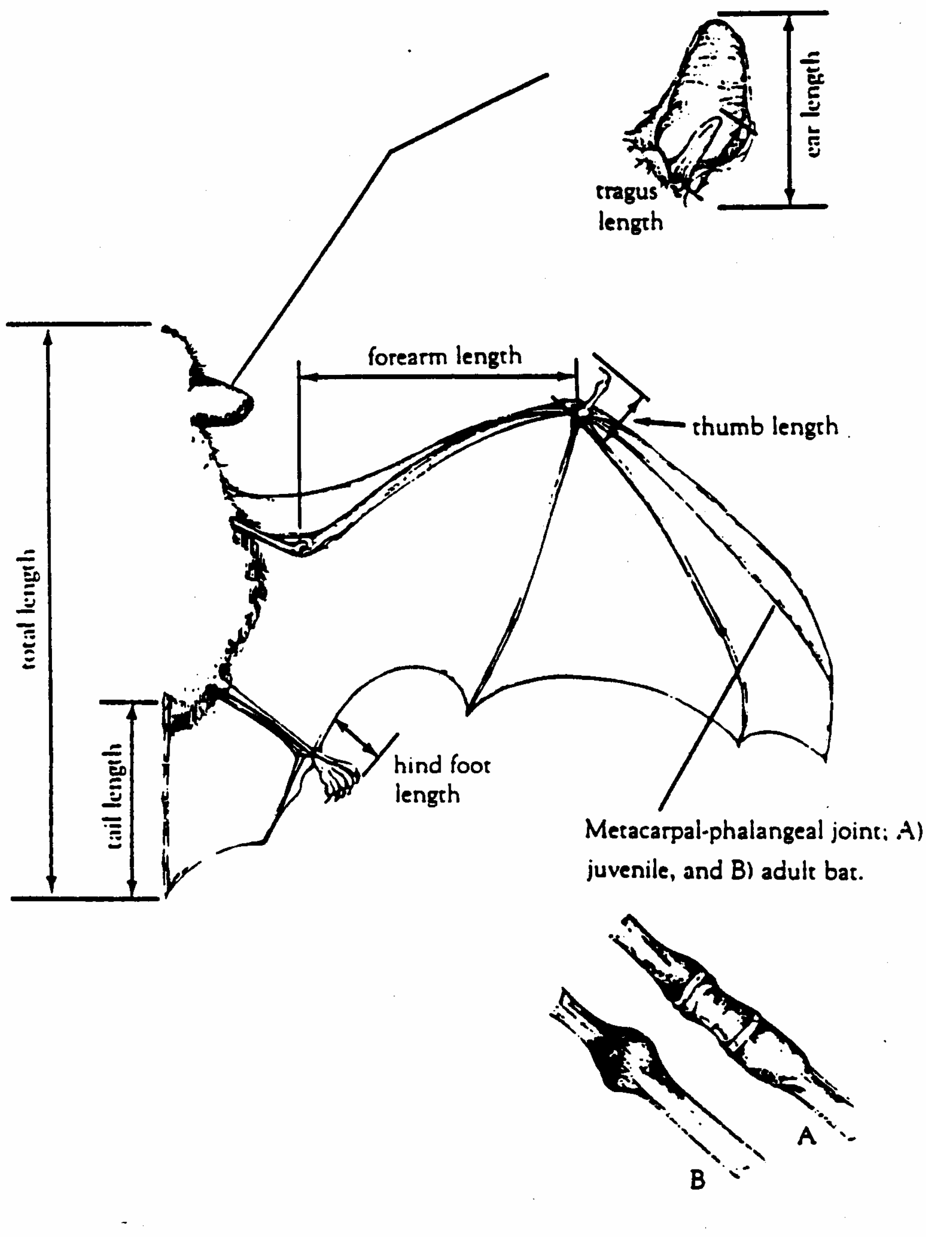
Inventory, Monitoring, Research Protocol

THE ANATOMY OF A BAT



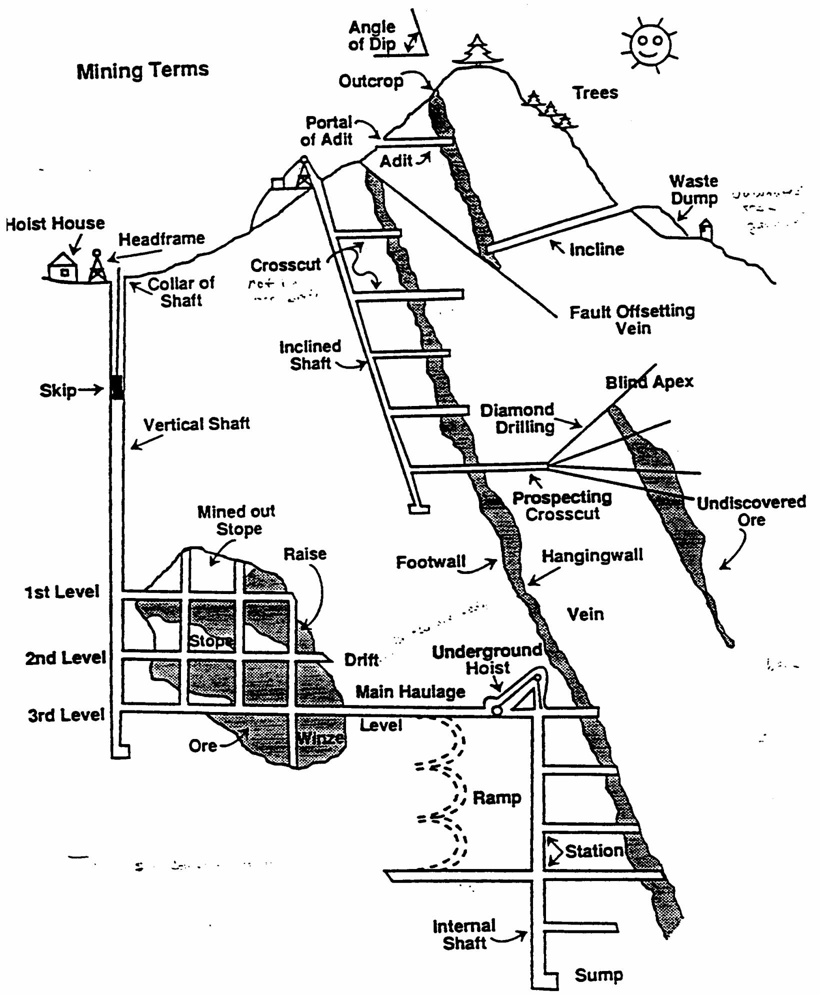
Source: "The bats of Texas" by David J. Schmidly, drawing by Christine Stetter

Measurements used in Species Identification Keys



Nevada Bat Survey Protocol

The following protocol was developed to guide scientists in the proper evaluation of bat populations and their habitats in Nevada. Qualified bat biologists should conduct surveys.



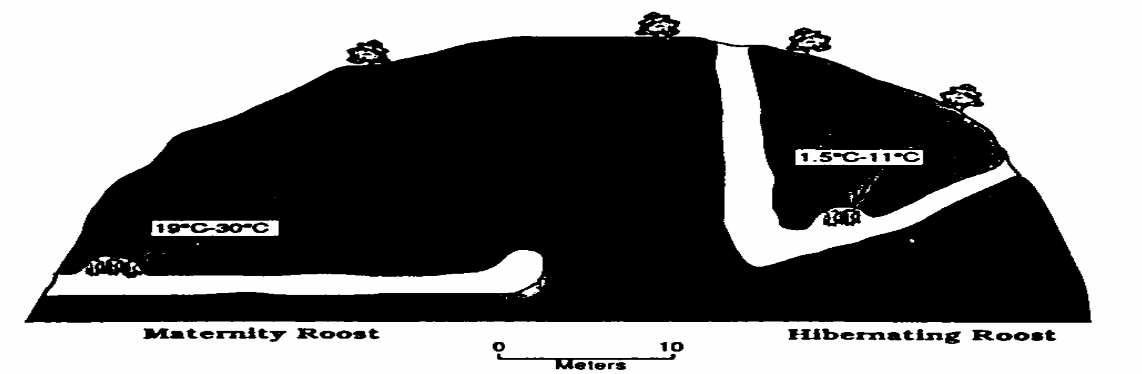
Abandoned Mines

Sherwin et al. (2002) and Altenbach et al. (2002) provide a detailed protocol for the proper evaluation of historical mines as bat habitat. These methods should be used prior to the initiation of any hard closure (e.g., back-filling, foaming, imploding) policies or renewed mining in historical mining districts. The authors advise great caution when drawing conclusions about the suitability or unsuitability of mine sites as summer, winter, lek and/or migration bat habitats without the employment of internal survey techniques. Incomplete investigations can lead to bat mortality and/or the destruction of bat habitats. The cited articles are provided in full on subsequent pages and are endorsed by the NBWG. As mentioned before in this volume, the broad scale use of liability-free, bat-friendly closure methods (e.g., fencing, hazard signing, gating and road closure) would reduce the need for pre-mine closure surveys.

Caves, Cliffs, Talus, Trees, Buildings, Bridges

Maternity roost evaluations are best conducted as external acoustic and/or night vision surveys. External acoustic/night vision surveys should be kept to a minimum and duplication of effort should be avoided whenever possible. The employment of external capture techniques adjacent cave openings must be done with great care. Capture surveys should only be conducted where a specific need can be articulated and must be done no more than once in a three year period (triennial basis). With the exception of emergency situations, the entering of bat maternity roost sites during the maternity season is strongly discouraged and may soon be forbidden by Nevada State Law (see Appendix B).

Internal hibernation roost evaluations during the hibernation season should be conducted no more than once every three years (triennial basis) and should only be conducted where a specific need can be articulated (long-term trend site, population decline is suspected, etc.). Duplication of effort must be avoided at these sites. With the exception of emergency situations and scheduled scientific investigations, the entering of bat hibernation roost sites during the hibernation season is strongly discouraged and may soon be forbidden by Nevada State Law (see Appendix B).



For all internal surveys, the use of white light is discouraged. The use of red filtered light is preferred. Beams should not be pointed directly at individual bats. Surveys should be expeditious and quiet. If you must talk, do so in a low voice. Do not whisper. Pick up the feet.

Water Sources

Many survey techniques can be employed at water sources. Population trends and changes in species composition over time can be evaluated at these sites using acoustic, night vision, infrared camera and capture techniques. A statewide survey grid is proposed in the Water Source section of this volume.

General Discussion of Capture and Acoustic Surveys

In order to obtain the most thorough inventory of bats, it is necessary to use as many techniques as possible. If time permits, a thorough search for available roosts (e.g. tree snags, caves, abandoned mines, buildings, bridges) should be conducted. Concomitantly, other features known or suspected to be attractant to bats should be evaluated (e.g., troughs, ponds, streams, riparian corridors, springs). This should be accomplished by examination of detailed topographic maps, consultation with local resource agencies, and conversation with local residents or others familiar with the area. There is also no substitute for a preliminary trip to a site to gain personal knowledge of the existing variability in terrain and habitat mosaic.

Standard capture methods can be used at any designated attractive feature. This can entail a variety of equipment and ingenuity but usually consists of a combination of mist nets and double frame harp traps. Some situations are best suited for one or the other but combined use can yield better success because of differential trap success among bat species. Depending on the type and configuration of a roost site, other types of capture devices may be more effective. A review of capture devices is given in Kunz and Kurta (1988).

Capture techniques provide animals in hand, which is often thought to provide definitive identification. In truth, this is not necessarily the case. Some species can be very difficult to identify, particularly in the field. In Nevada, two sets of species are difficult to distinguish in hand (California Myotis from Small-footed Myotis and Yuma Myotis from Little Brown Myotis). It is not uncommon for animals to be processed, identified and released during the night. Performing the necessary measurements and assessment of coloration can be difficult on a live animal in artificial light. Taking proper and repeated measurements on a live animal requires experience. The accompanying form data sheet for capture surveys provides a template for ensuring that critical measurements are obtained for the species identification. This form should be used to provide the minimum necessary for a competent capture survey. Voucher specimens should be taken for unusual captures (e.g., range extensions), animals of questionable identity, or those from areas with no previous surveys. Such specimens must be housed at a recognized, actively curated museum. Under no circumstances, can voucher specimen numbers exceed specifications on one's Scientific Collection Permit.

Acoustic survey methods provide a powerful tool for obtaining an accurate inventory of bats as well as more detailed information on habitat use and activity patterns. Equal to its power is the ability for this method to be misused. As with any survey method, if it is done correctly, the results will accurately reflect existing conditions. The reverse can also be true. The following protocol entails the use of the Anabat detector and analysis system (Titley Electronics, Ballina, NSW, Australia). The Anabat provides the ability to monitor in real time, allows low memory storage of all detected bat activity, provides digital storage on a computer hard drive, and has the ability to examine, edit and measure all calls in a sequence simultaneously. The small digital files are easily archived and provide a permanent voucher record. Thus, any errors in identification can be determined and corrected as new information/knowledge becomes available. There are other detectors available commercially.

The first question for any proposed survey is: "How many sampling periods should be surveyed?". The answer is as many as possible. Multi-season sampling is important for understanding the broad dynamics of species composition. Bats are highly mobile and exhibit a wide range of use strategies throughout the year. At a minimum, a location should be examined during each season. Is a single night sufficient? Not usually. Ample evidence exists to document that nightly patterns of activity can vary significantly. This is true for the number of individuals active within a species as well as for species composition. The more consecutive nights that can be examined, the more accurate the indication of bat use. A minimum of three consecutive nights for each sampling period is recommended. Capture devices should be re-arranged from night to night as bats learn to avoid new obstacles encountered. Acoustic devices are not intrusive and can be left in place each night.

Acoustic Surveys (Active vs. Passive)

Acoustic sampling can be conducted actively (observer present) or passively (observer absent). Data recording should be directly to a laptop computer rather than to a tape recorder. Cassette tapes introduce extraneous noise and frequency determination affected by change in battery voltage. Additionally, important information, such as exact time of activity, can be lost. Both active and passive methods are important and should be employed simultaneously where feasible. Without an external battery source, duration of active monitoring is limited to the life of the internal battery, usually two to three hours. It is desirable to actively monitor the general area being sampled by one or more passive units. This allows the observer the opportunity to get first hand knowledge of existing conditions and activity, which aids in interpreting and identifying vocalizations. Observing calls during the monitoring process, noting where bat activity is occurring, and getting visual feedback through spotlighting provide needed context critical to the identification of some species. Detailed methods for recording vocalizations, visual identification and interpretation of recorded vocalizations can be found in the Anabat User's Manual (Corben and O'Farrell; available at www.mammalogist.org). O'Farrell et al., (1999) present methods for identification as well.

Passive acoustical monitoring can be done several ways. An Anabat setup can be set in monitor mode (automatic record), the detector propped up to monitor the desired space, and then left to record. This is often done during short periods when capture devices must be checked and captured bats processed. Simply leaving the equipment exposed to the elements and passing animals does have inherent risks. An ideal compact and weatherproof setup contains a laptop, detector, ZCAIM, and an external battery for long-term use (O'Farrell, 1999). These units are portable and easily deployed. Multiple units can be operated simultaneously in order to monitor different habitats or other features geographically isolated from each other. Recently, T. Messina (personal communication) designed a permanent monitoring station. Currently, this system requires a compact computer and access to AC power, limiting the possibilities for remote field use. New advances in Anabat hardware will eventually eliminate the need for a computer, and thus the need for AC power. These units will be able to be placed in remote situations. Passive systems can generate huge quantities of data, which can present a problem when it comes time to review and identify species composition and activity. Improper detector placement and/or sensitivity settings can result in files full of echo and other noise (insects, etc.) that can interfere with the identification process.

Acoustic Surveys (Fixed-Point vs. Mobile)

Acoustic surveys can be conducted at fixed points or they can be mobile. Fixed points can yield detailed information about a particular habitat feature. Both active and passive monitoring is appropriate. To be most effective, fixed points should be selected randomly. The same type of decision-making for capture devices should be applied to fixed-point acoustic sampling. Because the volume of space actually sampled by the equipment is finite, it is imperative that locations be selected where bats should be expected to occur (e.g., water sources, riparian corridors, suspected flyways, habitat edges, and roosting sites). As with capture devices, proper placement of the acoustic device will maximize the quantity and quality of data obtained.

The Anabat detector is relatively directional with an apparent cone of reception of approximately 45 degrees. In reality, the envelope of detection is irregular and lobed within those 45 degrees. During active monitoring, it is best to pass the detector in a slow arc while searching for bats. Once detected, then the echolocation calls should be followed as best as possible. This maximizes the number of calls obtained in a sequence.

Orientation of a passive setup is critical to obtaining useful data. It is necessary to place the unit to sample the greatest concentration of bat activity. For a small water source, such as a tank or trough, the microphone should be oriented toward the space above the water and placed at least 15 m away. Although it is best to know one's detector and the nuances of its sensitivity setting, a good default sensitivity setting is six to seven. At a water source, a high concentration of bat activity can be expected. This can produce an acoustically cluttered environment similar to a single individual flying near vegetation or a rock face. Placing the detector a minimum of 15 m from such clutter helps reduce the amount of echo and other extraneous noise. At streams, vegetation edges, riparian corridors, or other linear habitats, place the unit to sample the long axis (parallel to the edge). Most activity will occur parallel to the edge, thus bats will be within the detection envelope longer than if the unit were oriented perpendicular to the edge.

Acoustical monitoring at roost sites can be useful but caution needs to be exercised. Any activity around a roost entrance involves a certain amount of clutter (physical or the presence of other bats). In some cases, the calls of bats exiting a roost are similar to those immediately given during hand release and bear no resemblance to calls given in free flight in the open. Thus, they are of no value in identifying species present. Active monitoring at a roost allows visual feedback and the ability to assess quality of calls. Immediate adjustment in sensitivity and/or changing position in relation to the entrance can be made. Passive monitoring does not allow this adjustment. Therefore, it is imperative to place the unit a sufficient distance away from the entrance (minimum of 15 m) to minimize clutter interference. The greater the amount of physical clutter around the entrance to a roost, the greater the distance the passive unit should placed away from the entrance.

In clutter, bat calls tend to be reduced in frequency range and duration. Thus, much of the diagnostic structure necessary for species identification is lost. This is particularly significant when dealing with species that can be confused. For example, California Myotis and Yuma Myotis are both 50 kHz bats (characteristic frequency approximately 50 kilohertz). In free flight and away from clutter, these bats are readily distinguishable. However, in clutter their vocal signatures virtually identical. They can be found roosting in the same structures, which can compound the problem. Capture methods would need to be used to assist in determining whether both species are present. If clutter cannot be avoided, it is best to limit identification to a group of species rather than risk misidentification.

Simply because bats are recorded at a roost, specifically a mine or cave entrance, does not mean the bats are using the structure. Likewise, simply because bats are not recorded at an entrance does not mean that bats are not using the structure (e.g., there may be unknown and/or multiple entrances). Also, actively monitoring near an entrance can inhibit bats from exiting the structure. This is particularly true for the Townsend's Big-eared Bat. Placing a passive unit can circumvent this problem, although a bat flying overhead could be perceived as using the entrance. Visual verification is sometimes necessary. Placement of a camcorder with infrared capabilities (e.g., Sony DCR-TRV 120 with Nightshot and hot shoe IR light source) focused on the entrance will verify specific ingress or egress by bats. Acoustic data will allow species identification.

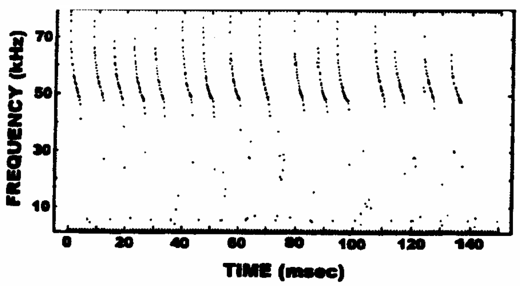
A detailed knowledge of species composition and activity at a fixed point provides a necessary understanding of use of that particular habitat feature or resource. However, this cannot be extrapolated to the landscape level. Most methods available survey finite sampling limits. Further, the sites elected for sampling are those known or suspected of having attractant qualities. Therefore, bat presence should be concentrated at those sites. Because of sampling restrictions, little is known about how bats disperse and use the landscape away from these specialized habitat features. Mobile acoustic sampling, similar to radio-telemetry in this context, can be used to examine landscape level bat use.

Routes should be selected carefully. Any road with night traffic can be dangerous and should be avoided. For mobile surveys, it is imperative that the time, mileage and GPS coordinate be taken at the beginning and end of each transect. The standard protocol for conducting a mobile survey includes driving between five and ten mph. The area ahead, to the side, and behind the vehicle should be scanned continuously while driving. When a bat is encountered, stop the vehicle immediately and actively monitor the surroundings for one minute. Mileage and/or a GPS fix should be taken. If no further vocalizations are detected, continue driving. If more bat activity is detected, continue monitoring for five minutes, and then proceed with driving. Visual techniques (e.g., spotlight) should be incorporated to assist in verifying species identity. Visual verification should be noted for specific files and that information incorporated into the text header. A single recording would indicate a commuting bat. More prolonged activity may indicate a foraging site or other habitat feature resulting in concentrated use. Each location resulting in a vehicle stop should be examined during the day and characterized by habitat and any features that might provide insight into bat use. A specific transect should stay within a specific habitat type. Multiple transects can be conducted in a single night. Although large areas of habitat can be examined, recognize that away from water or other attractant features, there may be relatively little bat use. For example, surveys through broad desert valleys without development may not yield a single encounter. However, with sufficient effort, it should be possible to locate movement corridors and localized feeding areas. These sites may be constant or they may change through time. Such knowledge is critical to the understanding and subsequent management of bats and is unattainable through most other field survey methods.

The form data sheet for acoustic sampling provides the minimum data that should be collected when conducting either fixed-point or mobile monitoring. If passive and active sampling is conducted simultaneously, multiple computers will be used. Number each computer and associated detector and ZCAIM so that all the equipment in a given setup remains constant. Also record which computers were assigned to the active and passive positions (e.g., STATIONARY LINE: Active #2, Passive #1 and #3 etc). If each is sampling different habitats, that information would be provided in the next two lines, separated by semicolons, respectively. If they are at widely divergent locations, UTM or Lat/Lon coordinates need to be provided for each (that information is always incorporated in the default text header in Anabat6).

As soon after collecting the data as possible, recorded files should be examined and species identity assigned (species codes entered for the species field in the text header). A representative file name (indicating a time date stamp as assigned by Anabat6) for each species encountered must be entered on the form. These files should be selected as the best representation of that species providing the basis for identification.

Any report of the results of capture or acoustic surveys should include copies of the completed data sheets in an appendix. Agency reports (e.g., annual report to NDOW for Scientific Collection Permit) should also include copies of acoustic voucher files. At least one would be required per species. However, if available, at least ten of the best quality files should be included for each species identified from each locality surveyed.



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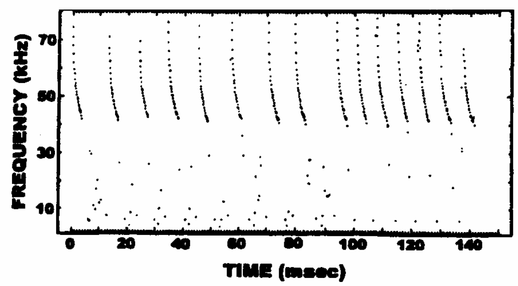

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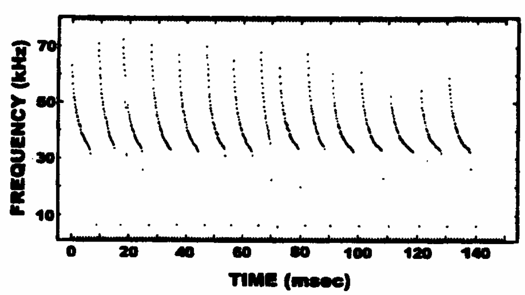

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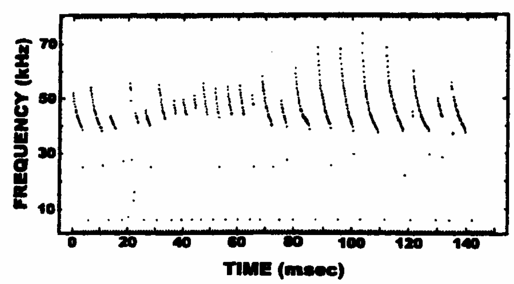

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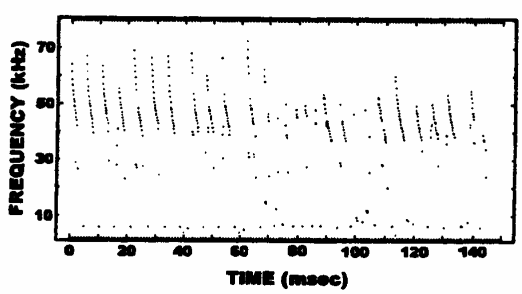

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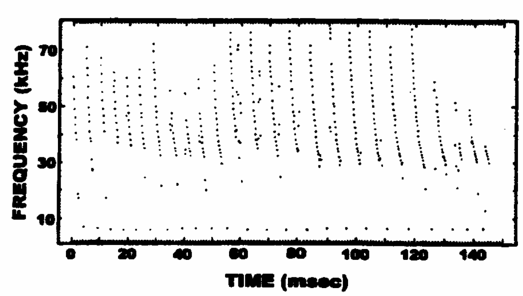

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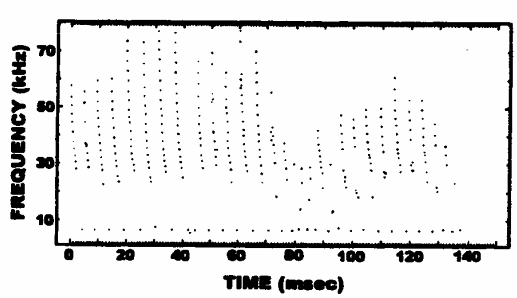

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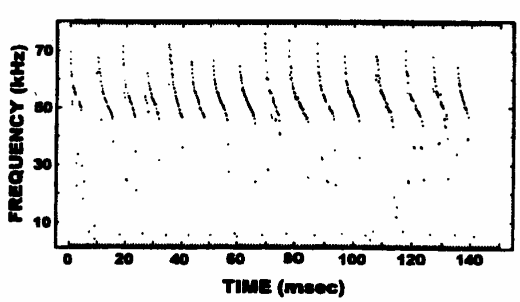
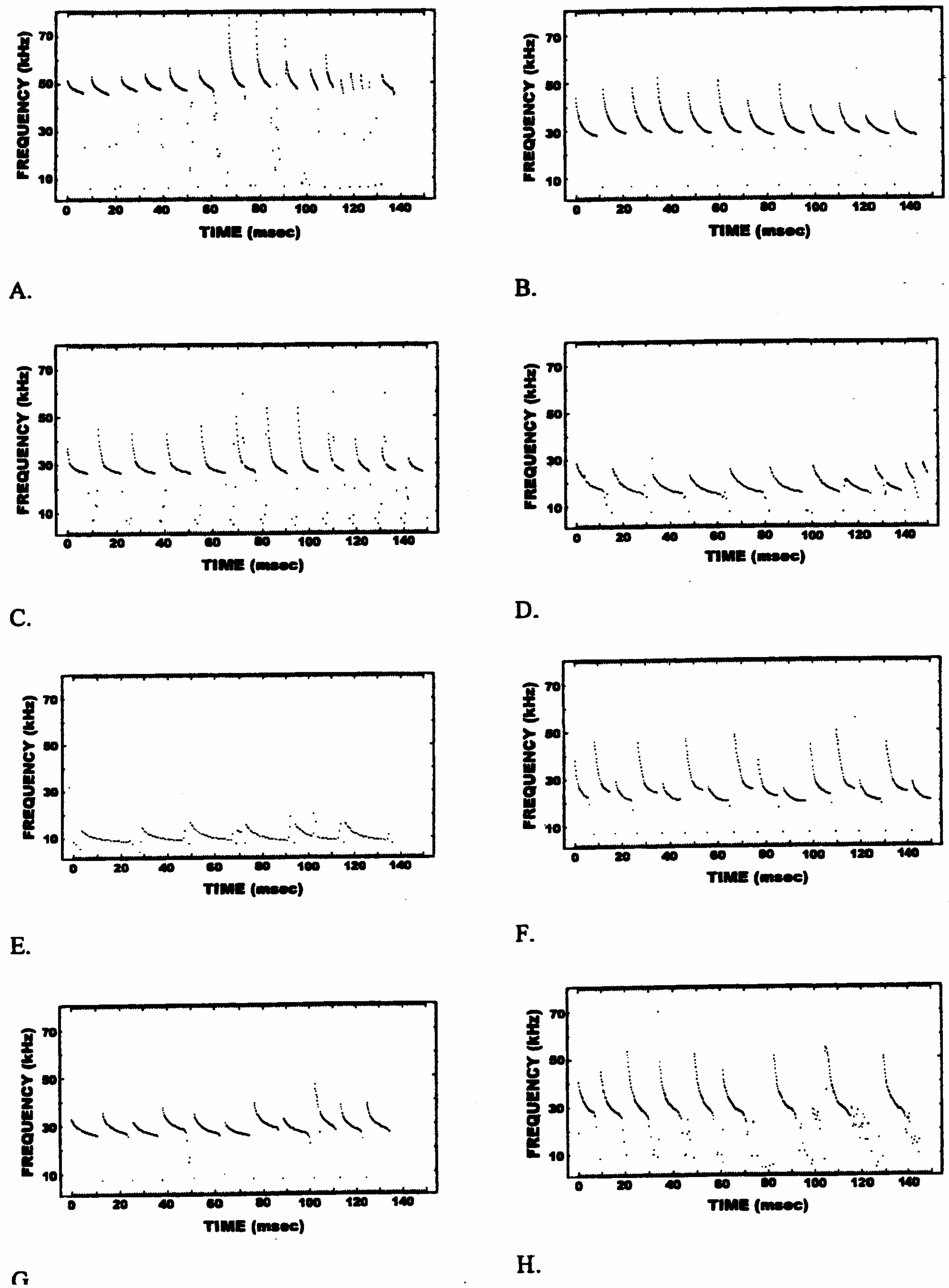


H.

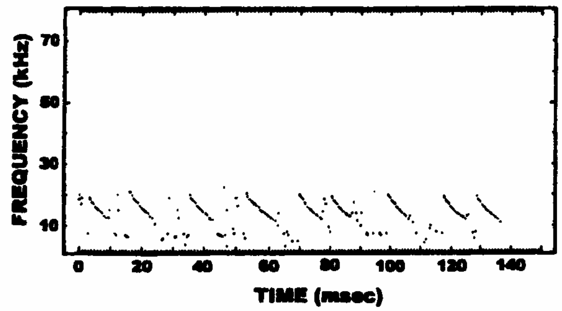
Select Anabat echolocation calls: (O'Farrell, 1997)

A) Myotis californicus, B) M. ciliolabrum, C) M. occultus, D) M. volans, E) A. auriculus, F) M. evotis, G) M. thysanodes, H) M. yumanensis.



Select Anabat echolocation calls: (O'Farrell, 1997)

A) Pipistrellus hesperus, B) Eptesicus fuscus, C) Lasionycteris noctivagans, D) Nyctinomops macrotis, E) Eumops perotis, F) Lasiurus cinereus, G & H) Tadarida brasiliensis.



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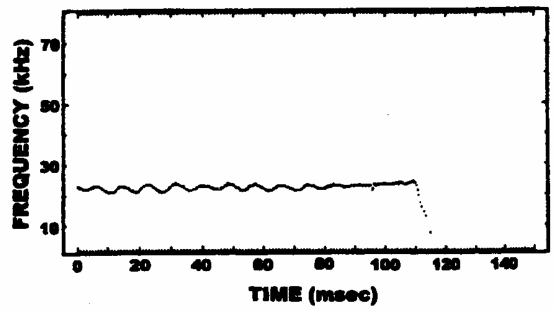

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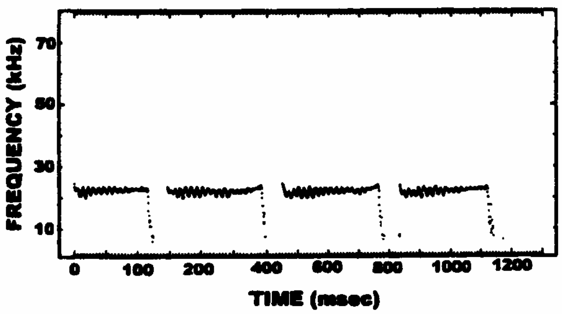

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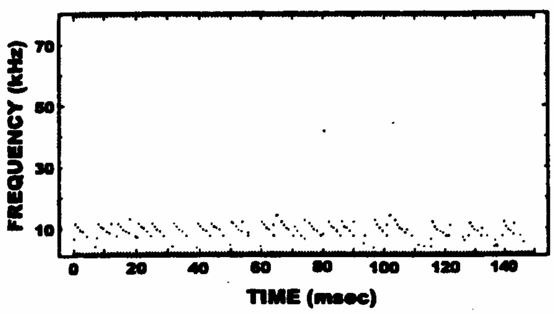

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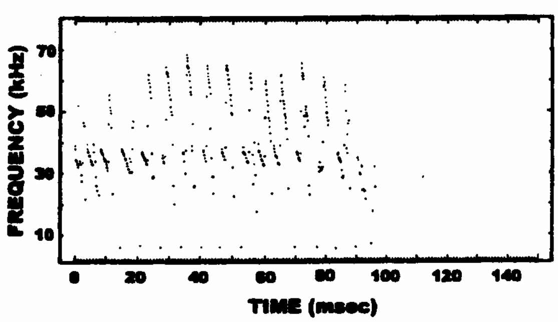

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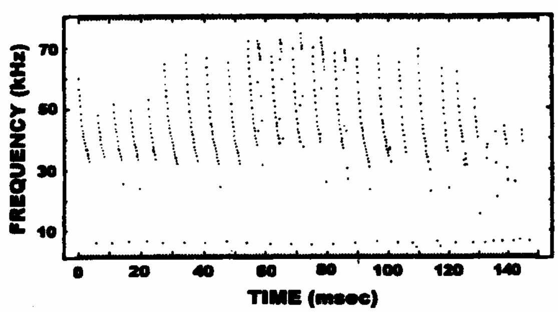

F.

Select Anabat echolocation calls: (O'Farrell, 1997) *A, B & C) Idionycteris phyllotis, D) Euderma maculatum, E) Corynorhinus townsendii, F) Antrozous pallidus.*

METHODS FOR DETERMINING LOCAL MINE CHARACTERISTICS OF IMPORTANCE TO BATS

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Abstract

When attempting to address questions regarding specific characteristics of mines that can be used to predict occupancy by bats, investigators need to identify several important criteria. We propose that the key questions that need to be articulated are: 1) what species is being addressed -- no two species have the same physiological/natural history requirements, 2) what type of use is being investigated (maternity, hibernation, etc.)-- this can greatly impact the conditions that are being sought, 3) what is the spatial scale of interest -- a tremendous amount of variability can be exhibited both within and among populations, 4) what temporal scale is being investigated -- a mine may appear unused for years and even decades, but that does not necessarily indicate that it is not actual habitat, 5) how will occupancy be interpreted -- what does occupancy indicate about roost "quality", and 6) how will habitat be defined -- where the bat roosts in a mine, the mine itself, a mine complex, etc. A decade of research has revealed that bat occupancy of mines is a highly complex issue. While simple explanations of complex phenomena may be attractive for management purposes, there is no accurate list of mine characteristics that can be used to gauge quality of habitat. When individual bats or colonies select roosts, they are most likely selecting for a set of conditions that a roost provides, not selecting for specific roost attributes. These conditions include (but are not limited to) temperature, humidity, protection from predators, density of local roosts, and protection from ambient conditions. Suitable conditions can be realized in mines of all type, structure and configuration. Conversely, local surface effects (such as climate, elevation, aspect, number of openings), may constrain subsurface conditions, making specific characteristics of a given mine irrelevant. Likewise, these same surface conditions may make seemingly unsuitable mines (small, simple workings) excellent habitat. As stated, no template is available against which mines can be compared to infer actual or potential use. Therefore, techniques for identifying constraints and important characteristics of roosts, on a local scale, will be discussed.

Key Words: Bats, abandoned mines, habitat, roosts, habitat selection, variability

Introduction

The use of abandoned mines by bats has become an important issue to the mining industry, management agencies, conservation groups and wildlife biologists. While documentation of bats using abandoned mines as roosts has long been known (Pearson, 1962), it has only been in the past two decades that the management and protection of abandoned mines has become a serious, industry-wide issue. The challenge of locating, identifying, and protecting critical roost locations, while concurrently providing for human safety and ongoing mineral exploration and extraction, is daunting. Techniques associated with locating (i.e., survey techniques) and protecting (education, signing, gating, etc) roosts are being addressed elsewhere in these proceedings (Altenbach *et al.*, this issue; Brown,*et al.*, this issue). Here we discuss how to identify specific characteristics of abandoned mines that are important to bats.

There is no list of variables that can be used to absolutely gauge the quality of a particular abandoned mine to local bats. In reality, the use of abandoned mines by bats is far too complex to suppose that a "cookbook" approach that lists attributes of all mines, that all bats select for can be effective. At best, sweeping inference about large scale biological processes is inaccurate, at worst, it can cause the implementation of inappropriate management and result in the destruction of the very resources needing protection. Examples of misappropriate extrapolation of data across spatial scales, are the following statements: "bats don't use coal mines," "bats won't use shafts," "mines less than 50' long won't be used by bats." Unfortunately, these statements were used to excuse conducting biological surveys of mines prior to site destruction (through reclamation, renewed mining activity, etc).

When attempting to identify habitat associations of a given species or group of species, it is imperative that the proximate and ultimate constraints of the system be understood (Krebs, 1989). As a general rule, the smaller the geographic range and more simple the natural history of a given organism, the more narrow will be the constraints imposed on the system (Krebs, 1989). The more narrow the constraints, the lower the potential variability, and the more easily definable the habitat associations. For example, habitat associations of the Rocky Mountain Bighorn Sheep (*Ovis canadensis*) are much more easily identified than those of the Great-horned owl (*Bubo virginianus* – Krebs, 1989).

Habitat associations of bats are difficult to define for several reasons. First, the proximate and ultimate constraints on the system are not clearly understood. Second, the natural history of most bats is complex, and in most species is still not well understood. Bats spend a significant amount of time roosting, and the first step in determining habitat affinities is to understand the types of roosts used. Approximately 25 species in the US are known to roost in abandoned mines and 22 of these are considered to be dependent upon abandoned mine workings during at least part of the year (ex. for hibernating – see Bogan, this issue; Harvey, this issue--). The association of these bat species with abandoned mines, coupled with the loss of abandoned mines to reclamation and renewed mining activity make it critical that we understand specific attributes of individual mines that make them suitable or unsuitable to bats.

The Problem

Unfortunately, no data set currently exists from which a model can be generated that can be used to identify specific variables of all abandoned mines that make them suitable to all bats as roosting habitat. It is important to remember that when individual bats or colonies select roosts, they are likely selecting for a set of conditions within a roost and are not selecting for specific roost attributes. Conditions of importance can be realized in mines of all size and configuration. In addition, local surface effects (climate, elevation, aspect, etc), often constrain subsurface conditions, making specific attributes of a given mine irrelevant (See Kurta, this volume).

For example, models of use by Townsend's big-eared bat (*Corynorhinus townsendii*) in northern Utah indicate that this species is distributed independent of internal characteristics of mines. Additionally, they are randomly distributed among available roosts in lower elevations associated with juniper woodlands (Sherwin, *et al.*, 2000b). However, this model does not work beyond the sub-regional level (scale dependent); in addition, this same model may not be applicable across temporal scales (Sherwin, *et al.*, 2000a). Models of roost affinities are both spatially and temporally scale-dependent, and will likely be extremely effective at local scales. However, applying these models to other locations and/or other systems is inappropriate at best (Sherwin, *et al.*, 2000a).

Investigating the Problem

The sensitivity of local models to variation in spatial and temporal scales make it critical that resource managers and researchers collect appropriate data in their system of interest and consider important variables driving selection of roosts at the local level. Due to the inherent complexity of this system, investigators need to clearly define specific problems and objectives of interest. Therefore, we propose that the a *priori* answering of six questions will aid managers and researchers in identifying local mines of importance to bats.

What species is being addressed?

No two species of bats have the same physiological or natural history requirements (Hill and Smith, 1984), therefore, it is essential that researchers clearly identify which species is/are being studied. Merely stating an investigation of roost selection by "bats" supposes that the entire system is static, with all populations of all species driven by the same constraints. In fact, enough variability exists among populations, and across ranges, that even species-level generalizations are rarely accurate (Sherwin, et al., 2000a).

What type of "use" is being investigated?

When discussing selection of abandoned mine roosts by bats, it is imperative that the type of use being discussed is clearly articulated. Types of use include maternity (pre-birthing, birthing, pre-weaning, weaning, post-weaning), bachelor, mating (lek sites), night roosts, migratory, hibernation, etc. Variables driving selection of roosts differ dramatically depending on the specific type of use being investigated.

What is the spatial scale of interest?

Effects of spatial scale are often ignored when attempting to identify variables of significance to selection of roosts by bats. Spatial scale should be clearly articulated *a priori*, as level of inference is limited to the level of spatial scale of collected data (i.e. data can never be applied at smaller spatial scales). For example, a landscape level study provides no data from which micro-climate inference should be made (see Channel and Lomolino, 2000; Sherwin, et al, 2000b; Sherwin, et al., 2000a; Strayer, 1999).

What temporal scale is being investigated?
Temporal scales range from within and among seasons to use of roosts within and among years. Some species exhibit tremendous variability in relative fidelity to specific roosts (Lewis, 1995; Sherwin, et al., 2000a; Sherwin, et al., 2000b). While all scales of temporal investigation are valuable, care must be made when attempting to impose short-term patterns on larger temporal scales. Systems can only be interpreted as simple (black and white—presence/absence) by a single visit. Only through the implementation of multiple surveys, across temporal scales, can accurate resolution of biological processes be achieved. This is particularly important when attempting to investigate more subtle patterns of roost fidelity and complex use of roosts reflecting complex behaviors (e.g., mating, intra/interspecific behaviors).

Temperature is probably the most important feature affecting use of roosts by bats and can be extremely temporally sensitive. The high surface-to-volume ratio of bats increases thermal stress, making activity metabolically costly. To offset these physiological costs, many temperate bat species respond to environmental stressors (decreased ambient temperatures, lowered concentrations of prey, etc.) by entering torpor and/or hibernation. There is an optimal temperature range that individuals seek, at which they minimize energy output, while maintaining some theoretical minimum of physiological activity. Temperatures below this range may induce permanent cellular damage while higher temperatures may result in costly output of energy. Similarly, other seasonal use requires equally complex thermal requirements (ex. maternity). When attempting to create a thermal profile of internal mine conditions, researchers must be aware of the difference between mean internal temperatures and the variance of internal temperatures. Some species appear to select for stable mean temperatures while others appear to prefer areas with low temperature variance. In addition, resolution of internal temperature profiles can only be achieved through the use of continuous recording devices (data loggers), as temperatures can vary dramatically within a site and can fluctuate tremendously (Figure 1). Point measurements at time of survey are not accurate estimates of internal temperature profile (Sherwin, *et al*., 2000b – Figure 2). Other potentially significant variables that are temporally sensitive include human disturbance and predation.

What level of biological significance will be attributed to occupancy, and what will occupancy infer about roost quality?
This will vary due to specific natural history requirements and current management status of individual species. For example, maternity sites are often viewed as more significant than bachelor sites. This assumes that constraints on reproductive females (with regards to roost selection) are more pronounced than those imposed on males. In addition, this may vary across a species' range. For example, in Utah, groups of hibernating Townsend's big-eared bats are generally small (1-2 individuals), with groups exceeding 5 individuals considered rare. So in Utah, a gate might be recommended for a mine used by a single individual, whereas this same standard may not be valid in New Mexico where wintering groups tend to be much larger.

How will habitat be defined?
The spatial scale of habitat is critical to the management of abandoned mines. It is vital that habitat be clearly and concisely defined. For example, will a roost be defined as the point of

actual interface between the organism and the substrate (i.e. the contact point), the feature of use (i.e. the crack, crevice, rock), the working providing the feature (the drift, stope, etc.), the entire mine (all drifts, stopes, etc), the opening(s) providing access to subterranean workings (many mines include dozens of openings), all mines in a complex (complexes often include hundreds of workings), all complexes in a landscape, etc. The definition of habitat dictates what kind of data will be collected. For example, if habitat is defined as the actual interface of the bat and the mine (point of roosting), only intensive, non-invasive techniques are appropriate to provide data necessary to elucidate selection of micro-climates (i.e. data loggers, continuous video, etc). If habitat is defined as "the mine" – including all openings, less intensive monitoring is necessary, but less resolution is provided. In addition, habitat should not be limited to specific roost attributes (however defined), but should include adjacent vegetative communities and other landscape data, because mines do not exist in a vacuum and selection of roosts can be completely independent of subsurface conditions.

Summary

While the use of abandoned mines by bats is a complex system we do not propose that it is unmanageable. However, it is only through understanding and appreciating the potential variability and reflected complexity of this system that biologically valid data regarding roost affinities of bats can be obtained. If the inherent complexity of this system is ignored and simplistic measures applied, mismanagement will result. By appreciating the potential variability in this system, researchers and managers will collect data applicable to the specific problems being investigated. We propose that by addressing the above questions before initiation of data collection, the likelihood of suitable techniques being applied increases.

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Richard E. Sherwin is an applied ecologist, interested in applying the most current techniques to the conservation and management of wildlife species. Current research pertaining specifically to the use of abandoned mines by bats has led him to over 3,000 abandoned mines throughout the United States, Canada, and Central America. This research has been presented at over 25 professional meetings, and has been published in several peer-reviewed journals.

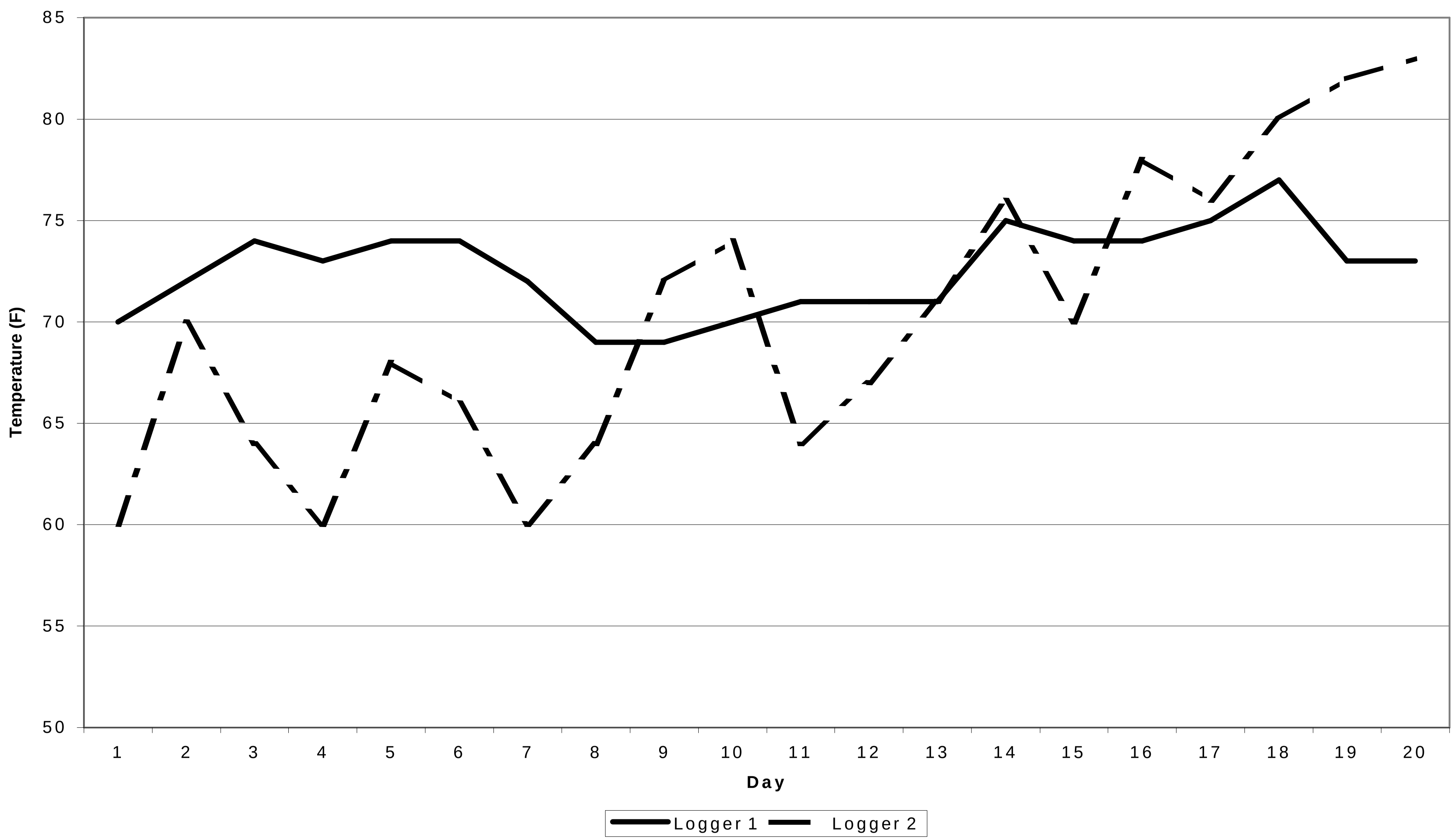

Figure 1. Two data loggers placed two feet apart in the same mine. These data suggest that caution be taken when attempting to create a thermal profile of mine with limited data.

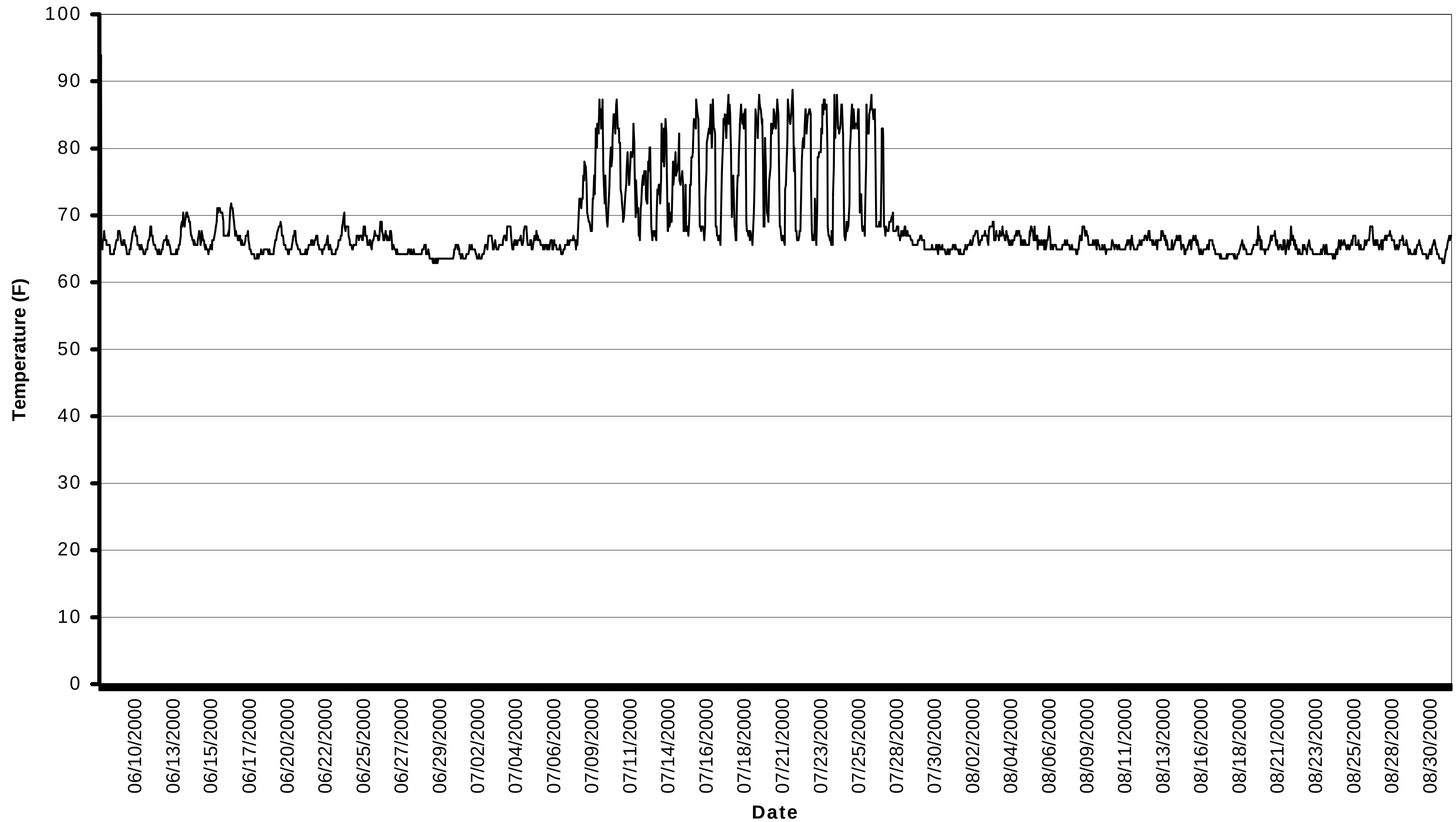

Figure 2. Temperature data collected at the interface of substrate and a maternity colony of Townsend's big-eared bat (*Corynorhinus townsendii*). Maternity colony present between 07-07-2000 and 07-29-2000. Internal micro-climate is regulated by the roosting colony and would appear to be "unsuitable" for a maternity colony based on simplistic sampling of temperatures.

PRE-MINE CLOSURE BAT SURVEY AND INVENTORY TECHNIQUES

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Abstract

Programs to safeguard abandoned mines have stimulated active programs to evaluate them for wildlife use, particularly use by bats. Experience gained over more than a decade of surveying abandoned mines has demonstrated that we still do not understand enough of the biology of the bat species commonly using abandoned mines, particularly in the West, to accurately predict patterns of use. Surveys are required and experience again has demonstrated that external surveys require specialized equipment and vastly more time than internal surveys. They are virtually incapable of detecting several types of bat use common in the West and those relying on them must be willing to err on the side of excessive caution to keep from making disastrous decisions about destructive closure based on negative survey results. Although internal surveys require proper equipment, experience and training, they are the most reliable and least labor intensive type of survey for evaluating roost quality. Internal surveys provide data from which more informed decisions about appropriate types of closures of mines, particularly those which are complex and have multiple entrances. They can provide critical information for the design of both protective and destructive closures. A small, steadily-growing pool of qualified surveyors makes internal evaluation more feasible and an enlightened attitude on the part of several agencies now permits formal training and experience in abandoned mine entry. In recent times, shaft evaluation has become feasible and can make a considerable contribution to informed closure decisions where shafts comprise a high proportion of abandoned workings. Orders of magnitude more complicated than entry of horizontal workings, specialized equipment and experience is required. Although marginally effective for bat surveys in shafts, relatively new down-hole camera technology has proven itself to be useful in identifying blind shafts and thus eliminating time intensive internal evaluation of working with virtually no bat potential. In districts with large numbers of shafts, this technology has saved hundreds of hours of survey time.

Introduction

As illustrated by Sherwin *et. al*. (this volume), the use of abandoned mines by bats is complex, as is the environment provided by the mines they use. The use of abandoned mines by bats is sensitive to both spatial and temporal scale, making any short term evaluation of abandoned mines difficult. As more time has been devoted to understanding this system across these scales, the more we have learned, and the better we are able to evaluate and predict the use of mines by bats. Experience over the last decade demonstrates we had only limited understanding of the capabilities, habits and requirements of many species of bats using mines and we still have a great deal to learn. Sherwin *et. al*. (this volume) emphasize that extrapolation from one temporal or spatial scale to another is risky. For example, use of correlative data of internal temperature and specific bat use at one site to judge another abandoned working as suitable or unsuitable, without appropriate survey, courts disastrous decisions. These problems are magnified when this same data is applied across larger spatial or temporal scales.

The following should not be taken as a comprehensive manual on mine evaluation, rather it points out stumbling blocks and factors that can be easily overlooked. It should be used as a starting point and a guide for refinement of a local program. The process of evaluation of abandoned mine use by bats is complicated and must be adjusted to accommodate regional differences, time schedules and availability of expertise. The material presented in this document is only applicable within the framework of the question which is being asked. For example, a biologist wishing to understand local population dynamics would apply these techniques over several years and gradually accumulate a more complete picture. Several years of surveys would be required to resolve patterns exhibited over a multi-year period. In contrast, a local manager who is limited to a single year of survey time, or worse, a single survey, is unlikely to resolve complex spatial and temporal patterns of use. Therefore planning of surveys must consider the least labor intensive and most productive approach and the limitations of the data must be understood prior to its interpretation. Sherwin, et al. (2000a) present effort curves which show average times required to resolve patterns of use in abandoned mines by *Corynorhinus townsendii*. This work emphasizes the need to understand what could be learned from single compared to multiple visits to the same mine workings.

Inventory and Initial Survey

Even though persons doing external surveys (either initial surveys or external bat surveys) are not required to go underground, they should realize that hazards exist on the surface around abandoned mine openings and they should have proper training on these hazards and how to avoid or minimize them. Shafts are very dangerous and surveyors should be specifically trained to approach them. Navo (1995) discusses possible levels of training for personnel as does Perkins and Schommer (1993).

An inventory is simply the location and generation of a map of all mine features in a project (an inactive mine or group of inactive mines scheduled for closure). An initial survey involves description of the mine openings (features) and recording of all information that can be gathered without underground entry including: dimensions, elevation relative to other openings, airflow direction and airflow temperature, obstacles in opening (rocks, vegetation, limbs, trash, portal or headframe timbers), potential hazards, depth of the mine feature (vertical or horizontal) as can be observed from outside, presence of internal complexity (drifts, crosscuts, raises, winzes or stopes) which can be observed from outside, and observations of any wildlife or wildlife sign (excrement, carcasses, staining, discarded parts of insect prey etc.). In some cases mine maps are available that can provide insight regarding the size, internal configuration and possible interconnection of multiple openings. However, for many older mines, no maps exist, or workings may have been modified subsequent to the creation of maps. The size of the mine dump is not a reliable indicator of internal volume. Typically a large dump indicates a proportionally high volume of internal workings but the inverse may not be true.

Airflow can indicate at least moderate size, multiple openings at different elevation, and complexity, but lack of airflow does not indicate their absence. Airflow in mines with single openings may be caused by barometric pressure changes. In mines with multiple openings at different elevation, airflow will typically change direction with season, and will cease for varying periods at seasonal turnover points. As the outside temperature drops below the mean annual temperature, air will generally exhaust from higher openings. It will exhaust from lower openings as the outside temperature rises above the mean annual temperature. However, there are numerous examples where this does not occur and no explanation of airflow patterns exists.

In an initial survey, a mine can sometimes be eliminated as a possibility for bat habitat. If the rib (side), back (ceiling) and floor of shallow adits and the rib (side) of shallow shafts can be observed to determine that no lateral workings are present (blind) and no sign of wildlife is seen, the mine probably has low potential as bat habitat. If a shaft is flooded above any lateral workings or if an adit is flooded to the back, even periodically, it can be considered to have low potential. However, even in some very shallow mine features, it is sometimes impossible to distinguish depressions from lateral workings. Adits as shallow as 10 ft have been found to have maternity colonies and guano accumulations from them are easily obscured by rock or debris on the floor. Significant colonies of bats have been found in lateral workings, impossible to see from the shaft collar, off of shafts as shallow as 10 ft. Reliable determination from the surface that a shaft is blind can be difficult in shafts as deep as 10 ft, highly unreliable in most down to 30 ft and virtually impossible in those deeper than 30 ft. The presence of shaft timbers makes reliable evaluation even more difficult. The use of a current generation of small, light video cameras offers a technological solution to the difficulties of finding lateral workings in shafts without the necessity of shaft entry. This is discussed below in the section on Shaft Evaluation.

Internal or External Surveys

If a mine feature cannot be eliminated as wildlife habitat by an initial survey, an external or internal survey is warranted. A decade of experience by many surveyors has demonstrated that external surveys are generally much more time consuming and can be less reliable for determining some kinds of use than internal surveys. Although this discussion treats external surveys as a fall-back option to be used when restrictions or underground hazards prevent a thorough internal survey, external surveys can provide data that internal surveys cannot. Some of the situations which favor internal surveys include: 1) large, complex underground mines with the possibility of multiple openings, 2) an area has a high number of scattered openings and underground connections are unknown, 3) time to conduct surveys is limited, 4) an understanding of interconnections required to maintain airflow to support significant bat use is needed. Some of the situations which favor external surveys include: 1) accurate counts are required for subsequent establishment of population trends, 2) data is required to establish which of several entrances are used by bats, 3) situations described below in A. In many situations, detailed knowledge of bat use requires a combination of both internal and external surveys.

Bat Survey Decision Key

The following decision making processes are presented in the form of a dichotomous key where each couplet references additional options. These are presented below and subsequently discussed in greater detail.

A Complete Internal Survey Possible..................B (below)

An internal survey should be conducted until at least a high proportion of the mine is evaluated before declaring that no bats or sign have been encountered. Generally, if bat use in a mine is significant, bats, sign, or both are encountered before the entire mine has been evaluated. It is seldom possible to see all of large and complex mines but it is also seldom necessary. If no evidence of bats has been encountered and the mine has inaccessible levels, large stopes which cannot be accessed, or levels in shafts which cannot be accessed, either the search must be expanded or an external evaluation is required.

A' Complete Internal Survey Not Possible.............G (below)

Reasons in A, hazards prevent or force termination of internal survey, authorities will not permit.

When it is determined that an internal survey is possible the following approach is one that has been used by one of the authors (JSA). Although continuously updated as understanding has changed, it was originally proposed by Altenbach and Milford (1991) and modified by Altenbach

(1995, 1999). It has been used, sometimes with modification necessitated by local conditions, for mines in much of the United States.

B **Cold Season Survey**

No Guano, Sign or Residents............................**F**
Guano or Other Sign..**C**
Residents..**E**
Internal Conditions (Water) May
Obscure Sign..**C**
All, or enough, of the mine cannot be seen......**G**

C **Warm Season Survey**

No Residents - Night Roost, Migratory Use,
Specialized Reproductive Behavior,
Undocumented Use...............................**D**
Residents...**E**

D **Fall or Spring Survey, Dropping Boards**

No Residents, No Additional Sign
(Roost Abandoned, Used Periodically)...........**E, F**
Residents, Additional Sign................................**E**

E **Decision to Bat Gate Involving Following Questions**

Is a threatened or endangered species involved?
Is use significant (determined regionally)?
Are alternative features, used in the same way, nearby?
How feasible is bat-compatible gating?
Will preservation of an abandoned roost provide habitat or mitigate habitat destruction elsewhere?
Is it likely survey missed periodic use?

F **Closure By Any Means**

Could survey have missed periodic use? Realization of assumptions which must be made if an external survey was applied. If any concern, final internal inspection, mist netting and tarping, or smoke bombing before closure.

G **External Survey**

By similar accumulation of data, involving observation of activity at openings, then decisions to E, F or G but with realization of the severe limits of external survey. With external survey techniques, significant kinds of use, eg. hibernation, reproductive behavior, migratory stopover, have a high probability of being missed.

Discussion of Internal Surveys (A)

An internal survey, conducted by an experienced bat biologist (experienced with the bat species which are likely involved based on geographic region, and experienced with bats and bat sign in underground workings), also trained and experienced in abandoned mine entry, has proved to be more reliable and less labor intensive than any other survey option. A team approach combining an experienced bat biologist, familiar with the hazards of abandoned mines, with a safety monitor, with a higher level of abandoned mine training and experience is equally appropriate. The safety monitor must make a decision that an internal survey is possible within the limits of safety or must make a decision to abort an internal survey if warranted. It is difficult for a safety monitor to watch every move of someone unfamiliar with basic mine hazards. Their lack of awareness of common and obvious underground hazards (eg. open winzes) invites catastrophic injury or death. A bat biologist, inexperienced in abandoned mine evaluation is often unaware of common hiding places and bat sign in underground workings.

Training and Safety Considerations for Abandoned Underground Mine Entry
As little as ten years ago, agencies and many private entities generally prohibited employees from entry of abandoned underground mines and were hesitant to hire even qualified consultants. Over the last ten years, a gradual and cautious change in attitude about entry of abandoned mine workings has taken place on the part of some Federal, State and private entities. Formal training on Abandoned Mine Entry by the Bureau of Land Management (Course No.3000-83), Forest Service (National Minerals Training Office, Mine Safety), combined with MSHA New Miner and Annual Underground Refresher training, has provided a small, but growing pool of persons qualified for entry.

Appendix 1 lists some required safety equipment. Internal surveyors should realize it is useless without comprehensive training in its use and limitations. Both are useless without thorough training in, and understanding of, the hazards associated with underground mines.

The subsequent discussion of internal surveys of abandoned or inactive mine workings is provided to illustrate the extent to which such mines are used by bats and the difficulties inherent in assessing that use. This is not a recommendation for others to conduct such surveys nor is it intended as a "how to" description. Abandoned or inactive underground mines are not "safe" to enter and there is no way they can be "made safe". (By the same reasoning cars and airplanes are not safe to ride in and mountains and lakes are not safe to hike or swim in). Persons entering them must understand and accept the associated risks. Anyone entering abandoned underground workings must have appropriate training and experience with the associated hazards and with the ways to minimize them. Caving experience does not qualify someone to enter an underground mine.

Cold Season (Internal) Survey (B)

Hibernating bats typically leave no trace of their presence and mine entry during this period is required to survey for them. Exceptions would include situations where pre-hibernation swarming of large numbers of certain species would be detected by external surveyors. During the initial cold season survey note is made of the layout of the mine and the possibility that parts of the mine cannot be explored. If it is determined that significant parts of a mine cannot be explored and no bats or bat sign is observed, external, warm season evaluation of the mine is required. Careful checking of even tiny cracks or holes in the back and rib is necessary since several species of bats hibernate in such openings. The evaluation of sign (guano, staining, discarded invertebrate parts, remains of dead bats) unless present in very large quantities, requires an experienced eye. An experienced surveyor should be able to identify the guano of many of the species, or at least most of the genera, likely encountered.

If bats are encountered in a cold season survey they must be identified with minimum disturbance. An experienced surveyor should be able to correctly identify any species using an abandoned mine. Mine lamp beams should not be aimed directly at hibernating bats and any attempt at identification should be limited to the minimum time possible. Getting exact counts of clustered or scattered bats does not warrant the disturbance involved. A quick estimate of numbers or of the size of a cluster is adequate and disturbance is kept at a minimum.

The above descriptions emphasize the necessity for experience on the part of an underground surveyor. Only an experienced surveyor is likely to find the sign indicative of use by all but very large numbers of bats, and bats which may use mine workings in an unobvious way may be overlooked. Highly experienced underground explorers with no bat experience (eg. miners, geologists) are notorious for completely missing obvious sign and conspicuous bats.

Warm Season (Internal) Survey (C)

Warm season generally means at a time when bats are active and flying in and out on a regular basis. The exact timing of these surveys will vary geographically and with yearly variations of local climactic conditions. For example, an unusually cold or prolonged Spring may cause a delay of a month in maternity activity. Consultation with local bat biologists is necessary to time warm season surveys. Maternity colonies may occupy one roost before delivery of pups, another for delivery, and a third after the pups are volant. This complexity must be considered in the timing of warm season evaluation.

Internal surveys during warm season are conducted with extreme care. Many species of bats are intolerant of disturbance at a roost site, especially during the time they are having and caring for pups. Disturbance can easily cause relocation of a colony and worse, mortality of pups (Mohr 1972, Humphrey and Kunz 1976). A mine is approached, entered and explored quietly during a warm season survey. Serious disturbance of alert bats in order to make identifications or counts is not warranted. If bats cannot be identified, or if an approximate count is not possible, without disturbing them, external evaluation involving capture or bat detectors and experienced interpretation is in order.

If no bats are found in residence, guano may contain discarded invertebrate appendages and wings that indicate night roosting. If night roosting is suspected, the mine is again entered at night to observe the species and numbers involved. The portal can be monitored with a bat detector or individuals can be captured with mist nets or harp traps. Bats are seldom encountered during an internal survey in mines used as migratory stopover roosts and identification of the species typically involves a careful search for carcasses which can then be identified. Repeated visits to the mine in the time period when migration is thought to occur makes encountering and identification of the residents more likely. Material placed on the floor where guano accumulation occurs (dropping boards) can resolve the time and amount of guano deposition. Recent discovery of mines used entirely for complex reproductive behavior (Brown, 1999) demonstrate highly significant, periodic use that can be difficult to resolve. Repeated external and internal observation was required to clarify this highly significant use after evidence was noted on an internal survey.

Shaft Evaluation

In many mining districts, shafts are common and may constitute a high proportion of the abandoned workings. In localities in many Western States, a high proportion are not flooded and many provide bat habitat. Because of the greater difficulties involved, many private interests and government reclamation programs have not been evaluating shafts as potential habitat prior to closure. Although sometimes sealed with non-destructive closures (ex., rebar grates), typically because of historic preservation requirements, most have been close destructively without evaluation or consideration of habitat potential. A notable exception is the Abandoned Mine Lands program in New Mexico where shafts have been evaluated and bat compatible closures have constructed if appropriate. Ten years of extensive experience evaluating shafts (over 2000) in New Mexico, California, Nevada, Utah, Minnesota, and Texas by the authors, has demonstrated that bats readily use them in all of the ways that horizontal workings are used, and the incidence of bat use of shafts is actually higher than in horizontal workings (Altenbach, et al., In Prep).

Lateral workings are notoriously difficult to detect in shafts and this is compounded by shaft timbering. A second issue is that even though internal shaft evaluation can be done safely, it is an order of magnitude more difficult and time consuming than horizontal mine evaluation because of the highly specialized equipment required to compensate for the higher risks. It requires more experience and is generally not recommended unless a specialist is available. The use of vertical climbing techniques is extremely dangerous for shaft evaluation because of the probability of material falling from the collar or rib. Surveyors using climbing techniques to access vertical workings are reckless, and jeopardize a cautious acceptance of internal mine evaluation procedures!

Use of down-the-hole video cameras, hard-wired to a surface viewing screen, has proved an effective tool to determine if a shaft is shallow and blind and thus does not require time consuming additional evaluation. This technique can also identify shafts that have one or more levels where bat use is possible and internal evaluation or conservative assumptions about use warranted. Without internal evaluation, this information would make a bat compatible closure a more reasonable alternative than if the internal complexity remained a mystery.

This technique is not a substitute for internal evaluation of shafts with lateral workings, deep shafts, or timbered shafts where a bat, or bat sign is probably not visible to the video camera. If internal evaluation is not possible in these shafts, it must be assumed that at least appropriate habitat for a variety of bat use exists and the mine feature should be surveyed externally. Highly significant hibernation sites for several species have been found to depths of nearly 3000 ft and maternity and bachelor colonies have been discovered at depths of over 400 ft. In addition, even blind shafts (without lateral workings) can trap cold air providing ideal hibernation sites for bats. Other shafts are warmed at depth, perhaps by geothermal heating, and provide warm temperatures ideal for other kinds of use.

Discussion of External Surveys (G)

External surveys require experienced personnel and a larger number of person-hours than internal surveys. Specialized equipment which is vital for effective external surveys can be costly, eg. night vision and sophisticated acoustic monitoring equipment, and can require extensive experience to use properly, eg. acoustic monitoring equipment. If an external survey is the only option, techniques are discussed by Navo (1995), Navo et. al.(1995) and Tuttle and Taylor (1994). Rainey (1995) provides an excellent overview of equipment, and references, to assist external surveying.

Applications

External survey techniques are suited for resolving warm season use (maternity or bachelor colonies) where exit or entry flights occur nightly over an extended period. Pre-hibernation swarming typified by large colonies of *Corynorhinus townsendii* and *Myotis lucifugus* may be readily detected if the timing of these events is predictable in a given locality. If these types of use are expected, external surveys may be appropriately timed and implemented to detect them. External surveys can only provide positive data, so absence of evidence should not be interpreted as evidence of absence. Uses such as migratory stopover, short-term responses to climatic changes, use in cold season by small numbers of bats or by bats which do not swarm are difficult to detect. In addition, external techniques are not reliable for resolving events which happen inside a mine, such as reproductive behavior. Data from an external survey cannot be applied across temporal scales and inference cannot be made about past or potential future use.

External surveys are particularly useful when combined with internal surveys at large, complex mines. Some bats (eg. *Antrozous* and some species of *Myotis* and *Pipistrellus*) are very secretive and are easily missed by experienced internal surveyors. If no bat use is detected in a large mine and it is clear that many parts of the mine are not accessible for close evaluation, an external survey of entrances in warm season may be appropriate.

Timing and Implementation

The timing of surveys is critical and depends upon the seasonal changes in bat activity typical of the region in question. Publications on the biology of species that might be in a particular area, as well as consultation with local bat biologists, provide a good starting point for planning the timing of external surveys.

Surveys should be conducted on nights without rain or strong wind, by observers stationed at least 15 ft off to the sides of the mine opening. Setup must be kept quiet be completed at least 30 minutes before sunset. Although red lights have been recommended for external surveys, recent evidence suggests bats may be more sensitive to red light than previously thought. After bats can no longer be seen silhouetted against an evening sky, night vision or InfraRed (IR) video camera equipment can be used to observe a mine opening. Observations must be maintained for at least 2 hours after sunset.

Bats often prefer specific entrances of multi-entrance mine complexes and disturbance by surveyors at this entrance is likely to cause use of an alternate. Even when surveyors attempt to be quiet, a large body of evidence suggests that bats are likely to be aware of their presence. Therefore, all entrances in a particular complex should be surveyed on the same night.

Equipment
The technology for remote, data logging, acoustic or proximity detector monitoring of mine openings has grown over the last decade. Rainey (1995) gives an overview of some examples but the availability of relatively inexpensive video cameras has revolutionized the field. These small cameras with highly sensitive IR detection can record bat activity at mine openings at distances of well over 50 ft. Unattended cameras, set to actuate at predetermined times, can collect data at as many mine openings as a surveyor has cameras. At one sixth the cost of high resolution night vision devices, the external survey capabilities of a single surveyor is increased enormously. An added benefit is that a carefully positioned, unmanned camera will be less likely to cause disturbance and use of alternate mine opening by bats. An IR video camera, coupled with a sophisticated acoustic monitoring system, provides the capability of accurate timing and resolution of activity with improved species identification.

External Capture Survey
If active bats cannot be identified during an internal or external survey, or if determination of sex or reproductive status is required, capture of some individuals for close examination may be warranted. Persons conducting capture surveys must be capable of field identification, rabies immunized and have necessary state and/or federal collecting permits. The help of local bat biologists, experienced in the use of capture devices to minimize injury to bats, and familiar with handling of local species is appropriate. Setup of mist nets or harp traps is completed at least 30 minutes before sunset and is done as quietly as possible. Nets or traps (with someone in attendance at all times) are left up at least two hours after sunset or later if there is a possibility that the mine is used as a night roost. After enough bats have been caught for identification and released, the capture devices are taken down to minimize disturbance.

Decision to Install Bat Compatible Closure (E)

Significance
If a threatened or endangered species is using a mine the decision to use some type of bat compatible closure is clear but must involve consultation with appropriate State and or Federal authorities. Presence of a Species of Concern, formerly a USFWS Category II, might be more significant than species not so listed.

The question of significant use is difficult as it is dependant on location and community structure. For example a single, hibernating individual of one species might not be significant in one part of its range but would be in another. Variability in the use of roosts within a species' range makes it impossible to create range wide rules about significance. In some regions single hibernating individuals in small, scattered mines are typical, in others, small to large groups are typical. Input from local bat biologists is necessary to evaluate numbers and conditions of use in the light of comparison with other local populations or trends in population size. Significance must also be weighted against the presence or absence of a comparable mine feature or protected natural roost site, used in the same way, being nearby. All scenarios must be weighed against the complexity, feasibility, cost and reliability of such closures.

A maternity or bachelor colony of any species is significant and cause for installation of bat-compatible closure. The use of a mine by bats in any way not documented or not understood should be considered highly significant unless it can be demonstrated otherwise. All closures but must be weighed against involved costs, feasibility and availability of comparable, more easily gated features nearby.

Another complicating factor is the movement between roost sites over seasons or even years. Maternity colonies of some species such as *Corynorhinus townsendii* routinely move among available abandoned mines over the course of gestation, birth, growth and maturation of the pups (Sherwin, et al., 2000b). Before a site is declared abandoned, additional evaluation over at least a year to check for fresh sign, or bats, is prudent.

Timing of Mine Closure (E, F)

The selection of appropriate "time windows" for non-bat-compatible closure must minimize the chance that unknown residents will be trapped inside. Installation of bat-compatible closures must likewise be timed to minimize disturbance of residents. These time windows will vary with the type of use, the species present and the region of the country. Closure activities need to be coordinated with the help of local bat biologists.

Conclusions

When the systematic evaluation of bat use in abandoned mines was undertaken on a near national scale a decade ago, it was hoped that correlations between external characteristics of an abandoned mine and its use by bats could be established. This would at best eliminate the need for internal evaluation and at least simplify the survey process. Tuttle and Stevenson (1978) and Tuttle and Taylor (1994) have suggested that if the internal configuration, configuration of openings and mean annual surface temperature is known, internal temperature conditions, and thus suitability for bat occupancy, can be predicted. They infer, perhaps correctly, that mines with multiple openings and complex internal configuration are likely to have variations of internal conditions that maximize the chances parts will be suitable to bat use. However, as Sherwin *et. al* (this volume) have shown, correlations of use and temperature, especially microenvironmental temperature, have been difficult to establish. Small, uncomplicated mine workings can have large and significant use by bats. Even if we could make broad spatial and temporal scale predictions about temperature and use, we are still unable to predict internal temperature itself.

The size, internal configuration and number and configuration of openings of most mines is nearly impossible to determine by external evaluation. In some instances, mine maps may be available but our experience shows that these are seldom complete. The quantity of waste rock at a portal is not necessarily an indicator of internal volume. Ventilation openings, common in many mines (Hardesty, 1988), sometimes have no waste rock around them, are often small and many times inconspicuous. Where there are several mines in a restricted area, the configuration of surface openings gives virtually no indication of how, or if, the internal workings connect. Airflow measurements must be made at all openings to even guess at internal configuration and a variety of conditions can influence airflow. Strong airflow at a mine portal suggests that there are other openings but lack of airflow does not indicate their absence. In addition, the airflow patterns of some mines as yet cannot be explained. Similar mines, close to each other, can have very different internal temperatures because of geothermal heating or for unknown reasons.

For the majority of abandoned mine sites no mean annual temperature data exists. Often a town for which temperature data is available is at a different altitude than a mine site only a few miles away and has different surface temperature conditions.

Bat biologists have a great deal to learn about even basic bat biology. This data has been accumulating for many years and a great deal is known about many species but even for very common species, large gaps exist. For example, *Myotis yumanensis* is an extremely common warm season resident of the Rio Grande and Pecos drainage in New Mexico but until a migratory stopover roost of this species was discovered in a deep shaft in the mountains of central New Mexico, **nothing** was known of the non-warm season activity of this species in New Mexico. In June the internal temperature of this mine is several degrees cooler than any known maternity roost site of any bat found in New Mexico. However, in June female *Myotis thysanodes* with near term foetuses were found in torpor in these workings. A possible hypothesis is that the animals may be driving embryonic diapause with this behavior. Both of these examples of bat use were considered highly significant and justified bat-compatible closure. We are continually surprised by finding bats at great depth in shafts in both warm season and cold season.

Until comprehensive research provides a measure of predictability, we believe the systematic evaluation of all mine features scheduled for closure provides the only possibility for combination of the goals of securing abandoned mines for human safety and protecting bats that may rely on them. We have to consider that almost any mine can be potential habitat for bats and the only way to know is to look.

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Appendix 1: Safety Equipment for Abandoned Mine Entry

The **MINIMUM** safety equipment required for underground work includes: Approved hard hat with chin strap, steel-toed boots, three sources of MSHA-approved light, multi-gas detector with at least O_2, CO, Combustible Gas capability, O_2 detector with remote sensor head. Additional equipment such as a respirator with filters is useful in some situations where particulates, radioactive particles or pathogens may be a factor. If any vertical climbing is required, the appropriate, specialized equipment and training (as well as practice) in its use is obviously vital. Vertical climbing in abandoned mines, especially in shafts, is an order of magnitude more dangerous than typical vertical mountaineering practice and is warranted under only rare circumstances. Training and supervised experience with this safety equipment, as well as thorough understanding of the circumstances and conditions which necessitate its use, is vital.

ACOUSTIC BAT SURVEY DATA SHEET

LOCATION:

LAT (N) º ´LON (W) º ´UTM Zone Easting Northing

DATE:

STATIONARY: Active Passive

HABITAT:

DRIVING:

Drive Start:

Drive End:

HABITAT:

DRIVING:

Drive Start:

Drive End:

HABITAT:

Temperature: ºC Wind: Sky:

Sunset: hrs Sunrise: hrs Moonrise: hrs Moonset: hrs

Moon (Illumination): %

Collectors:

SPECIES	Representative File Name	NOTES

BAT COLLECTION DATA SHEETS

Location

Latitude (N)________º________________' **Longitude (W)**________º________________' **UTM Zone**______ **Easting**___________________ **Northing**

Date________________________________ **Nets Open**________**hrs** **Nets Closed**________**hrs** **# nets**________ **# traps**________ (See Reverse) **Wind**__________ **Cloud Cover**

Collectors____ **Sunset**________**hrs** **Sunrise**________**hrs** **Moon**____**%** **Moonrise**________**hrs** **Moonset**________**hrs**

Time	Species	Sex	TW	Age	FA	HF	Ear	Keel	Tmb	Tl	Wt (g)	Reprod.	VS	N/T	Notes

Sex: M = Male; F = Female. **TW:** Tooth wear – 1 = no wear; 2 = rounded, ¾ = length; 3 = ½ length; 4 = near gum line. **Age:** A = Adult; YY = Young of year (epiphyses not fused). **FA** = Forearm length. For Myotis spp.: **HF** = Hindfoot. **Ear** = Length from notch. **Keel:** A = Absent; P = Present. For small-footed myotis spp.: **Tmb** = Thumb length; **Tl** = Length of tail tip beyond edge of tail membrane. **VS** = Vocal signature obtained from hand release. **N/T** = captured in Net (N) or Trap (T).

KEY TO THE BATS OF NEVADA

1 a. Nose with a prominent leafy projection (Fig. 1) (Family PHYLLOSTOMIDAE) — 2
  b. Nose without prominent leafy projection — 3

Figure 1a

Figure 1b

2 a. Ears large (> 25 mm) (Fig. 1a); tail prominent (> 30 mm) — *Macrotus californicus*
  b. Ears < 25 mm; tail absent or vestigial; nose elongate (Fig. 1b) — *Choeronycteris mexicana*

3 a. Approximately 50% of tail extending beyond the trailing edge of the interfemoral membrane (Family MOLOSSIDAE) — 4
  b. Tail fully within the interfemoral membrane with no more than a few millimeters extending beyond the edge of the membrane (Family VESPERTILIONIDAE) — 7

4 a. Forearm < 55 mm — 5
  b. Forearm > 55 mm — 6

5 a. Ears not joined at the base although occasionally meeting (Fig. 2a); 2nd phalanx of 4th digit > 5 mm (Fig. 2c) — *Tadarida brasiliensis*
  b. Ears joined at the base (Fig. 2b); 2nd phalanx of the 4th digit < 5 mm (Fig. 2d) — *Nyctinomops femorosaccus*
    [Not known from Nevada but recent extensions of the known range in northern Arizona suggests looking for this species at least in Clark County]

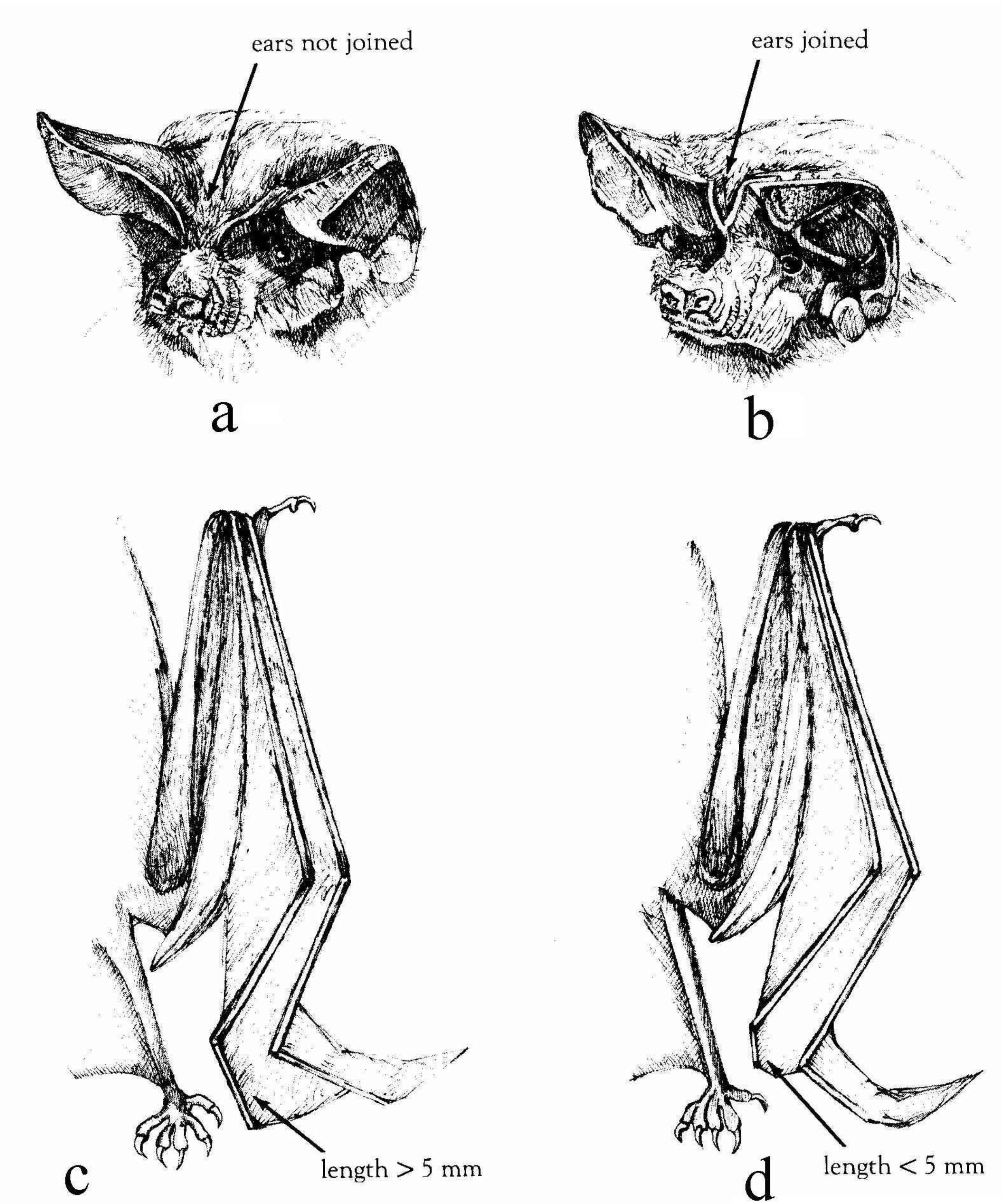


Figure 2

6 a. Forearm < 70 mm; upper lip with deep vertical wrinkles — *Nyctinomops macrotis*
b. Forearm > 70 mm; upper lip smooth — *Eumops perotis*

7 a. Ears large (> 28 mm from notch to tip — 8
b. Ears < 28 mm from notch to tip — 11

8 a. Dorsal fur black with 3 large white spots on the back — *Euderma maculatum*
b. Fur color variable but not black; no white spots — 9

9 a. Two lappets projecting over forehead from the base of the joined ears (Fig. 3a) — *Idionycteris phyllotis*
b. No lappets present between the base of the ears — 10

Figure 3a

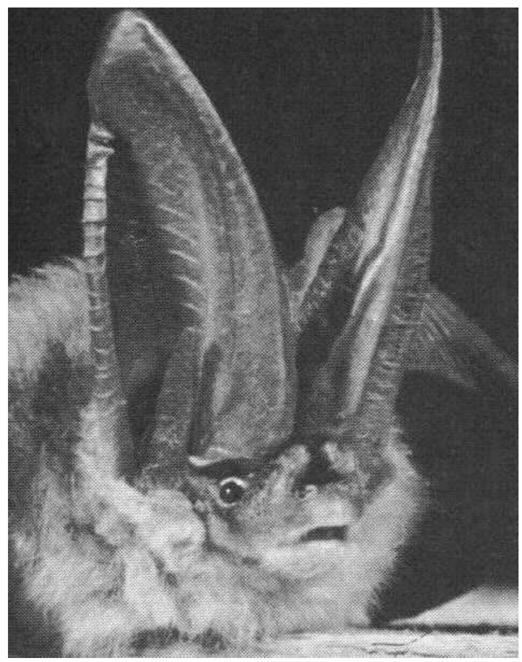


Figure 3b

10 a. A conspicuous lump on either side of the snout (Fig. 3b); fur brown to gray — *Corynorhinus townsendii*
b. No conspicuous lump on either side of the snout; fur pale yellowish — *Antrozous pallidus*

11 a. At least the anterior half of dorsal surface of interfemoral membrane well-furred — 12
b. Dorsal surface of interfemoral membrane naked or anterior third sparsely-furred — 15

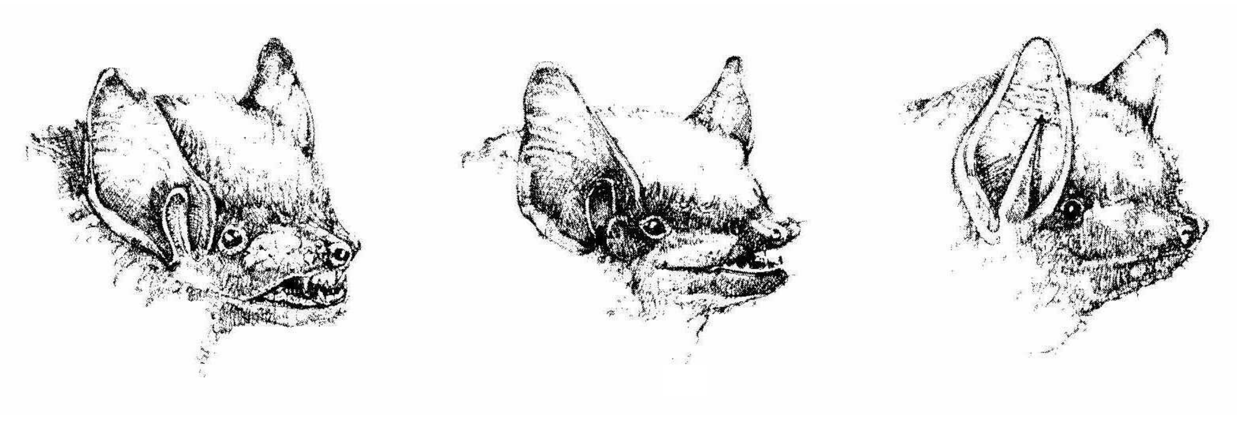
12 a. Dorsal fur black with many hairs distinctly silver-tipped — *Lasionycteris noctivagans*

b. Color variable but never uniformly black; fur may or may not be silver-tipped — 13

13 a. Posterior half of dorsal surface of interfemoral membrane bare or with scattered hairs; yellow coloration; forearm 42-48 mm — *Lasiurus xanthinus*
b. Entire dorsal surface of interfemoral membrane well-furred — 14

14 a. Forearm 38-43 mm; reddish coloration — *Lasiurus blossevillii*
b. Forearm 48-58; mahogany brown coloration with distinct silver-tipped fur — *Lasiurus cinereus*

15 a. Tragus short (<6 mm), blunt, rounded, and curved (Fig. 4a or b) — 16
b. Tragus long (> 6 mm), pointed, and straight (Fig. 4c) — 17



a) broad, rounded tragus b) curved, blunt tragus c) straight, pointed tragus

Figure 4

16 a. Forearm > 40 mm — *Eptesicus fuscus*
b. Forearm < 40 mm — *Pipistrellus hesperus*

17 a. Ear > 16 mm — 18
b. Ear < 16 mm — 19

18 a. Conspicuous fringe of hair on posterior edge of interfemoral membrane (Fig. 5) — *Myotis thysanodes*
b. No conspicuous fringe of hair on posterior edge of tail membrane but some hairs possible; ears 20-24 mm — *Myotis evotis*

Figure 5

19 a. Calcar with keel (Fig. 6) — 20
b. Calcar without keel — 22

Figure 6

20 a. Hindfoot > 8.5 mm; forearm 35-41 mm; ventral wing surface haired from elbow to the knee — *Myotis volans*
b. Hindfoot < 8.5 mm — 21

21 a. Forehead rising abruptly from the rostrum (Fig. 7); when viewed from above, naked part of snout about as long as width of nostrils; thumb usually < 4 mm; tip of tail does not extend beyond edge of interfemoral membrane (Fig. 8b, d) — *Myotis californicus*

b. Forehead sloping gently from the rostrum (Fig 7); when viewed from above, naked part of snout ca. 1.5 times as long as width of nostrils; thumb usually > 4.5 mm; tip of tail extends ca. 2 mm beyond edge of interfemoral membrane (Fig. 8a, c) — *Myotis ciliolabrum*

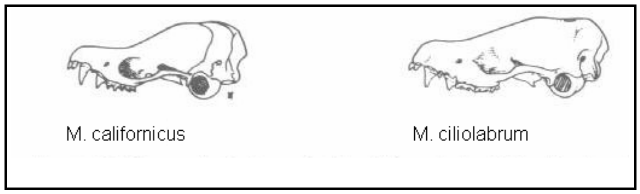


Figure 7

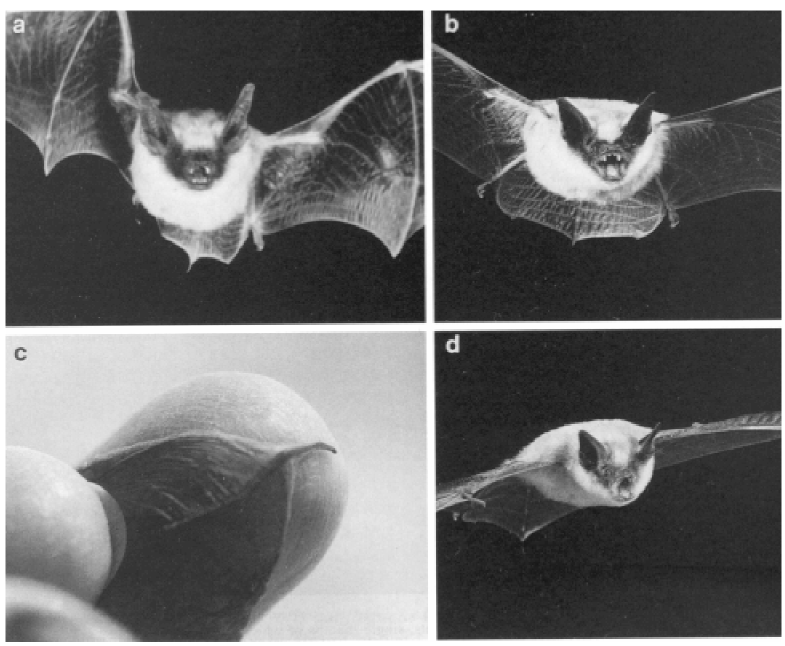


Figure 8

22 a. Forearm usually < 40 mm — 23

b. Forearm usually > 40 mm; conspicuous bare patch between scapulae — *Myotis velifer*

23 a. Forearm 36-41 mm; usually 1 upper premolar (Fig. 9); ear darker than dorsal fur — *Myotis lucifugus*

b. Forearm 32-38 mm; always 2 upper premolars; ear pale, same color as dorsal fur — *Myotis yumanensis*

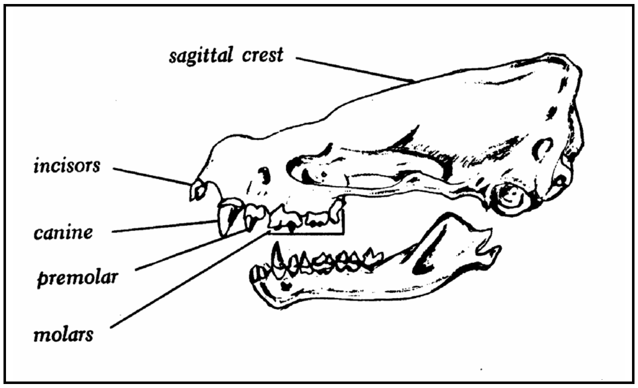


Figure 9

APPENDIX B

Proposed Legislative / Administrative Actions

Species Classification Changes for Nevada

The following table list State Classification Changes as recommended by the Nevada Bat Working Group. All information was adapted from the following sources:

- Σ 'Western Bat Species - Regional Priority Matrix' Western Bat Working Group, 1998.
- Σ Literature citations from the Nevada Bat Conservation Plan.
- Σ Nevada Natural Heritage Program Database, 2001.
- Σ Local Bat Professionals.
- Σ U.S. Fish and Wildlife Service, Proposed Rule, Endangered and Threatened Taxa, 50CFRPart 17.

Species	Current State Status	Recommended State Classification Change	Justification Criteria	
			NAC 503.103	NAC 503.104
Mexican Long-tongued Bat	Unprotected	Protected	2, 3, 4, 6	NA
California Leaf-nosed Bat	Unprotected	Sensitive	2, 4, 5, 6	1, 3, 4
Pallid Bat	Unprotected	Protected	4	NA
Townsend's Big-eared Bat	Unprotected	Sensitive	2, 3, 4, 5, 6, 7	1, 2, 3, 4
Big Brown Bat	Unprotected	Protected	4	NA
Spotted Bat	Threatened	No Change		
Allen's Lappet-browed Bat	Unprotected	Sensitive	4, 6	1
Silver-haired Bat	Unprotected	Protected	4	NA
Western Red Bat	Unprotected	Sensitive	2, 3, 4, 5	2, 3
Hoary Bat	Unprotected	Protected	4	NA
Western Yellow Bat	Unprotected	Protected	2, 4, 5	NA
California Myotis	Unprotected	Protected	4	NA
Small-footed Myotis	Unprotected	Protected	4, 6	NA
Long-eared Myotis	Unprotected	Protected	4, 6, 7	NA
Little Brown Myotis	Unprotected	Protected	4	NA
Fringed Myotis	Unprotected	Protected	4, 6	NA
Cave Myotis	Unprotected	Protected	2, 4, 5, 6	NA
Long-legged Myotis	Unprotected	Protected	4, 6, 7	NA
Yuma Myotis	Unprotected	Protected	4, 6	NA
Western Pipistrelle	Unprotected	Protected	4	NA
Western Mastiff Bat	Unprotected	Protected	4, 6	NA
Big Free-tailed Bat	Unprotected	Protected	4, 6, 7	NA
Brazilian Free-tailed Bat	Unprotected	Protected	3, 4, 6, 7	NA

The following state classification criteria were obtained from Nevada Administrative Code (NAC), Updated November, 2000:

NAC 503.103 Criteria for classification of wildlife as protected. A species or subspecies of wildlife may be further classified as protected if the division (wildlife) determines, from available information, that *one or more* of the following criteria exists:

1. The wildlife is found only in this state (Nevada) and its population, distribution or habitat is limited.
2. The wildlife has a limited population or distribution within this state that is likely to decline as a result of human or natural causes.
3. The population of the wildlife is threatened as a result of the deterioration or loss of its habitat.
4. The wildlife has ecological, scientific, educational or other value that justifies its classification as protected.
5. The available data is not adequate to determine the exact status of the population of the wildlife, but does indicate a limited population, distribution, or habitat.
6. The wildlife is listed by the United States Fish and Wildlife Service in the Federal Register as a Category 1, 2 or 3 species, or it is classified as threatened or endangered in the federal Endangered Species Act of 1973, as amended.
7. Other evidence exists to justify classifying the wildlife as protected.

(Added to NAC by Board of Wildlife Commissioners, effective 7-6-92)

NAC 503.104 Criteria for classification of wildlife as sensitive. A species or subspecies of wildlife may be further classified as sensitive if the division determines, from available information, that one or more of the following criteria exists:

1. The population or distribution of the wildlife is in a significant decline.
2. The population of the wildlife is threatened as a result of disease or predation or ecological or human causes.
3. The primary habitat of the wildlife is deteriorating.
4. The wildlife is listed by the United States Fish and Wildlife Service in the Federal Register as Category 1, 2 or 3 species, or it is classified as threatened or endangered in the federal Endangered Species Act of 1973, as amended.

(Added to NAC by Board of Wildlife Commissioners, effective 7-6-92)

Nevada Bat Roost Protection Act
(Drafted from Arizona Legislation)

Nevada Bat Roost Protection Law NRS 000.000 Defacing or damaging caves, caverns, historical mine workings, cliffs, talus slopes, or tree roosts or wildlife therein; classification

Section A.
A person commits defacing or damaging of caves, caverns, historical mine workings, cliffs, talus slopes, or tree roosts or wildlife therein if such a person knowingly, without the prior written permission of the owner/manager:

1. Breaks, breaks off, cracks, carves upon, writes or otherwise marks upon or in any manner destroys, mutilates, injures, defaces, removes, displaces, mars or harms any material found in any cave, cavern, historical mine working, cliff, talus slope, or tree roost; or
2. Either directly or indirectly kills, harms or disturbs plant or animal life found in or adjacent to any cave, cavern, historical mine working, cliff, talus slope, or tree roost; or
3. Disturbs or alters the condition of such cave, cavern, historical mine working, cliff, talus slope, or tree roost or wildlife therein or takes into a cave, cavern, historical mine working or tree roost any aerosol or other type of container containing paints, foams, harmful solvents, dyes or other coloring agents; or
4. Breaks, forces, tampers with, removes or otherwise disturbs a lock, gate, door or other structure or obstruction designed to prevent entrance to a cave, cavern, historical mine working or tree roost whether or not entrance is gained; or
5. Breaks, forces, tampers with, removes or otherwise disturbs interpretive information at the entrance of a cave, cavern, historical mine working or tree roost; or
6. Disturbs/enters a bat maternity roost between 1 April and 1 September.
7. Disturbs/enters a bat hibernation roost between 1 October and 1 April.

Section B.
As used in this section, “material” means any natural or manmade material found in any cave, cavern, historical mine working, cliff, talus slope, or tree roost.

Section C.
Defacing or damaging caves, caverns, historical mine workings, cliffs, talus slopes, or tree roosts or the wildlife therein is a gross misdemeanor.

Scientific Collection Permit Changes (NRS 503.650)
Addendum Specific to Bats

Permit Requirement

Prior to application to the Nevada Division of Wildlife for a Scientific Collection Permit to study bats, applicants must:

1. Attend at least one bat study workshop developed and presented by a recognized organization or group of individuals who specialize in bat conservation.
2. Accrue at least five, 12-hour bat survey sessions (60 hours) with a permitted bat biologist in the field (travel hours excluded).
3. Provide at least three letters of recommendation from wildlife/conservation biologists.
4. Provide at least three references other than individuals tapped for letters.
5. Provide proof of 1-4 with permit application.
6. Sign and date acknowledgement that applicant has read and understands, and will to the best of his/her ability abide by the ethical conduct outlined in the *Nevada Bat Survey Protocol* and the *Nevada Bat Roost Protection Act* found in the *Nevada Bat Conservation Plan* (2002).

Following presentation by the Nevada Division of Wildlife of a Scientific Collection Permit to a qualified bat biologist, the biologist must:

1. Follow all permit stipulations, with no exception:
   a. Strict adherence to species, number, area, and methods authorized.
   b. Collect voucher specimens only as directed in the survey protocol.
   c. Collect no more than two voucher specimens of any species/per location/per permit year.
   d. Provide acoustical voucher specimens whenever possible.
   e. Voucher collection inside roosts is strictly prohibited.
   f. Use, non-intrusive survey methods (e.g., acoustical, passive, infrared night vision, infrared video, sign catchers) whenever possible.
   g. Contact local bat biologists prior to fieldwork to eliminate duplication of effort and undue stress on bat populations.
   h. Use accepted acoustical and capture bat survey form data sheets found in the survey protocol.
   i. Provide all data in a digital format to the Nevada Division of Wildlife, Bureau of Wildlife Diversity, 1100 Valley Road, Reno, Nevada 89512-2817, 775-688-1500.
   j. Provide all locations, including roost locations in UTMs (FOIA Exempt).
   k. Provide report within 10 days of permit expiration date.
   l. Do not publish exact roost locations in peer-reviewed technical and popular literature.
   m. Provide a copy of all pertinent research, technical and popular literature to the Division.

Failure to follow any/all permit stipulations will result in permit revocation and/or non-renewal of future Scientific Collection Permit applications in Nevada.

APPENDIX C

Federal Cave Resource Protection Act of 1988 (Summary)

Given that:

1. Caves on federal lands are an invaluable and irreplaceable part of the Nation's heritage.
2. Caves are threatened due to improper use, increased recreation, urban spread and a lack of statutory protection.

Therefore:

1. Secure, protect and preserve caves on federal lands.
2. Keep confidential the nature and exact location of caves (exempt from FOIA requests).
3. Prosecute anyone who destroys or harms caves (Punishment: up to three years in prison, up to $10,000 fine.).

APPENDIX D

Guidelines for the Protection of Bat Roosts (Summary)

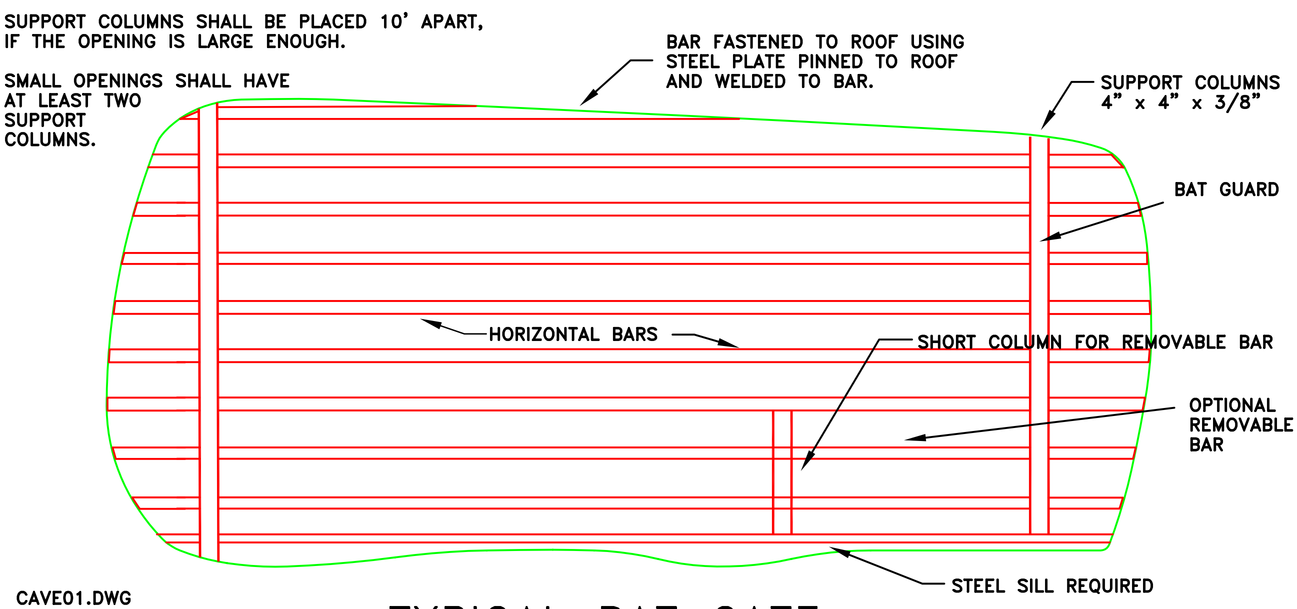
1. Do not reveal exact locations of bat roosts in technical and popular literature.
2. Do not enter bat roosts while bats are present*.
3. Do not collect bats in or near entrances*.
4. Do not allow the destruction of bat roosts.
5. Do not allow the destruction of water sources near bat roosts.
6. Do not allow the destruction of bat foraging habitats near roosts.
7. Do not conduct scientific investigations of bats without obtaining proper permits.
8. Do not use firearms, open-flame torches or toxicants near or in roosts.
9. Educate the public about the benefits of bats.

**Some protocol exceptions*.

APPENDIX E

Approved Designs for Bat Gates

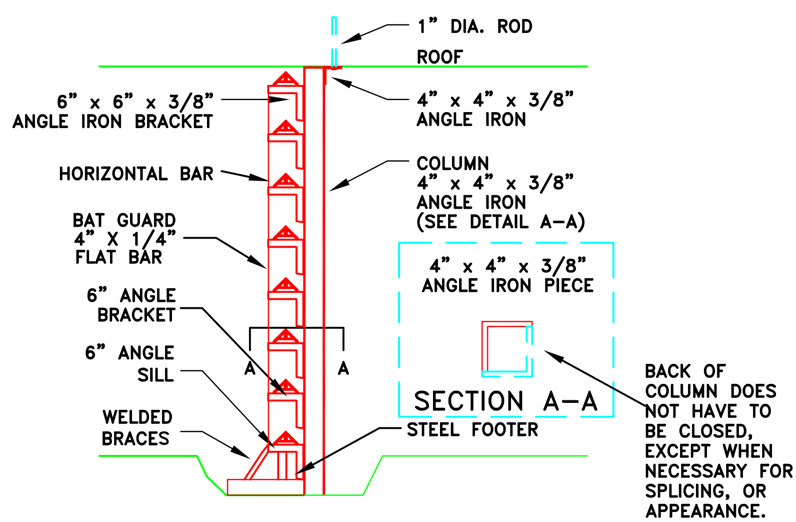
(Designed by R. Powers, Drafted by M. Washburn, cc American Cave Conservation Association)



CAVE01.DWG
Designed by Roy Powers,
Drafted by Mike Washburn
© American Cave Conservation Association

TYPICAL BAT GATE
BACK ELEVATION VIEW

NOT TO SCALE

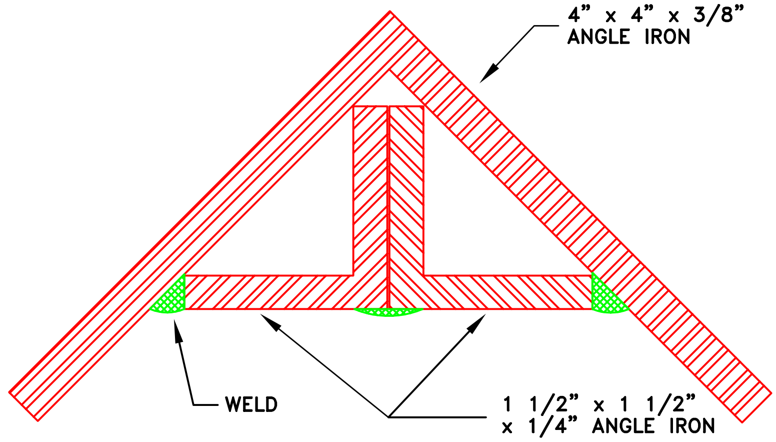


FOR ALTERNATE FOOTER, REFER TO SILL DETAIL 1

END SUPPORT COLUMN

NOT TO SCALE

CAVE02.DWG
Designed by Roy Powers, Drafted by Mike Washburn, © American Cave Conservation Association

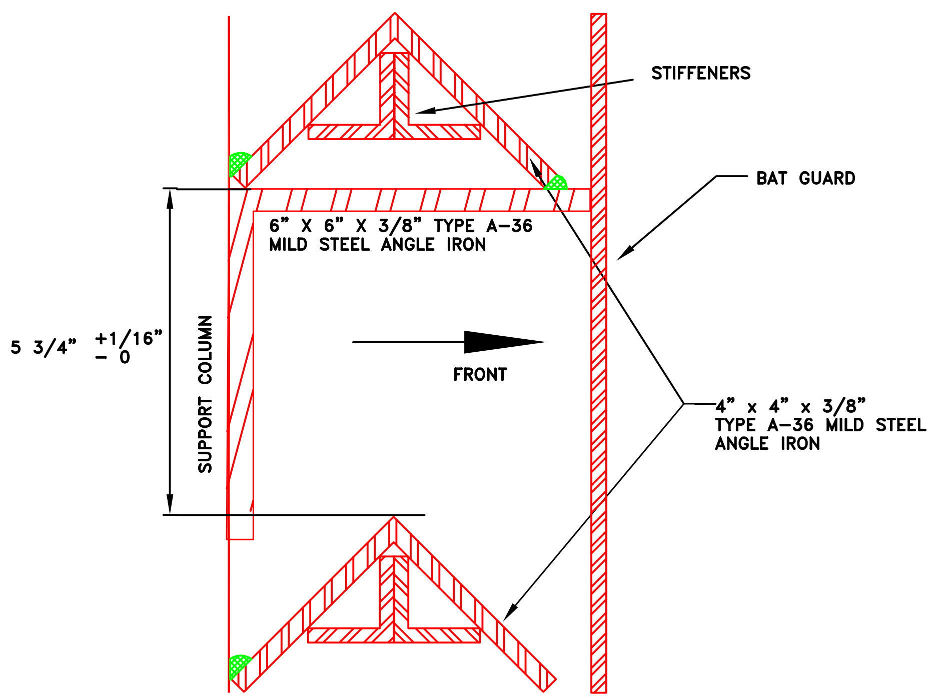


STIFFENERS RUN THE FULL LENGTH OF THE HORIZONTAL BAR,
EXCEPT FOR BEING 2" SHORTER ON EACH END.

STIFFENER DETAIL
Horizontal Bars

NOT TO SCALE

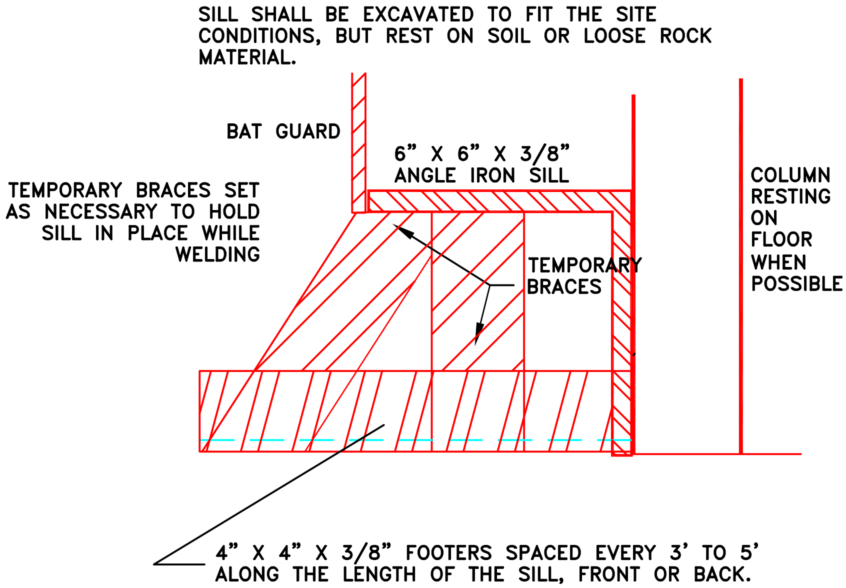
CAVE03.DWG
Designed by Roy Powers, Drafted by Mike Washburn



HORIZONTAL BAR SPACING
TYPICAL DETAIL

NOT TO SCALE

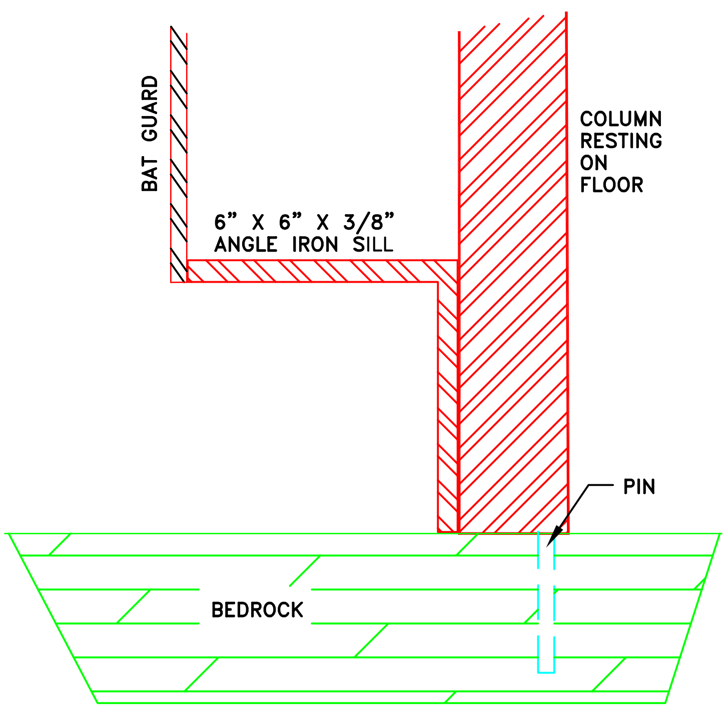
CAVE04.DWG
Designed by Roy Powers, Drafted by Mike Washburn



SILL DETAIL 1

NOT TO SCALE

CAVE05.DWG
Designed by Roy Powers, Drafted by Mike Washburn



SILL DETAIL FOR BEDROCK FLOOR

NOT TO SCALE

CAVE06.DWG
Designed by Roy Powers, Drafted by Mike Washburn

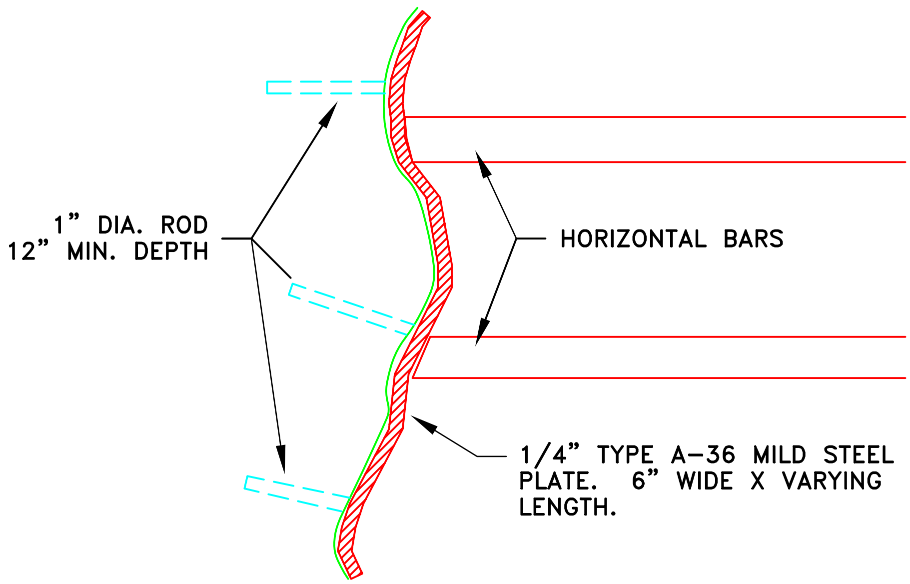
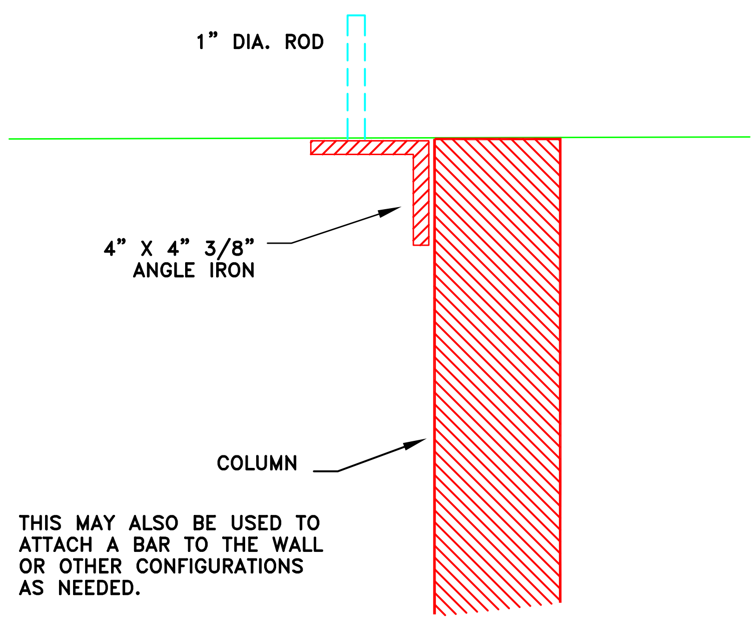


PLATE ATTACHMENT DETAIL

NOT TO SCALE

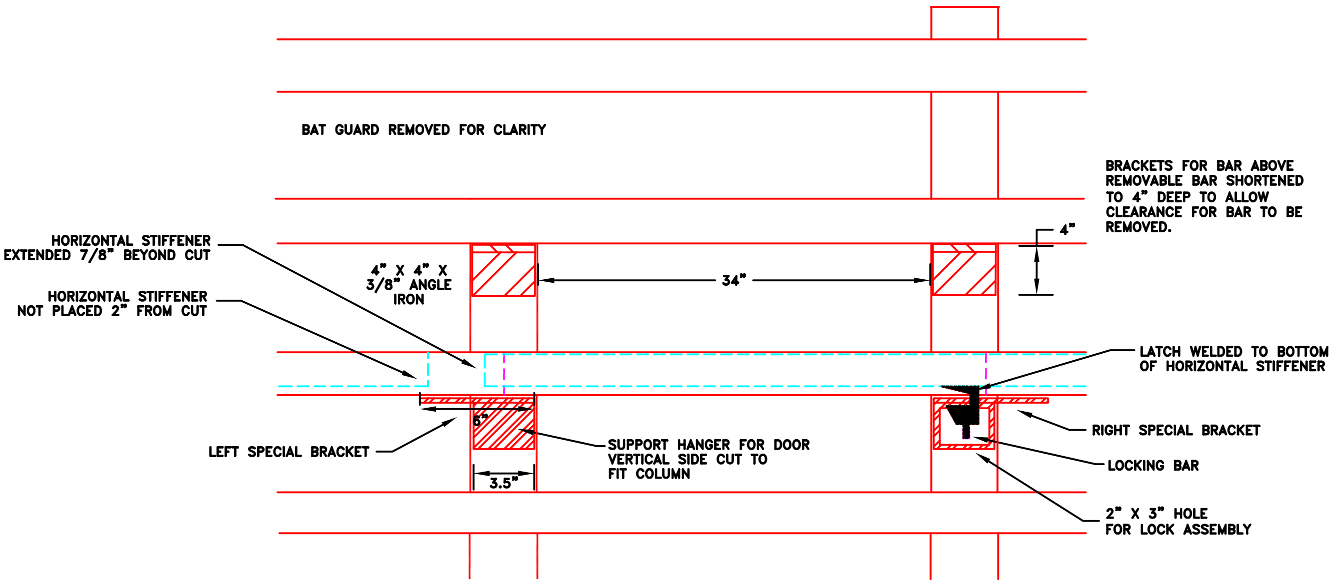
CAVE07.DWG
Designed by Roy Powers, Drafted by Mike Washburn



ATTACHMENT DETAIL

NOT TO SCALE

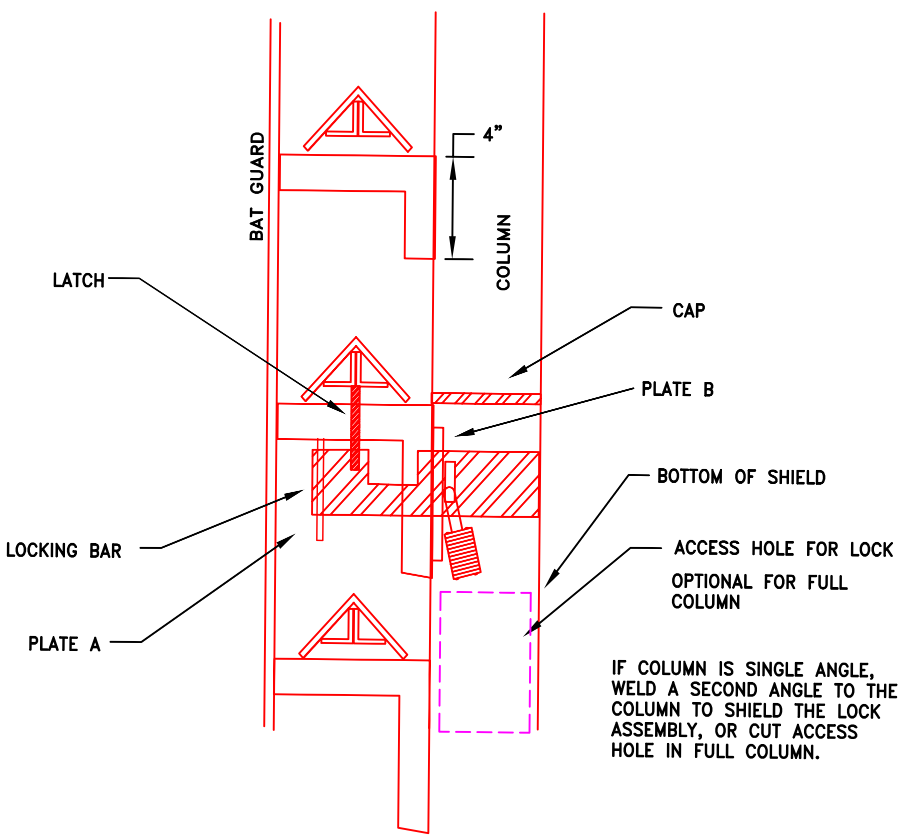
CAVE08.DWG
Designed by Roy Powers, Drafted by Mike Washburn



CAVE09.DWG
Designed by Roy Powers, Drafted by Mike Washburn

REMOVABLE BAR DETAIL
FRONT ELEVATION VIEW

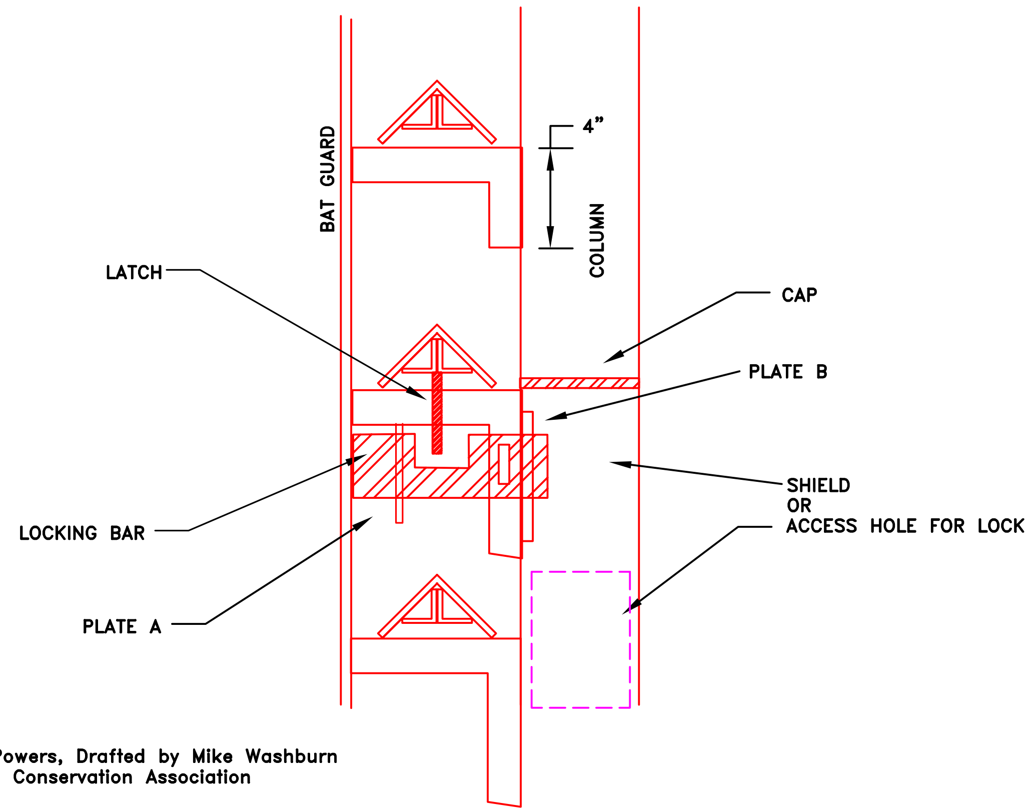
NOT TO SCALE



PROFILE VIEW OF LATCH IN LOCKED POSITION

CAVE10.DWG
Designed by Roy Powers, Drafted by Mike Washburn

NOT TO SCALE

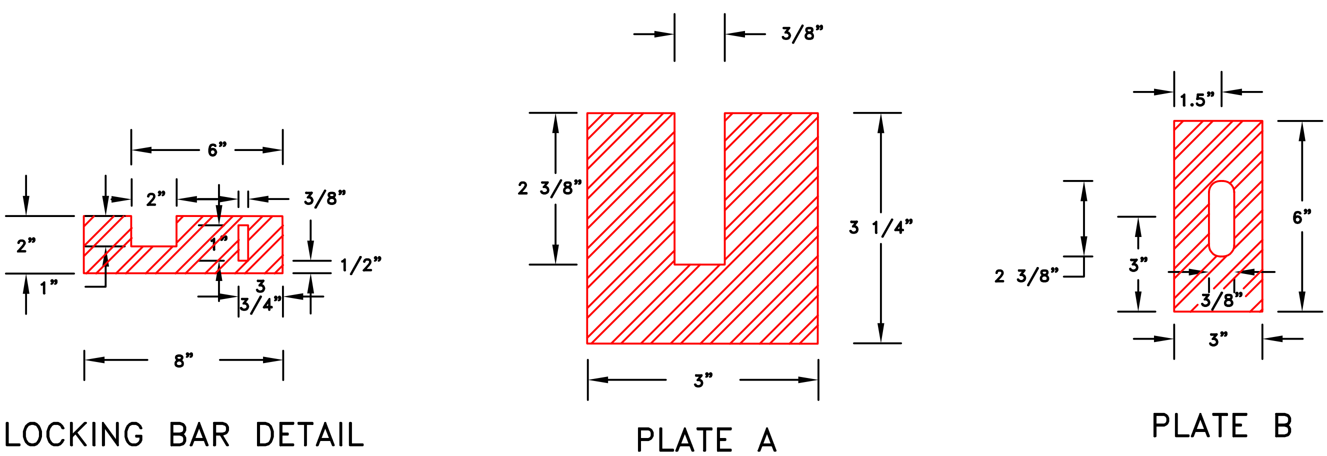


CAVE11.DWG
Designed by Roy Powers, Drafted by Mike Washburn

PROFILE VIEW OF LATCH IN OPEN POSITION

NOT TO SCALE

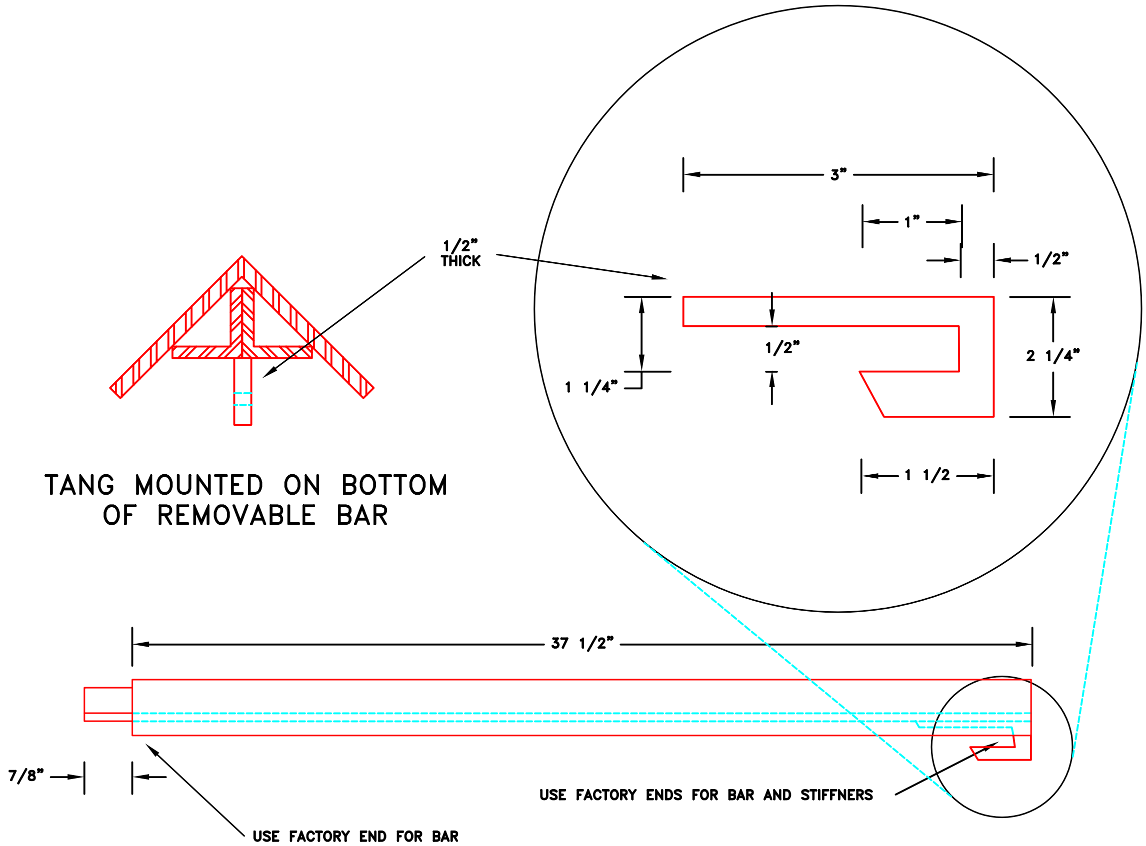
PIECES MADE FROM 1/4” FLAT BAR STOCK



CAVE12.DWG
Designed by Roy Powers, Drafted by Mike Washburn

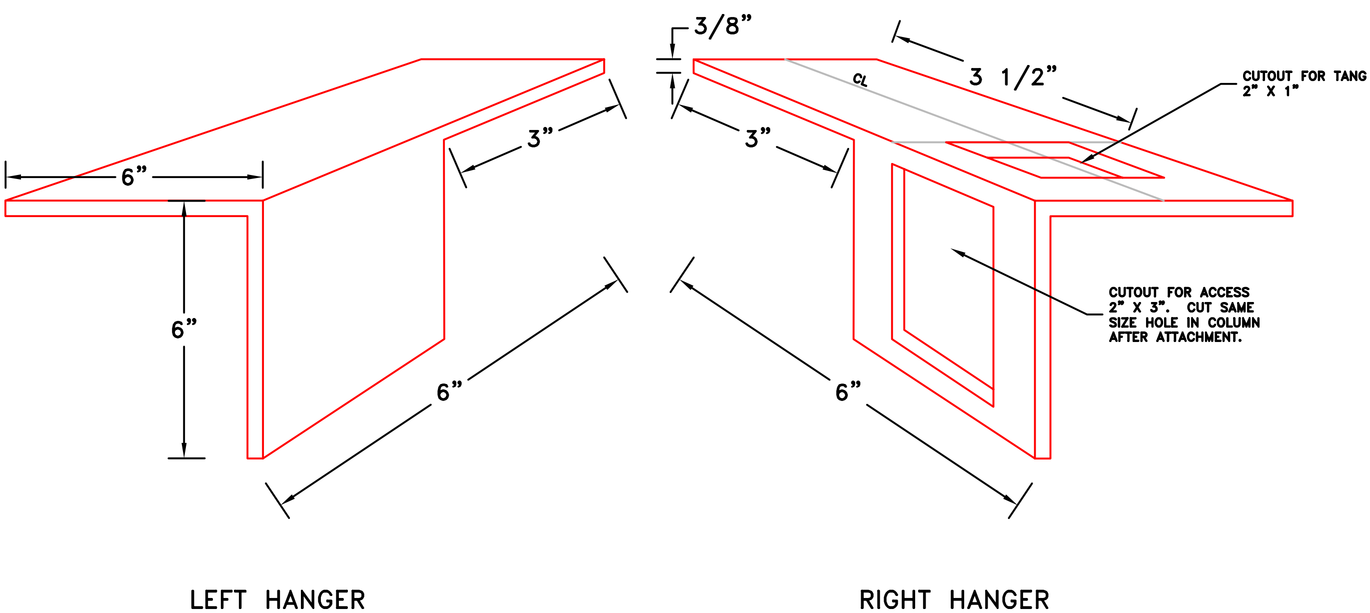
LATCH DETAILS

NOT TO SCALE



REMOVABLE BAR DETAIL

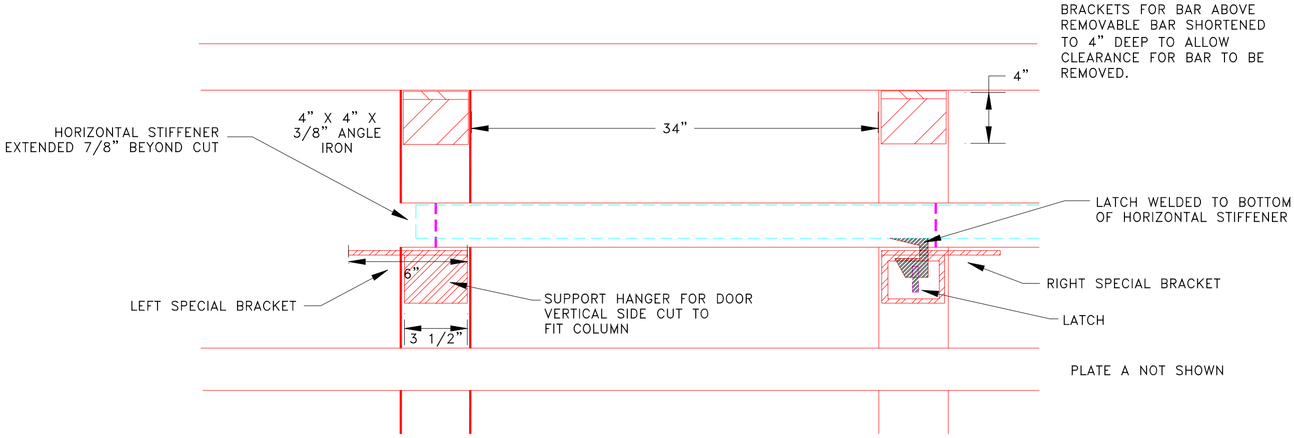
CAVE13.DWG
Designed by Roy Powers, Drafted by Mike Washburn
American Cave Conservation Association



CAVE14.DWG
Designed by Roy Powers, Drafted by Mike Washburn
American Cave Conservation Association

SPECIAL BRACKETS FOR SUPPORTING REMOVABLE BARS

NOT TO SCALE

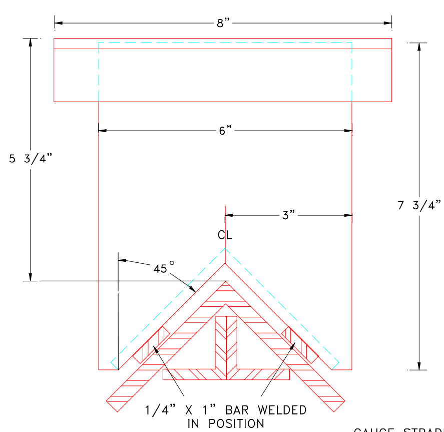


1. PLACE REMOVABLE BAR ON BRACKETS AND CHECK LOCATIONS FOR LATCH, PLATES A AND B.
2. SET RIGHT SIDE HORIZONTAL BAR TO FIT AGAINST RIGHT SIDE OF REMOVABLE BAR.
3. SET LEFT SIDE HORIZONTAL BAR TO FIT AGAINST LEFT END OF REMOVABLE BAR.

CAVE15.DWG
Designed by Roy Powers, Drafted by Mike Washburn

ASSEMBLY SEQUENCE FOR REMOVABLE BAR FRONT ELEVATION VIEW

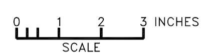
NOT TO SCALE

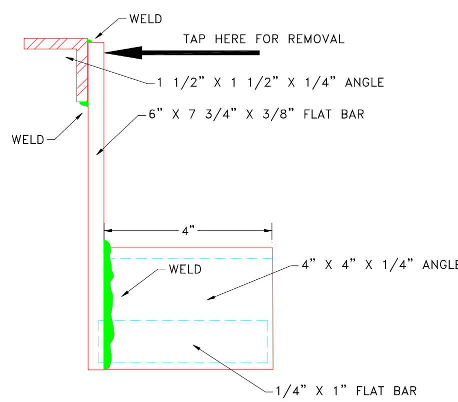


GAUGE STRADDLES HORIZONTAL BAR

END VIEW

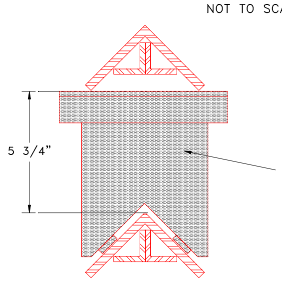
NOT TO SCALE





SIDE VIEW

NOT TO SCALE



SPACING GAUGE IS USED TO ACCURATELY SPACE BARS DURING ASSEMBLY. AFTER WELDING, GAUGE IS TIPPED OVER BY TAPPING ON BACK TOP WITH HAMMER FOR REMOVAL.

NOT TO SCALE

HORIZONTAL BAR SPACING GAUGE

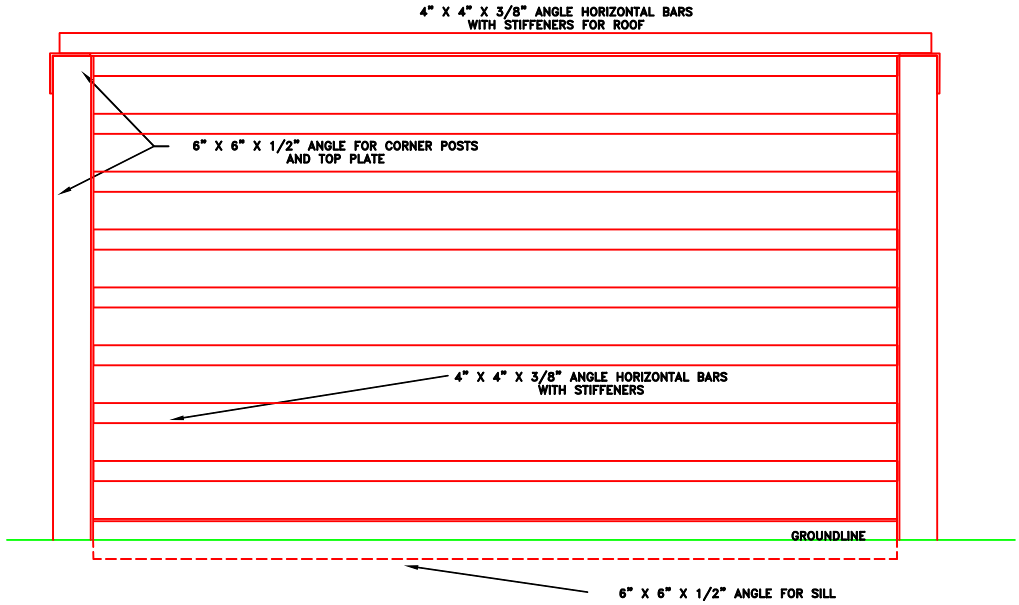
(MINIMUM OF 3 NEEDED)

CAVE16.DWG
Drawn by J. Nieland

LENGTH, WIDTH AND HEIGHT OF CAGE WILL BE ADJUSTED TO FIT FIELD CONDITIONS.

HORIZONTAL BARS MAY SPAN UP TO 10 FEET BEFORE ADDITIONAL POSTS ARE REQUIRED.

5 3/4" SPACING BETWEEN BARS



CAGE TYPE CLOSURE FOR SHAFTS

FRONT VIEW

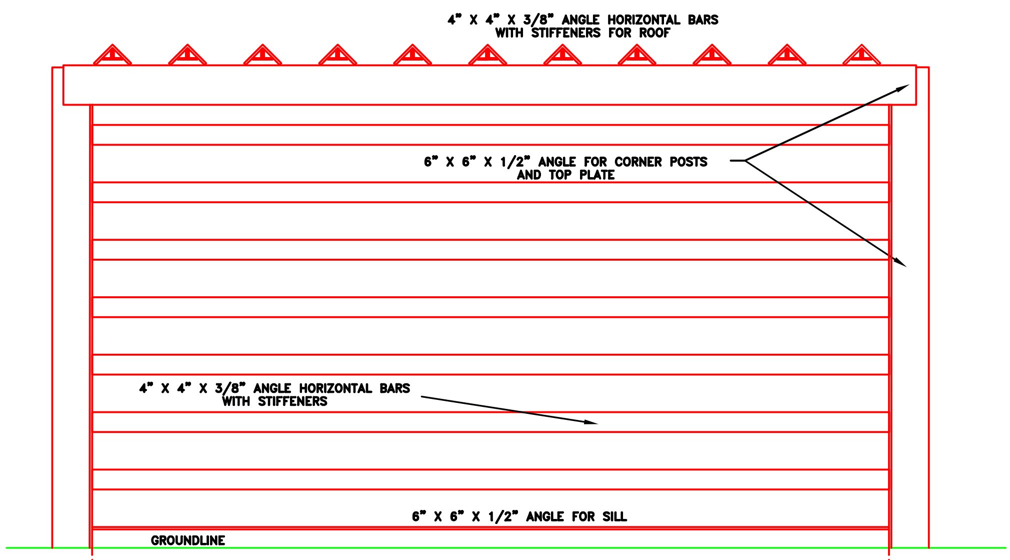
NOT TO SCALE

CAVE18.DWG
Designed by Roy Powers, Drafted by Mike Washburn
American Cave Conservation Association

LENGTH, WIDTH AND HEIGHT OF CAGE WILL BE ADJUSTED TO FIT FIELD CONDITIONS.

HORIZONTAL BARS MAY SPAN UP TO 10 FEET BEFORE ADDITIONAL POSTS ARE REQUIRED.

5 3/4" SPACING BETWEEN BARS



CAGE TYPE CLOSURE FOR SHAFTS

SIDE VIEW

NOT TO SCALE

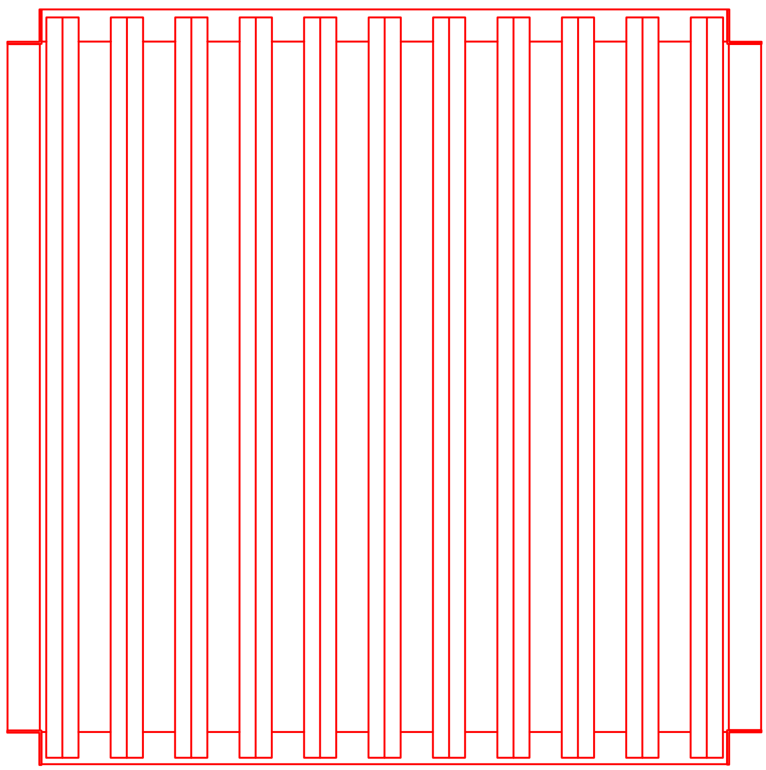
CAVE19.DWG
Designed by Roy Powers, Drafted by Mike Washburn
© American Cave Conservation Association

LENGTH, WIDTH AND HEIGHT OF CAGE WILL BE ADJUSTED TO FIT FIELD CONDITIONS.
HORIZONTAL BARS MAY SPAN UP TO 10 FEET BEFORE ADDITIONAL POSTS ARE REQUIRED.

5 3/4" SPACING BETWEEN BARS

4" X 4" X 3/8" ANGLE HORIZONTAL BARS WITH STIFFENERS FOR ROOF

6" X 6" X 1/2" ANGLE FOR CORNER POSTS AND TOP PLATES



CAGE TYPE CLOSURE FOR SHAFTS

TOP VIEW

NOT TO SCALE

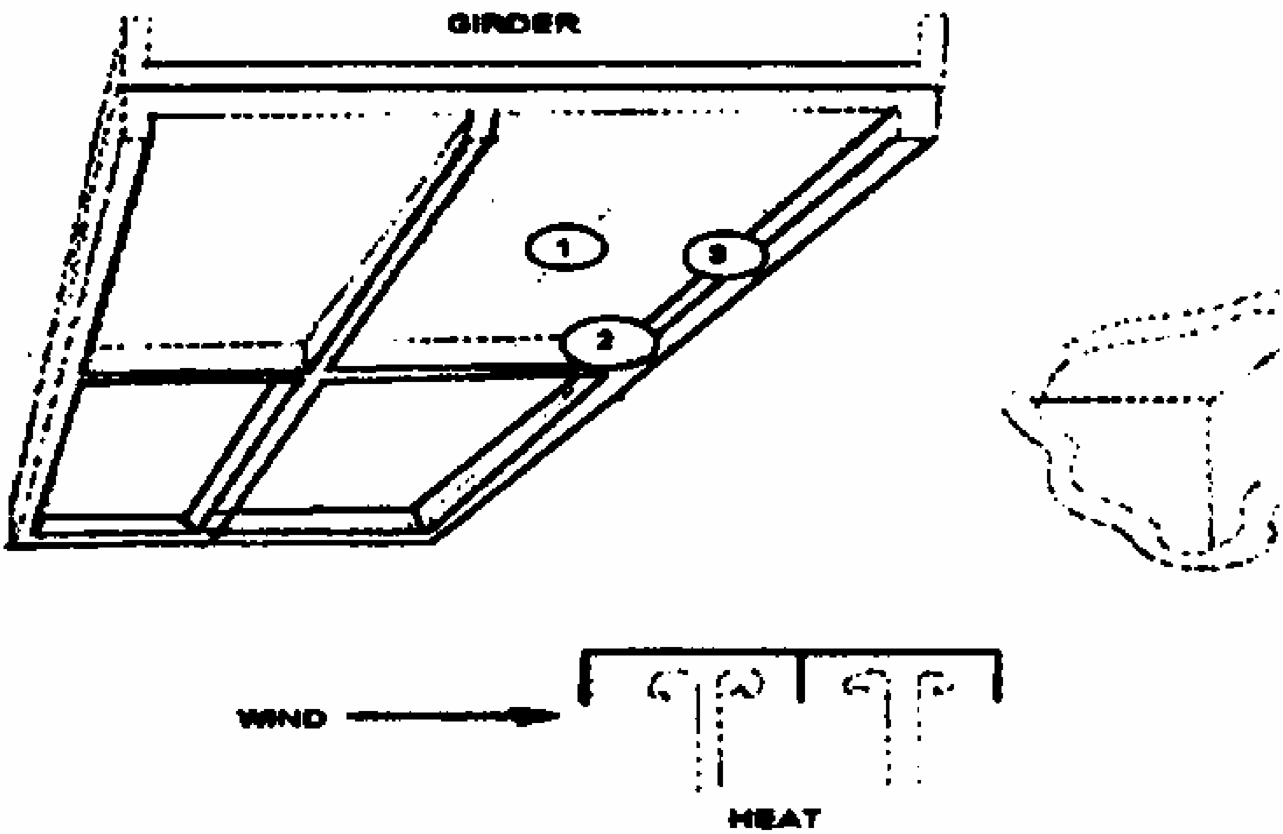
CAVE20.DWG
Designed by Roy Powers, Drafted by Mike Washburn

APPENDIX F

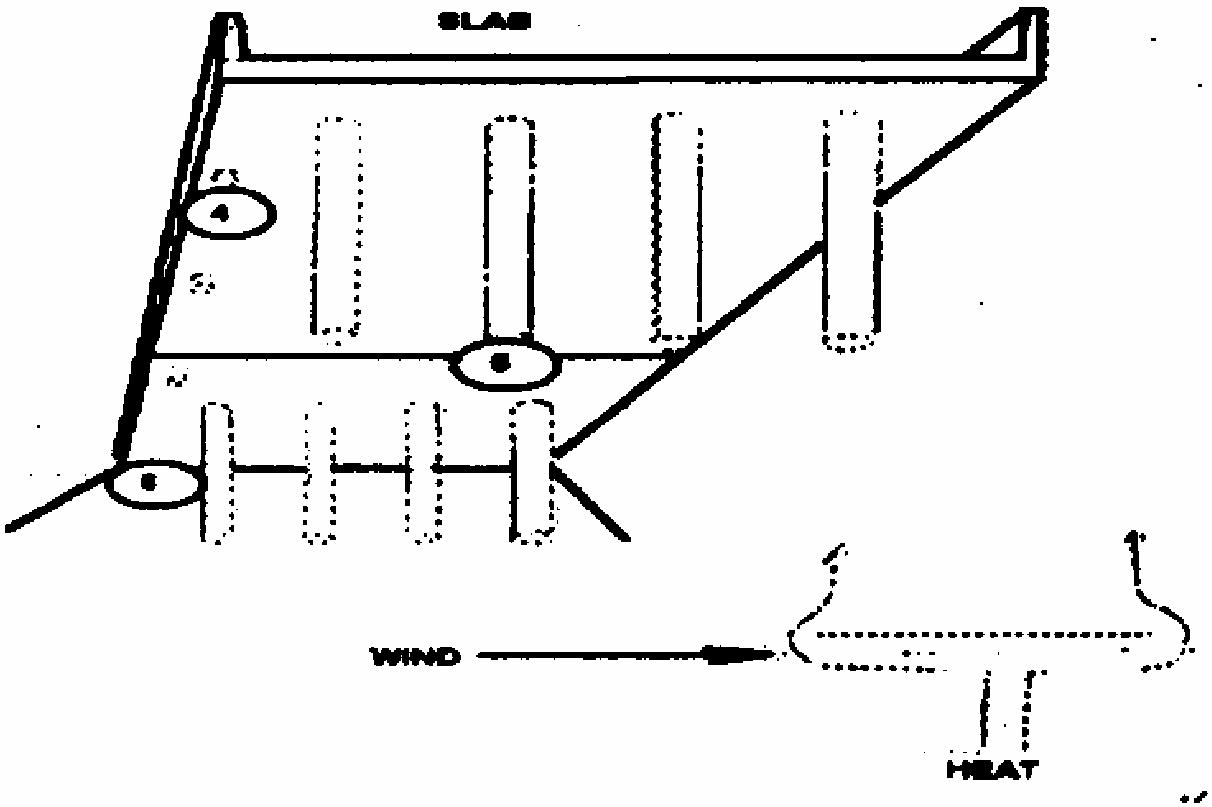
Bridge Features Used by Bats

(Designed by Gregg A. Erickson, Caltrans)

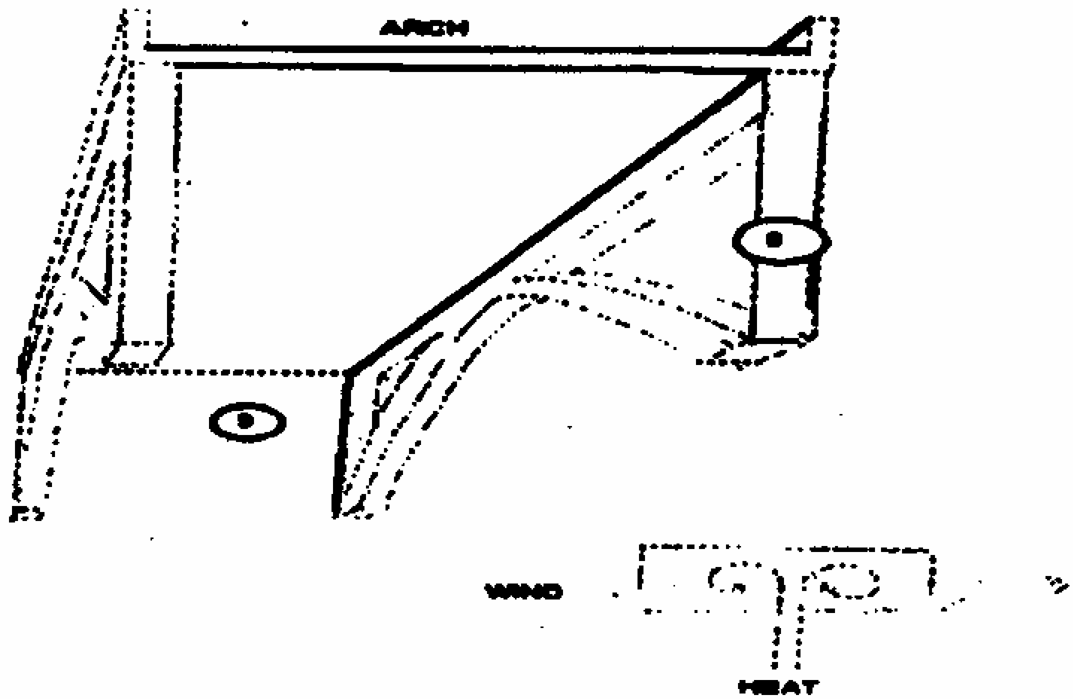
■ Roost Features



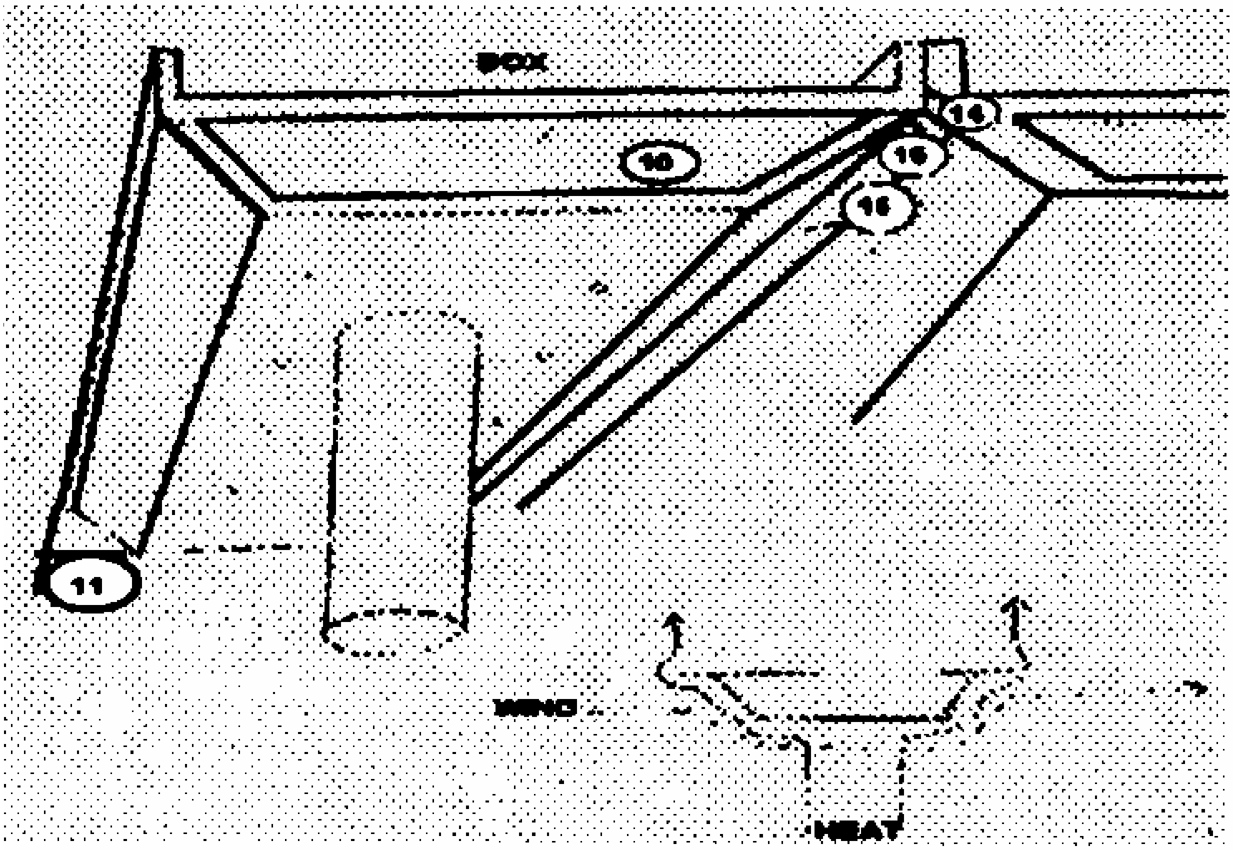
Roost Features



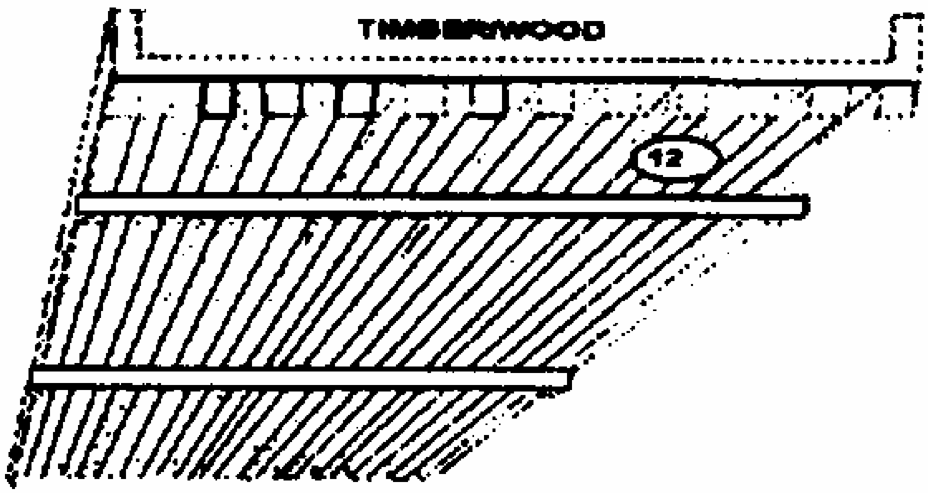
■ Roost Features



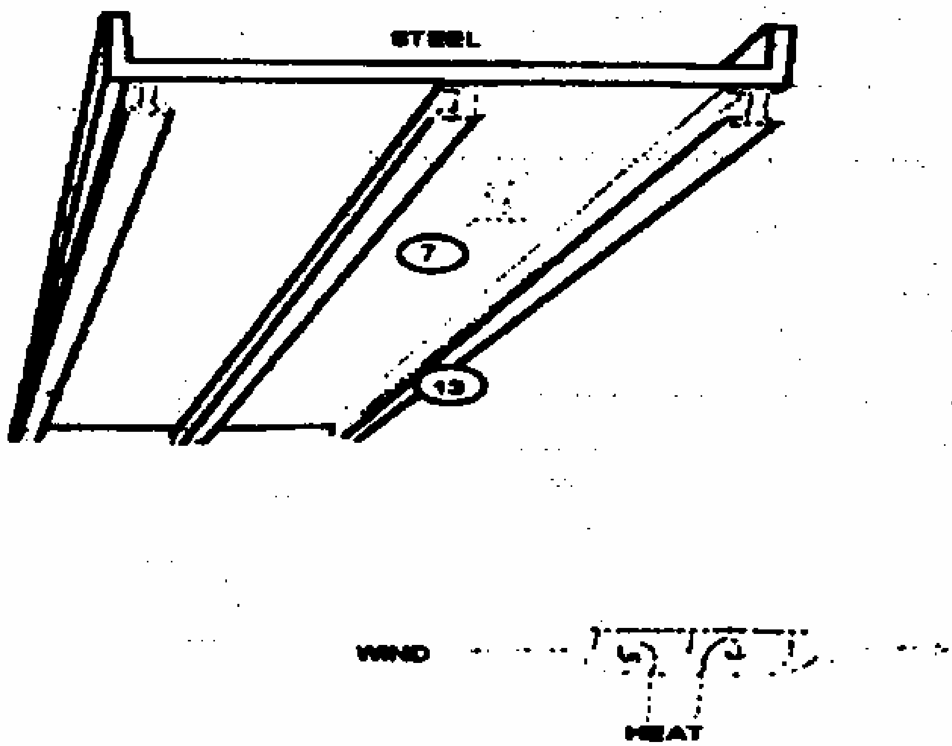
▪ Roost Features



■ Roost Features



■ Roost Features



APPENDIX G

Cottonwood / Sycamore Resolution from the Western Bat Working Group

Developed at the Reno, Nevada meeting
September 29, 2001

WHERE AS it has been widely demonstrated that regionally 70-98 percent of cottonwood (*Populus spp*.) and sycamore (*Platanus spp*.) galleries have been lost in western North America,

AND WHERE AS it is recognized that these ecosystems provide unique foraging and roosting habitats for bat species across western North America,

AND WHERE AS existing research and historical site records indicate a reliance on these ecosystems by the western red bat (*Lasiurus blossevillii*) in the southwestern United States,

BE IT RESOLVED that the Western Bat Working Group (WBWG) hereby supports the further research, inventory, conservation, maintenance, restoration and re-establishment of historical cottonwood and sycamore ecosystems across western North America.

FURTHERMORE this resolution will be forwarded to the national office of The Wildlife Society, Partners-In-Flight, Natural Heritage Foundation, North American Bat Conservation Partnership, and other professional and natural resource conservation organizations that have an interest in states/provinces supported by the WBWG.

APPENDIX H

Pinyon/Juniper Forest Resolution from the Nevada Bat Working Group

Developed at Reno Meeting
September 28, 2001

WHERE AS it has been widely demonstrated that the long-eared myotis (*Myotis evotis*), long-legged myotis (*Myotis volans*), and fringed myotis (*Myotis thysanodes*) roost in pinyon juniper forest habitat,

AND WHERE AS the hoary bat (*Lasiurus cinereus*) has been documented roosting in Utah juniper (*Juniperus osteosperma*) (J.A. Williams, personal communication) and roosting and foraging in Rocky Mountain juniper (*Juniperus scopulorum*) (P.V. Bradley personal communication),

AND WHERE AS it is recognized that the Townsend's big-eared bat (*Corynorhinus townsendii*) forages extensively in pinyon juniper habitat,

AND WHERE AS it is recognized that this ecosystem provides unique foraging and roosting habitats for bat species across western North America,

BE IT RESOLVED that the Nevada Bat Working Group (NBWG) hereby supports the further research, inventory, conservation, maintenance, restoration and re-establishment of mid to late seral stage pinyon juniper forest ecosystems across Nevada.

BE IT FURTHER RESOLVED that the Nevada Bat Working Group (NBWG) hereby suggests that any treatment procedures aimed at reducing pinyon juniper habitat should:

- leave larger diameter trees (avg 46 cm dbh), especially those in a later seral stage of decay and less bark (Chung-MacCoubrey 2001).
- leave a majority of the pinyon juniper habitat (>90%) in tact in any watershed.
- not allow prescribed burning or vegetative alteration in pinyon-juniper or shrub steppe habitat within a 2.5 km radius of known bat roosts (Pierson et al., 1999).
- maintain 95% of the available pinyon juniper woodland canopy within 10 km of any known Townsend's big-eared bat maternity colony as critical foraging habitat.

FURTHERMORE this resolution will be forwarded to the national office of the BLM, USFS, NPS, USFWS, NDOW, BCI, The Wildlife Society, Partners-In-Flight, Natural Heritage Foundation, North American Bat Conservation Partnership, Western Bat Working Group, and other professional and natural resource conservation organizations that have a stake in the conservation of Nevada’s bats.

APPENDIX I

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(Subcommittee of the Western Bat Working Group)

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APPENDIX J

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