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## BAT DISTRIBUTION AND HIBERNACULA USE IN WEST CENTRAL NEVADA

Amy J. Kuenzi<sup>1,2</sup>, Giselle T. Downard<sup>1</sup>, and Michael L. Morrison<sup>1,3</sup>

**ABSTRACT.**—We captured 299 individuals of 11 bat species in mist-nets at 18 water sources in west central Nevada from June through August 1994. *Myotis ciliolabrum*, *Pipistrellus hesperus*, *M. californicus*, and *Corynorhinus townsendii* were the most common species captured. These species are apparently broadly distributed throughout west central Nevada, occurring in a variety of habitat types. We captured *Euderma maculatum* at 2 localities. These represent the 1st known records of this species in Esmeralda County, Nevada. Mine adits were surveyed for hibernating bats from December 1994 through February 1995. We determined the presence of 3 hibernating species: *C. townsendii*, *M. ciliolabrum*, and *P. hesperus*. Bats were present in 19 of 70 mines (27%) we surveyed at elevations ranging from 1500 m to 2460 m. *C. townsendii* was the most common species encountered. Our study provides some much-needed baseline data on bat distribution and use of mines for hibernacula in west central Nevada.

*Key words:* Chiroptera, bats, Nevada, distribution, Great Basin, *Euderma maculatum*.

Over the past few decades, the effects of habitat loss, and both destruction and disturbance at roost sites, have negatively affected some bat populations (Humphrey 1978, Tuttle 1979, Richter et al. 1993). Concern over declining populations and the subsequent federal listing of some species have increased both public and natural resource agency interest in bat conservation. Unfortunately, data necessary to develop meaningful conservation and management plans for bat species are often lacking. Even such basic information as species distribution is not available for many locations (Saughey 1991), including much of the state of Nevada. The distribution of bats within the state was first summarized by Hall (1946). Recently, Ports and Bradley (1996) provided new information on distribution and habitat affinities of bats in eastern and northeastern parts of the state. Current information on bat distribution in other parts of Nevada is still lacking. Our study was initiated to gather data on the distribution of bat species found in the west central part of the state.

### STUDY AREA

Our study was conducted in Esmeralda County, southwestern Mineral County, and a

small portion of southwestern Nye County, Nevada (Fig. 1). The study region includes several broad alluvial valleys and flats separated by 7 large mountain ranges and many isolated peaks. Elevation ranges from 1200 m to >2800 m. Mean annual precipitation ranges from 10 cm to 40 cm (Houghton et al. 1975). Vegetation in this region is characteristic of the Great Basin, dominated by sagebrush (*Artemisia* spp.) or saltbush (*Atriplex* spp.) associations at low elevations and pinyon pine (*Pinus monophylla*) and juniper (*Juniperus osteosperma*) at higher elevations (Turner 1982).

To examine patterns of distribution by different bat species, we classified each survey site into 3 habitat types: water sources surrounded by desert shrubs such as sagebrush (*Artemisia* spp.) or saltbush (*Atriplex* spp.), elevation approximately 1200–2000 m; water sources surrounded by pinyon pine and juniper, elevation approximately 2000–2900 m; and streams lined with deciduous trees such as cottonwood (*Populus* spp.), willow (*Salix* spp.), or quaking aspen (*Populus tremuloides*), elevation approximately 2150–2800 m. We used categories similar to those of Ports and Bradley (1996) to aid in comparisons between their study and ours.

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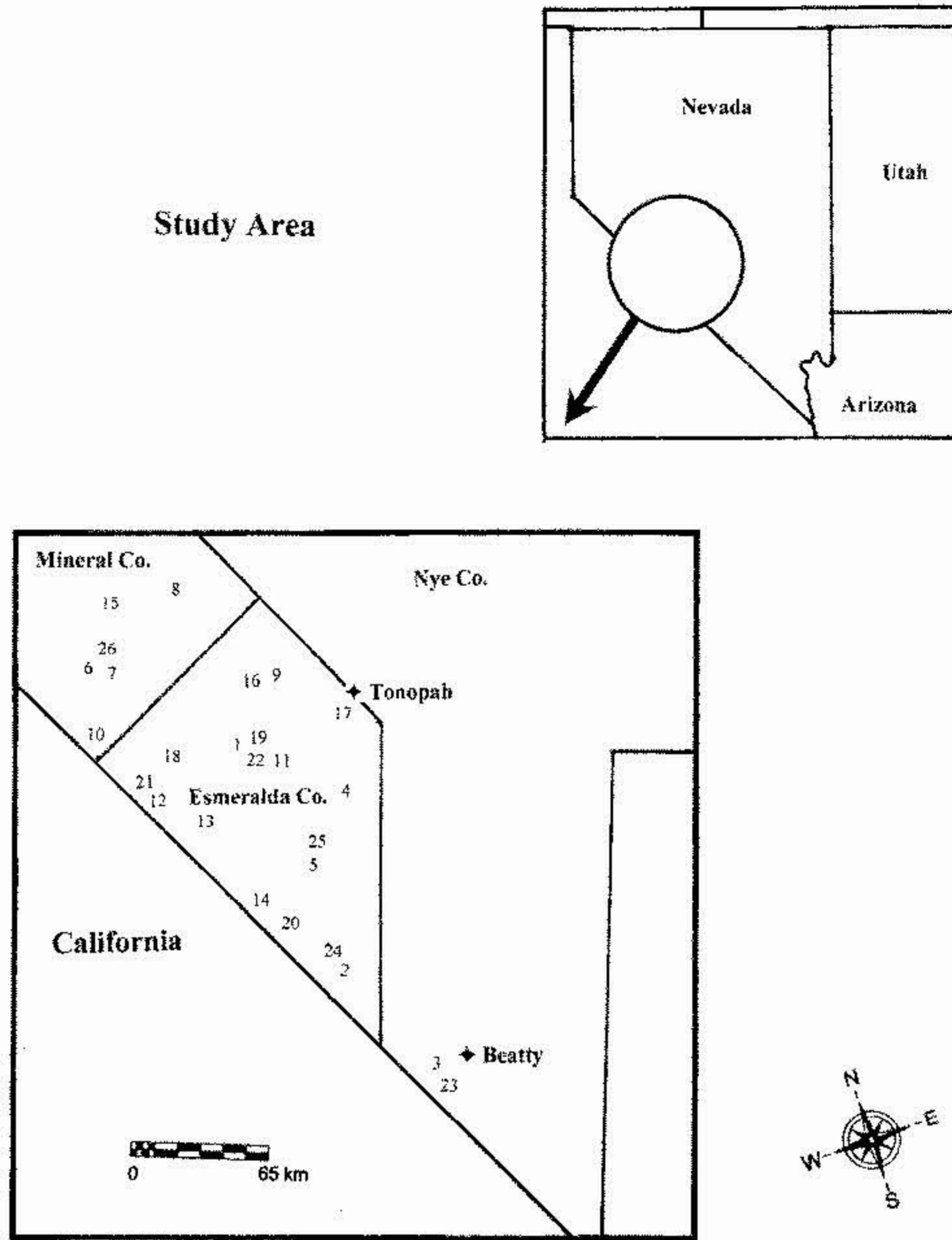


Fig. 1. Location of sites in west central Nevada in which bat surveys were conducted, June 1994 through February 1995.

## METHODS

### Mist-netting Surveys

We captured bats using  $2 \times 12$ -m, 36-mm mesh, 50-denier mist-nets placed across or along edges of perennial streams, ponds, springs, and troughs from June through August 1994. Nets were opened at dusk and left open for 3–4 h depending upon bat activity, which normally decreased rapidly 3 h after dusk. Captured bats were identified to species and sexed. The reproductive condition of females was assessed by visual examination of the lower abdomen and mammary glands (Racey 1988). All captured bats were released after handling.

*Myotis californicus* and *M. ciliolabrum* are difficult to distinguish from one another in some localities. In west central Nevada we

used a combination of characteristics including pelage coloration (Barbour and Davis 1969, Hall 1981, Szewczak et al. 1998), pattern of hair covering the snout (van Zyll de Jong 1985), forehead profile, and length of the 3rd metacarpal (Bogan 1974) to differentiate between the 2 species.

Echolocation calls of *Euderma maculatum* are audible to the human ear, allowing species recognition without direct capture (Leonard and Fenton 1984). At some of our survey sites the presence of this species was determined from echolocation calls rather than mist-net captures.

### Mine Surveys

Mine surveys were conducted from mid-December 1994 through February 1995. Single entries were made into mines to locate

TABLE 1. Number of bats captured by species from west central Nevada, June–August 1994.

	Number captured	Percent of total captures	Percent of sites
<i>Myotis californicus</i>	46	15.4	61.1
<i>Myotis ciliolabrum</i>	84	28.1	66.7
<i>Myotis evotis</i>	19	6.4	16.6
<i>Myotis volans</i>	5	1.6	0.6
<i>Lasionycteris noctivagans</i>	6	2.0	0.6
<i>Eptesicus fuscus</i>	15	5.0	0.6
<i>Pipistrellus hesperus</i>	80	26.8	44.4
<i>Corynorhinus townsendii</i>	24	8.0	44.4
<i>Euderma maculatum</i>	3	1.0	27.8 <sup>a</sup>
<i>Antrozous pallidus</i>	15	5.0	33.3
<i>Tadarida brasiliensis</i>	2	0.7	0.6
TOTAL	299	100.0	

<sup>a</sup>Includes 2 sites where *E. maculatum* presence was determined from echolocation calls.

hibernating bats. We chose areas to be surveyed by consulting USGS 7.5' topographical maps. Mine adits that appeared unsafe or that were actively being mined were not surveyed. Mines were deemed unsafe if we questioned the stability of walls and/or ceilings. All shafts were considered hazardous and thus not entered. We measured temperature and relative humidity at the entrance of each mine and at 10-m intervals throughout the adit using a digital hygrometer (Protimeter, Bucks, England).

Mines were explored and all accessible reaches inspected for hibernating bats. We took care to minimize disturbance to bats by moving quietly and quickly through the mine. We determined species present by non-contact visual inspection. Temperature and relative humidity were measured at each roost site. Average temperature and relative humidity in mines that contained bats and those that did not were compared using a 2-tailed *t* test (Zar 1984).

## RESULTS

### Mist-netting Surveys

We identified a total of 299 individuals of 11 species from 18 water sources in 21 trap-nights from west central Nevada (Table 1). *M. californicus* and *M. ciliolabrum* were the most broadly distributed species within the study region (Table 2). *M. ciliolabrum* occurred in all habitat types and was the most abundant species captured in west central Nevada. *M. californicus* occurred in all habitat types and

TABLE 2. Occurrence of bat species by locality (see Appendix) and habitat type (S = water sources surrounded by desert shrubs, P = higher-elevation water sources surrounded by pinyon-juniper, D = streams lined by deciduous trees) for each species in west central Nevada, June–August 1994.

	Localities (Appendix)	Habitat type
<i>Myotis californicus</i>	2, 3, 6, 7, 9, 10, 12, 14–17	S, P, D
<i>Myotis ciliolabrum</i>	1, 2, 4, 6–12, 14, 15	S, P, D
<i>Myotis evotis</i>	8, 10, 15	P, D
<i>Myotis volans</i>	14	P
<i>Lasionycteris noctivagans</i>	15	P
<i>Eptesicus fuscus</i>	14	P
<i>Pipistrellus hesperus</i>	3, 6, 7, 9, 11, 14, 16, 17	S, P
<i>Corynorhinus townsendii</i>	2, 4, 5, 7, 8, 14, 15, 17	S, P
<i>Euderma maculatum</i>	4, 8, 11, 14, 18	S, P
<i>Antrozous pallidus</i>	6, 7, 8, 13, 14, 15	S, P
<i>Tadarida brasiliensis</i>	11	S

was the 3rd most abundant species captured. Two other species of *Myotis* (*M. volans* and *M. evotis*) were less common. *M. volans* was captured at only 1 site in mid-elevation pinyon-juniper woodlands. *M. evotis* occurred in pinyon-juniper woodlands and in riparian stream corridors.

*Pipistrellus hesperus* was the 2nd most abundant species captured in west central Nevada. *P. hesperus* was captured at 44% of the survey sites, occurring in both desert shrub and pinyon-juniper woodlands. *Corynorhinus townsendii*, captured at over half the water sources surveyed, occurred in desert shrub and pinyon-juniper woodlands.

*E. maculatum* was captured at 2 sites in Esmeralda County (Table 1, Appendix). Echolocation calls were used to determine this species' presence at 2 additional sites in Esmeralda County and 1 site in Mineral County. *E. maculatum* occurred in both desert shrub areas and pinyon-juniper woodlands. *Antrozous pallidus* was also found in these 2 habitats and was captured at 4 of 18 sites.

*Lasionycteris noctivagans*, *Eptesicus fuscus*, and *Tadarida brasiliensis* were detected at only 1 site each in west central Nevada. Both *L. noctivagans* and *E. fuscus* were captured only in pinyon-juniper woodlands, while *T. brasiliensis* was captured only in low-elevation desert shrub.

Reproductive females (pregnant, lactating, post-lactating) were captured in 9 of 11 species

TABLE 3. Reproductive status of female bats captured in west central Nevada, June–August 1994.

Bat species	Total captured	Number pregnant	Number lactating	Number post-lactating	Percent reproductive
<i>Myotis ciliolabrum</i>	51	9	3	9	41.2
<i>Myotis californicus</i>	29	0	3	9	41.4
<i>Myotis evotis</i>	8	0	1	1	25.0
<i>Myotis volans</i>	4	0	0	0	0.0
<i>Lasiomycteris noctivagans</i>	4	0	0	1	25.0
<i>Eptesicus fuscus</i>	7	0	3	0	42.9
<i>Pipistrellus hesperus</i>	59	28	10	1	66.1
<i>Corynorhinus townsendii</i>	14	3	2	4	64.3
<i>Euderma maculatum</i>	1	0	0	0	0.0
<i>Antrozous pallidus</i>	8	2	4	1	87.5
<i>Tadarida brasiliensis</i>	2	1	0	0	50.0

present in west central Nevada (Table 3). Over half of all females captured were reproductive at capture. The percentage of females reproductively active for any 1 species ranged from 0% for *M. volans* and *E. maculatum* to 87.5% for *A. pallidus*. Pregnant females of *A. pallidus*, *M. ciliolabrum*, *M. californicus*, *C. townsendii*, and *P. hesperus* were captured until the 1st week in July (Appendix). We began capturing lactating females around this same time.

#### Mine Surveys

We determined the presence of 3 hibernating species: *C. townsendii*, *M. ciliolabrum*, and *P. hesperus* in west central Nevada. Nineteen of 70 mines we surveyed contained a total of 42 *C. townsendii*, 12 *M. ciliolabrum*, and 4 *P. hesperus* (Table 4). These mines were located at elevations ranging from 1500 m to 2460 m (Appendix). *C. townsendii* was the most common species encountered, present in 16 of 19 mines that contained bats (Table 4). *M. ciliolabrum* was found in 7 of 19 mines (37%) and *P. hesperus* in 3 of 19 (16%). Six mines contained more than 1 species of hibernating bat, hibernating as near as 0.5 m to one another. Most mines (68%), however, contained only 1 species. Individuals of the 3 species were always observed hibernating singly; we never observed clusters of bats in any of the mines surveyed.

We found no difference in average temperature between mines that contained bats and those that did not ( $t = 0.81$ , 68 df,  $P = 0.42$ ) and no difference in average relative humidity ( $t = 0.11$ , 68 df,  $P = 0.91$ ). The average temperature in mines containing bats ranged from 0.4°C to 18.6°C (Table 4). Relative humidity in these mines ranged from 22% to 58%. In most instances bats selected roosts with cooler tem-

peratures and higher humidities than the average for that mine (Table 4). *C. townsendii* was found hibernating at locations with air temperatures of 0.0–17.0°C ( $\bar{x} = 6.1 \pm 4.9$ ) and relative humidity of 21.0–66.0% ( $\bar{x} = 41.8 \pm 12.6$ ). *M. ciliolabrum* occurred at air temperatures of 1.0–17.0°C ( $\bar{x} = 5.2 \pm 4.3$ ) and relative humidity of 24.0–66.0% ( $\bar{x} = 48.5 \pm 10.2$ ), while *P. hesperus* hibernacula had air temperatures from 0.0°C to 14.0°C ( $\bar{x} = 7.3 \pm 5.7$ ) and relative humidity of 21.0–52.0% ( $\bar{x} = 37.3 \pm 12.7$ ).

#### DISCUSSION

Hall (1946) provided maps of the probable distribution of bat species in Nevada. However, specimens and other records of occurrence within these distributions were limited to relatively few locations. Our results contribute some new locality records for bat species in west central Nevada.

Of special interest during our study was the capture and audible detection of *E. maculatum*. This species is distributed throughout western North America (Watkins 1977, Hall 1981) and occurs in vegetation zones ranging from desert shrub to montane coniferous forest (Handley 1959, Findley and Jones 1965). Although *E. maculatum* may be locally abundant (Woodsworth et al. 1981, Leonard and Fenton 1983, 1984), it is considered rare over its geographic range (Watkins 1977). In Nevada *E. maculatum* is known from only 5 localities (Best 1988). The 2 sites in which we captured *E. maculatum* represent the 1st known records of this species in Esmeralda County. In addition, there are no records of *E. maculatum* in Mineral County, where we detected its presence based on echolocation calls.

TABLE 4. Mean temperature and relative humidity ( $\pm$  standard deviation) of mine tunnels in west central Nevada that contained bats during winter 1995, and number of each species observed with mean temperature and mean relative humidity at their roosting sites within those mines.

Location <sup>a</sup>	Temperature (C°)	Relative humidity (%)	<i>Corynorhinus townsendii</i>	<i>Myotis ciliolabrum</i>	<i>Pipistrellus hesperus</i>
			No. (temperature, relative humidity)		
19 (a)	4.8 $\pm$ 1.7	42.3 $\pm$ 3.1	1 (3.0, 48.0)	0	0
19 (b)	0.4 $\pm$ 1.0	47.8 $\pm$ 3.5	2 (0.5, 46.5)	0	1 (0.0, 46.0)
19 (c)	0.9 $\pm$ 1.1	49.0 $\pm$ 2.3	1 (0.0, 52.0)	0	0
19 (d)	2.3 $\pm$ 1.3	45.8 $\pm$ 0.5	1 (3.0, 47.0)	0	0
20	14.5 $\pm$ 0.7	34.3 $\pm$ 4.9	0	1 (17.0, 24.0)	0
21 (a)	2.3 $\pm$ 1.1	43.3 $\pm$ 2.7	4 (1.0, 41.5)	0	0
21 (b)	6.1 $\pm$ 1.9	35.4 $\pm$ 6.1	0	1 (8.0, 53.0)	0
21 (c)	5.4 $\pm$ 1.9	41.3 $\pm$ 3.1	1 (5.0, 47.0)	2 (4.5, 46.0)	0
21 (d)	7.0 $\pm$ 2.1	36.7 $\pm$ 3.4	2 (6.0, 38.0)	0	0
22 (a)	2.7 $\pm$ 0.5	46.2 $\pm$ 4.3	1 (3.0, 49.0)	0	0
22 (b)	5.0 $\pm$ 2.1	44.5 $\pm$ 7.2	1 (4.0, 45.0)	2 (6.0, 42.5)	0
23	18.6 $\pm$ 1.7	28.1 $\pm$ 5.5	2 (17.0, 32.0)	0	0
24 (a)	12.7 $\pm$ 3.1	22.3 $\pm$ 2.5	8 (12.3, 22.3)	0	1 (14.0, 21.0)
24 (b)	9.5 $\pm$ 1.0	42.5 $\pm$ 7.8	2 (9.0, 41.0)	0	0
25	9.6 $\pm$ 2.1	39.3 $\pm$ 13.2	7 (7.7, 37.7)	0	2 (7.5, 38.0)
26 (a)	8.1 $\pm$ 3.8	46.3 $\pm$ 6.3	1 (4.0, 51.0)	3 (3.7, 50.1)	0
26 (b)	2.0 $\pm$ 1.8	57.8 $\pm$ 5.5	7 (1.1, 60.7)	2 (2.0, 61.0)	0
26 (c)	5.6 $\pm$ 4.7	47.9 $\pm$ 7.8	0	1 (1.0, 55.0)	0
26 (d)	13.1 $\pm$ 4.7	34.7 $\pm$ 10.0	1 (7.0, 49.0)	0	0

<sup>a</sup>See Appendix.

Another species for which there is no previous record of occurrence in Mineral County is *A. pallidus* (Hall 1946). We captured reproductive females at 4 locations within this county. Although locality records exist for northern Mineral County, our captures of *M. ciliolabrum*, *M. californicus*, *M. evotis*, *P. hesperus*, and *L. noctivagans* are all new records for the southern part of the county.

We determined the presence of 11 species of bats in west central Nevada. *M. ciliolabrum*, *P. hesperus*, *M. californicus*, and *C. townsendii* were the most common species captured. These species are apparently broadly distributed in this portion of Nevada, occurring in a variety of habitat types. Ports and Bradley (1996) found *M. ciliolabrum* and *C. townsendii* to be widely distributed in a variety of habitats throughout eastern Nevada; *P. hesperus* was rare in eastern Nevada, and *M. californicus* did not occur. In the White/Inyo Mountains of eastern California and western Nevada, both *P. hesperus* and *M. californicus* are relatively common and occur in many different vegetation zones (Szewczak et al. 1998).

*L. noctivagans* was one of the rarest species we found, being captured at only 1 site. Hall (1946) reported only 2 locality records for this species within our study region, both from Esmeralda County. Ports and Bradley (1996)

found this species to occur only in high-elevation areas that had a combination of coniferous and/or deciduous trees. Male and nonreproductive female *L. noctivagans* roost alone under loose bark or in crevices in dead or dying trees (Campbell et al. 1996, Mattson et al. 1996), while reproductively active females form maternity colonies in tree cavities (Campbell et al. 1996, Betts 1998). It is possible that suitable roost sites for this species are limited in west central Nevada. However, given the large scale at which we conducted our surveys, we made no attempt to quantify the availability of potential roost sites.

*E. fuscus* also was captured at only 1 location. Szewczak et al. (1998) captured this species only upstream from ranches with established agricultural fields. *E. fuscus* is commonly associated with buildings (Barbour and Davis 1869), which are rare in the areas we surveyed. This lack of man-made structures may be a factor in the limited distribution of *E. fuscus* within our study region. However, *E. fuscus* is also known to roost in trees and rock crevices (Kurta and Baker 1990).

Over half of all female bats we captured were reproductively active. Although limited, our sample sizes do provide some indication of dates of parturition. Based on our capture data, *A. pallidus*, *M. ciliolabrum*, *M. californicus*,

*C. townsendii*, and *P. hesperus* in west central Nevada likely give birth sometime in late June or early July. These dates are similar to those reported by Hall (1946).

The number of individuals and species we captured at individual sites was highly variable. Our mist-netting surveys focused on water sources. Preference for foraging over open water varies with bat species (Fenton et al. 1980), and interspecific foraging strategies may have influenced the species captured. However, during active periods most bat species do drink nightly (Kunz 1982), and many of the water sources we visited were the only ones available for many kilometers in any direction. It is likely that bat populations in these areas are dependent on these isolated water supplies. Other factors that possibly influenced our capture results are the placement and configuration of mist-nets (Kunz and Kurta 1988) and temporal variation in bat activity (Hayes 1997).

*C. townsendii*, *M. ciliolabrum*, and *P. hesperus* were found hibernating in 27% of the mines we surveyed. Similar results have been obtained by others. In a winter survey of 85 mines in central Nevada, Alcorn (1944) found 14 *C. townsendii* in 12 mines, 19 *M. ciliolabrum* in 14 mines, and 6 *P. hesperus* in 3 mines. Szewczak et al. (1998) also found *C. townsendii* and *M. ciliolabrum* to be scattered sparsely throughout mines in the Inyo and White Mountains of eastern California and western Nevada.

We found no difference in average temperature and relative humidity between used and nonused mines. However, evidence suggests that bats select hibernacula that provide stable temperature and humidity regimes (Humphrey 1978, Genter 1986). Since our temperature and relative humidity data were collected on only a single visit, we have no information on how these varied over the winter. A lack of mines providing stable environments would help explain why the majority of mines we surveyed did not contain bats.

Thorough knowledge of the current distribution of any species is necessary to maintain existing populations. Results of this study contribute some important information on bat distribution and use of mine adits for hibernacula in west central Nevada, but much work remains to be done. Data on roost and foraging-site selection are needed to develop a better understanding of bat species within this region.

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APPENDIX. Locations of survey sites and species examined from west central Nevada, 1994–1995.

1. Cave Springs (S)<sup>a</sup>, Silver Peak Range, Esmeralda Co., Nevada. E425700, N4174100<sup>b</sup>, 1860 m. 1 June 1994. *M. ciliolabrum* (2 males).
2. Old Camp (P), Gold Mountain, Esmeralda Co., Nevada. E471200, N4123300, 2085 m. 16 June 1994. *M. californicus* (2 males, 2 nonreproductive females), *M. ciliolabrum* (1 male, 2 nonreproductive females), *C. townsendii* (1 male).
3. Lower Indian Springs (S), Bullfrog Hills, Nye Co., Nevada. E518100, N4088500, 1220 m. 19 June 1994. *M. californicus* (1 nonreproductive female), *P. hesperus* (1 male, 2 pregnant females).
4. Dago Joe Springs (P), Montezuma Range, Esmeralda Co., Nevada. E471600, N4174600, 2060 m. 22 June 1994. *M. ciliolabrum* (17 males, 6 pregnant females), *C. townsendii* (2 males, 2 pregnant females), *E. maculatum* (1 male).
5. Unnamed spring, 0.2 km east of Blue Dick Mine (P), Palmetto Mountains, Esmeralda Co., Nevada. E413500, N4145600, 2185 m. 24 June 1994. *C. townsendii* (2 nonreproductive females).
6. Unnamed spring, 4 km south of Teel's Marsh and 0.5 km northeast of Rock House Springs (S), Mineral Co., Nevada. E380600, N4223200, 1600 m. 6 July 1994. *M. californicus* (1 nonreproductive female), *M. ciliolabrum* (1 male, 11 nonreproductive females), *P. hesperus* (7 males, 1 pregnant female, 6 lactating females, 8 nonreproductive females), *A. pallidus* (1 pregnant female).
7. Company Springs, 4.25 km south of Teel's Marsh (S), Mineral Co., Nevada. E380200, N4223400, 1540 m. 7 July 1994. *M. californicus* (4 nonreproductive females), *M. ciliolabrum* (3 males, 3 pregnant females, 1 lactating female, 12 nonreproductive females), *P. hesperus* (2 males, 24 pregnant females, 2 nonreproductive females), *C. townsendii* (1 nonreproductive female, 1 pregnant female), *A. pallidus* (1 pregnant female).
8. Dunlap Tunnel Springs (P), Pilot Mountains, Mineral Co., Nevada. E415700, N4244900, 2330 m. 9 July 1994. *M. ciliolabrum* (1 male, 2 lactating females, 2 nonreproductive females), *M. evotis* (3 males, 1 lactating female, 1 nonreproductive female), *C. townsendii* (3 males, 1 lactating female), *E. maculatum* (audible detection), *A. pallidus* (1 lactating female).
9. Crow Springs (S), Monte Cristo Range, Esmeralda Co., Nevada. E448300, N4233400, 1575 m. 11 July 1994. *M. californicus* (1 male, 1 lactating female, 3 nonreproductive females), *M. ciliolabrum* (2 males, 2 post-lactating females, 1 nonreproductive female), *P. hesperus* (3 males, 1 lactating female, 1 unknown escapee).



10. Pinchot Creek (D), White Mountains, Esmeralda Co., Nevada. E387600, N4198100, 2360 m. 13 July 1994. *M. californicus* (1 nonreproductive female), *M. ciliolabrum* (1 male, 2 nonreproductive females), *M. evotis* (1 male).
11. Cottonwood Springs (S), Silver Peak Range, Esmeralda Co., Nevada. E431500, N4174100, 1920 m. 19 July 1994. *M. ciliolabrum* (1 male), *P. hesperus* (2 males), *E. maculatum* (audible detection), *T. brasiliensis* (1 nonreproductive female, 1 lactating female).
12. Middle Creek (D), White Mountains, Esmeralda Co., Nevada. E391400, N4188800, 2155 m. 20 July 1994. *M. californicus* (1 lactating female, 1 nonreproductive female), *M. ciliolabrum* (1 nonreproductive female).
13. Dyer Reservoir (S), Dyer, Esmeralda Co., Nevada. E404600, N4170500, 1465 m. 24 July 1994. *A. pallidus* (1 lactating female).
14. Pigeon Springs (P), Sylvania Mountains, Esmeralda Co., Nevada. E441000, N4141000, 2000 m. 25 July 1994. *M. californicus* (3 males, 1 nonreproductive female), *E. fuscus* (4 males, 3 lactating females, 2 nonreproductive females), *P. hesperus* (2 lactating females, 2 nonlactating females), *C. townsendii* (1 nonreproductive female), *E. maculatum* (1 nonreproductive female), *A. pallidus* (5 males, 2 lactating females), 2 August 1994. *M. californicus* (1 male), *M. ciliolabrum* (2 males, 1 female), *M. volans* (1 male, 4 females), *E. fuscus* (4 males, 2 females), *P. hesperus* (4 males, 6 females), *E. maculatum* (1 male), *A. pallidus* (2 males, 1 female).
15. Pepper Springs (P), Excelsior Mountains, Mineral Co., Nevada. E391000, N4242500, 2010 m. 3 August 1994. *M. californicus* (2 males, 1 post-lactating female), *M. ciliolabrum* (1 male, 3 nonreproductive females, 3 post-lactating females), *M. evotis* (7 males, 5 nonreproductive females, 1 post-lactating female), *L. noctivagans* (2 males, 1 post-lactating female, 3 nonreproductive females), *C. townsendii* (3 males, 1 lactating female, 2 post-lactating females, 1 nonreproductive female), *A. pallidus* (1 post-lactating female).
16. Cook Springs (S), Monte Cristo Range, Esmeralda Co., Nevada. E448400, N4233400, 1920 m. 5 August 1994. *M. californicus* (6 males, 1 lactating female, 7 post-lactating females, 1 nonreproductive female, 1 unknown escapee), *P. hesperus* (1 male, 1 nonreproductive female).
17. Willow Springs (S), Weepah Hills, Esmeralda Co., Nevada. E457900, N4210500, 1880 m. 7 August 1994. *M. californicus* (2 males, 1 nonreproductive female, 1 post-lactating female), *P. hesperus* (1 lactating female, 2 nonreproductive females, 1 post-lactating female), *C. townsendii* (1 male, 2 post-lactating females).
18. Fish Lake Valley Hot Springs (S), Esmeralda Co., Nevada. E413500, N4190400, 1470 m. 26 June 1994. *E. maculatum* (audible detection).
19. Mine adits near Tarantula Springs, Silver Peak Range, Esmeralda Co., Nevada. (a) E436300, N4183400, 2070 m. 2 January 1995. *C. townsendii* (1 hibernating). (b) E437200, N4183100, 2160 m. 2 January 1995. *P. hesperus* (1 hibernating), *C. townsendii* (2 hibernating). (c) E437200, N4183100, 2161 m. 2 January 1995. *C. townsendii* (1 hibernating). (d) E437500, N4183500, 2100 m. 2 January 1995. *C. townsendii* (1 hibernating).
20. Mine adit near Lida, Esmeralda Co., Nevada. E459300, N4143200, 1812 m. 26 February 1995. *M. ciliolabrum* (1 hibernating).
21. Mine adits near Dry Creek, White Mountains, Esmeralda Co., Nevada. (a) E390700, N4190300, 2220 m. 3 January 1995. *C. townsendii* (4 hibernating). (b) E390300, N4190600, 2270 m. 3 January 1995. *M. ciliolabrum* (1 hibernating). (c) E390100, N4190600, 2260 m. 3 January 1995. *C. townsendii* (1 hibernating), *M. ciliolabrum* (2 hibernating). (d) E390200, N4190800, 2220 m. 3 January 1995. *C. townsendii* (2 hibernating).
22. Mine adits near Coyote Springs, Silver Peak Range, Esmeralda Co., Nevada. (a) E436200, N4180400, 1800 m. 4 January 1995. *C. townsendii* (1 hibernating). (b) E436200, N4180500, 1800 m. 4 January 1995. *C. townsendii* (1 hibernating), *M. ciliolabrum* (2 hibernating).
23. Mine adit near Upper Indian Springs, Bullfrog Hills, Nye Co., Nevada. E515700, N4089400, 1500 m. 24 February 1995. *C. townsendii* (2 hibernating).
24. Mine adits near Old Camp, Gold Mountain, Esmeralda Co., Nevada. (a) E470200, N4124300, 1980 m. 26 February 1995. *P. hesperus* (1 hibernating), *C. townsendii* (8 hibernating). (b) E472700, N4123100, 2170 m. 26 February 1995. *C. townsendii* (2 hibernating).
25. Blue Dick Mine, Palmetto Mountains, Esmeralda Co., Nevada. E450600, N4145700, 2460 m. 26 February 1995. *P. hesperus* (2 hibernating), *C. townsendii* (7 hibernating).
26. Mine adits near Marietta, Excelsior Mountains, Mineral Co., Nevada. (a) E380800, N4237200, 1945 m. 30 December 1994. *M. ciliolabrum* (3 hibernating), *C. townsendii* (1 hibernating). (b) E380500, N4237600, 1950 m. 30 December 1994. *M. ciliolabrum* (2 hibernating), *C. townsendii* (7 hibernating). (c) E382300, N4234600, 1625 m. 31 December 1994. *M. ciliolabrum* (1 hibernating). (d) E381400, N4234200, 1560 m. 31 December 1994. *C. townsendii* (1 hibernating).

<sup>a</sup>Habitat type (see Table 2)

<sup>b</sup>Universal Transverse Mercator (UTM) coordinates