

OCCASIONAL PAPERS

THE MUSEUM

TEXAS TECH UNIVERSITY

NUMBER 157

15 MARCH 1996

BATS OF MOHAVE COUNTY, ARIZONA: POPULATIONS AND MOVEMENTS

E. LENDELL COCKRUM, BILL MUSGROVE, AND YAR PETRYSZYN

INTRODUCTION

Most of this report is concerned with banding activities carried out in Mohave County, Arizona, between 10 Jul 1959 and 29 Mar 1964, mainly by Bill Musgrove and students in his high school biology classes. Mohave County, in the northwestern part of the state, has an area of 13,260 square miles (almost 11 times the size of the state of Rhode Island) and ranges in elevation from about 160 feet (Colorado River) to 8266 feet (Hualapai Peak).

Included for each of 21 species that are known to occur in the area are: (a) records of bats banded and recovered (b) a regional synonymy, (c) a list of specimens examined by Cockrum and (d) a list of specimens reported in the literature. Details of the banding activities are included to provide a baseline data for determining trends in populations.

The first record of a bat in Mohave County appears to have been a Pallid Bat, *Antrozous pallidus*, taken at Fort Mohave on 1 May 1861. The second, taken sometime in 1864-65, "in the Colorado Desert near Fort Mojave" by Elliott Coues (1867:284), became the type of a "new" species—*Myotis macropus* (a synonym of *Myotis yumanensis*). Both *Antrozous* and *Myotis yumanensis* are still common in the region.

In addition to 21 species documented as occurring in Mohave

County, two others may also be present: the Western Yellow Bat (*Lasiurus xanthinus*) which probably occurs in limited numbers along the Colorado River, and the Mexican Long-tongued bat (*Choeronycteris mexicana*) which may be an accidental visitor.

RESULTS AND DISCUSSION

Banding activities were carried out between 10 Jul 1959 and 29 Mar 1964. Any interpretation of these records should take into account that banding efforts were not uniformly distributed either by time, type of activity (Table 1) or geography. The number of each species captured probably is fairly indicative of the relative population size in the areas studied—the lower elevations in the southern and southwestern part of the county (see distribution maps). The same amount of effort, confined to higher elevations and to the northern and eastern parts of the county, would have yielded quite different results. Further, almost none of the “negative” efforts (*i. e.*, no bats found or captured) were recorded. Hindsight tells us that such records might have provided further insight into the habits of some species.

More effort was devoted to collecting data during the “summer”, 1 Apr - 31 Oct (204 of 246 field trips— 83%), than during the “winter”, 1 Nov - 31 Mar. Over 56% of the recorded dates of activity were in the months of Jun, Jul and Aug—the “summer vacation” of a high school science teacher. Even when we make allowances for this difference, the winter effort (17%) produced only 12 percent (1540 of 13102) of the bats captured. The winter roosts of *Macrotus* and *Plecotus* and a late Mar group of male *Tadarida* made up all but 43 of the 1540 taken in the “winter” (Table 2).

The availability of water was a major factor influencing the capture of bats in mist nets (Table 3). Bats appear to go no farther than necessary to drink. When water is available in a large number of ponds and pools, few utilize any one given site. Spring and summer are usually times of limited rainfall in this region (Sellers and Hill, 1974). Progressively fewer places with water cause bats to make longer flights and result in the concentration of individuals at the available water.

When only a small water tank was available in a large area, the rate of capture of bats increased dramatically. Locality 37 (Appendix), a

Table 1. Bat collecting activities by month and by method of capture. Each "activity" is one session at mist nets (usually set over water) or one visit to a roost (usually in a cave, mine tunnel, or building).

	net	roost	total
January	3	6	9
February	2	8	10
March	1	14	15
April	4	20	24
May	3	9	12
June	14	3	17
July	47	32	79
August	19	24	43
September	6	17	23
October	1	7	8
November	0	2	2
December	3	1	4
Totals	103	143	246

mist net set over a tank in the foothills of the Hualapai Mountains, 4.5 miles SSE Kingman, is an example. Relatively few bats were taken there in Apr and May. By Jun and early Jul, when temperatures were high and watering places were limited, we estimated that over 1000 bats secured water at this place each night. The summer rains begin in late Jul and Aug. After that, few bats were taken at this tank. On 11 Aug 1961, Maya and Cox, when netting at this site noted (banding records): "water everywhere!" The number of bats visiting the tank for water was greatly reduced.

During the dry season, increased activity occurred at water standing in various mine entrances. For example, locality 11 (Appendix), a mist net over water at the entrance of Stockton Hills Mine, 8 miles N Kingman, was the place of capture of 170 bats in about three hours on 8 Jul 1962 when several hundred others escaped capture. An understanding of these variations is essential to making meaningful comparisons of population estimates of the various species.

Table 2. Bat captures by season. "Winter" = 1 Nov-Mar 31. "Summer" = 1 Apr-31 Oct.

	"winter"			"summer"			total
	m	f	total	m	f	total	
<i>Macrotus</i>	168	188	356	653	1089	1742	2098
<i>M. yumanensis</i>	1	4	5	49	184	233	238
<i>M. velifer</i>	0	0	0	823	626	1449	1449
<i>M. lucifugus</i>	0	0	0	1	1	2	2
<i>M. thysanodes</i>	2	2	4	430	731	1161	1165
<i>M. volans</i>	2	0	2	97	171	268	270
<i>M. californicus</i>	1	1	2	70	126	196	198
<i>M. ciliolabrum</i>	1	3	4	32	30	62	166
<i>Lasionycteris</i>	0	0	0	1	0	1	1
<i>Pipistrellus</i>	9	2	11	308	818	1126	1137
<i>Epescius</i>	8	7	15	132	388	520	535
<i>L. blassevillii</i>	0	0	0	0	0	0	0
<i>L. cinereus</i>	0	0	0	1	3	4	4
<i>Eudernia</i>	0	0	0	1	1	2	2
<i>Idionycteris</i>	0	0	0	25	194	219	219
<i>Plecotus</i>	250	829	1079	135	723	858	1937
<i>Antrozous</i>	0	0	0	147	244	391	391
<i>Tadarida</i>	59	3	62	1613	1696	3309	3371
<i>N. femorosaccus</i>	0	0	0	1	1	2	2
<i>N. macrotis</i>	0	0	0	1	6	7	7
<i>Eumops</i>	0	0	0	1	9	10	10
Totals	501	1039	1540	4521	7041	11562	13102

In geographic distribution, some species were taken only at higher elevations (*e. g. Myotis volans*), others only at lower elevations (*e. g. Macrotus*). Some species were taken only in roosts; others essentially only in nets over water and never in either day or night roosts. None of the 2098 *Macrotus* were taken anywhere but in roosts. Essentially the same is true for *Myotis velifer* (1448:1), *Plecotus* (1731:214), and *Tadarida* (3144:230). In contrast, the ratios for *Pipistrellus* (2:1135), *Myotis volans* (2:268), and *Eptesicus* (25:521) clearly indicate that we did not find their day roosts.

In the following "Accounts of Species," details of literature reports, specimens examined, banding activities and some observations concerning natural history are given. The synonymy includes the original description, the first usage of the name combination utilized by us, and all of the usages that we found in the literature that refer to material from Mohave County.

The Records of Occurrence section includes Specimens Examined, Literature and Banding Records. The number associated with a locality refers to the species distribution map. The number in brackets (*e. g.* [A 11]) refers to the number assigned a banding locality as described in the Appendix. The following abbreviations are used to indicate the collection in which the specimens are housed: CM Carnegie Museum, Pittsburgh, Pennsylvania. KHS Kingman High School, Biology Laboratory, Kingman, Arizona. LBSC Long Beach State University, Long Beach, California. MNA Museum of Northern Arizona, Flagstaff. MVZ Museum of Vertebrate Zoology, University of California, Berkeley. SDSNH San Diego Society of Natural History, San Diego, California. SIU Southern Illinois University, Carbondale. UA University of Arizona, Tucson. UI University of Illinois, Museum of Natural History, Urbana. UM Museum of Zoology, University of Michigan, Ann Arbor. US United States National Museum, Washington, D. C.

When specimens examined were reported in previous publications, the citations follow the listing under Specimens Examined. Specimens or observations reported in the literature and not seen by us are listed in the Literature Section.

Table 3. Method of capture of various bats. Bats were captured in mist nets (usually set over water) or in their roosts.

	Net		Roost		Total
	m	f	m	f	
<i>Macrotus</i>	0	0	821	1277	2098
<i>M. yumanensis</i>	0	3	50	188	241
<i>M. velifer</i>	1	0	822	626	1449
<i>M. lucifugus</i>	0	0	1	1	2
<i>M. thysanodes</i>	150	282	229	504	1165
<i>M. volans</i>	97	171	2	0	270
<i>M. californicus</i>	57	112	14	15	198
<i>M. ciliolabrum</i>	33	33	0	0	66
<i>Lasionycteris</i>	1	0	0	0	1
<i>Pipistrellus</i>	316	819	1	1	1137
<i>Eptesicus</i>	133	377	7	18	535
<i>L. cinereus</i>	1	3	0	0	4
<i>Euderma</i>	1	1	0	0	2
<i>Idionycteris</i>	3	67	22	127	219
<i>Plecotus</i>	85	129	300	1431	1945
<i>Antrozous</i>	132	214	15	29	390
<i>Tadarida</i>	32	196	1640	1503	3371
<i>N. femorosaccus</i>	1	1	0	0	2
<i>N. macrotis</i>	1	6	0	0	7
<i>Eumops</i>	0	0	1	9	10
Totals	1044	2414	3925	5729	13112

ACCOUNTS OF SPECIES

MACROTUS CALIFORNICUS BAIRD, CALIFORNIA LEAF-NOSED BAT

Macrotus californicus Baird, Proc. Acad. Nat. Sci., Philadelphia, 10:116, 1858, type from Old Fort Yuma, Imperial County, California, on right bank of Colorado River, opposite present

town of Yuma, Arizona; Hardy, *Jour. Mamm.*, 30:434, 1949; Cockrum, *Mammals of Arizona*, Univ. Az. Press, 1960, p. 32; Hoffmeister, *Mammals of Arizona*, Univ. Az. Press, 1986, p. 60. *Macrotus waterhousii californicus*, Hall, *Mammals of North America*, John Wiley, New York, 3 Apr 1981, p. 104.

Comments

All of the California leaf-nosed bats were captured in roosts; none were captured in mist nets set over water. Most roosts visited by us were in warm, dry mine tunnels deep enough that the bats were in complete darkness. Different tunnels were used in winter and summer. Most roosts consisted of clusters of 20 or more bats, with individuals slightly separated from each other. Some hung separately or in small groups. The bats were usually alert when approached and were easily disturbed. A partial segregation of the sexes occurs during the summer while young were non-volent.

California leaf-nosed bats are restricted to the lower elevations of Mohave County. In the southern part of the county they have been taken along Burro Creek, and along the Bill Williams River, and at scattered localities in the Colorado River Valley. North of the Colorado River, they have been reported only once—from “small hole in roof of abandoned tunnel, S side of Virgin River at Virgin Narrows, northeast of Littlefield” on 10 Mar 1945 (Hardy, 1949:434). Cockrum examined this specimen about 1956, at Long Beach State College, where Dr. Hardy was then a member of the faculty.

Table 4 summarizes, by sex and month of capture, the records of *Macrotus*. Active individuals were encountered throughout the year. Neither hibernation nor seasonal disappearance as a result of migration were observed. The 3 to 1 sex ratio in Jul is the result of banding activities being carried out mainly at maternity colonies where adult males were absent.

A total of 479 (190 m, 289 f) were recovered, mostly in place. Forty-two (1 m, 41 f) of the recaptures were taken at places other than the point of banding. Movements from winter roost to a maternity colony include: from Tunnel, Needle Rock [location A 4] in Jan to Rawhide Mine area [A 7] 58 miles to the SE in Jul (1 f) as well as 9 females moving from Burro Creek area [A 6] banded in Jan, Feb, and

Table 4. *Macrotus californicus* captures by month and sex. The numbers are the totals of specimen examined, bats banded and bats observed.

Month	Males	Females	Total
January	80	146	226
February	86	33	119
March	1	7	8
April	253	256	509
May	8	1	9
June	7	1	8
July	224	681	905
August	46	75	121
September	0	0	0
October	115	75	190
November	0	1	1
December	1	1	2
Totals	821	1277	2098

Apr and captured in Jul in the Rawhide Mine Area 21 miles WSW in Jul.

Movements from a maternity colony (Rawhide Mine area, banded in Jul) include 1 m and 8 f moving 21 miles ENE to the Burro Creek area (recovered in Jan, Apr, and Oct). One female was recovered by Steve Gallezioli of the Arizona Game and Fish Commission 85 miles ESE at Lake Carl Pleasant in Maricopa County and two females were recovered 56 miles WSW in a mine tunnel, Riverside Mountains, San Bernardino County, California by Al Beck.

Records of occurrence

Specimens examined:— Total, 5 (2 m, 3 f), as follows:

1. Virgin Narrows above Littlefield, 1 f, 10 Mar 1945, LBSC. (Hardy, 1949:434; Hall, 1981:104; Hoffmeister, 1986:62.) 3. Mine tunnel, Telephone Pole Cove, 1 mile N Katherine Landing, 700 ft. [A 18]. 1 f, 30 Aug 1959, KHS. 5. Mine tunnel, 3 1/2 miles E Burro Creek State Highway 89 bridge [A 57], 1 m, 27 Mar 1960, KHS; = 1.5 mile N [= W] Mohave Co. line, 3 miles NE highway 93, Golden Keys Mine, Woody Holms Ranch, 1 m and 1 f, 27 Dec 1965, UA.

[=Golden Keys Mine, 10 miles W Bagdad, 3500 ft., Irwin and Baker, 1967:195; Hall, 1981:104; Hoffmeister, 1986:6.]

Banding records:— Total banded, 1667 (709 m, 958 f); total local recoveries, 430 (187 m, 243 f); total foreign recoveries, 45 (2 m, 43 f); as follows: 2. Tunnel, Clark Co., Nev. [A 69]. Banded 6 m, 2 f on 9 Apr 1961. Banded 146 m, 63 f on 13 Aug 1961; recovered 2 m, 12 f on 10 Jul 1963. Banded 7 m, 1 f on 29 Jun 1962. Banded 45 m, 51 f on 10 Jul 1963. 3. Tunnel, Katherine Landing [A 18]. Banded 1 f on 16 Apr 1960. Banded 1 f on 13 Aug 1961. 4. Tunnel, Needle Rock [A 52]. Banded 48 m, 61 f on 28 Jan 1962; recovered 3 m on 8 Apr 1962; foreign recovery, 1 f at 0.25 mile S Rawhide [A 7] on 25 Jul 1963. Banded 4 m on 8 Apr 1962. 6. Tunnel j, Burro Creek [A 54j]. Banded 190 m, 245 f on 16 Apr 1961, recovered 7 m, 1 f on 17 May 1961, recovered 51 m, 15 f on 1 Oct 1961; recovered 41 m, 45 f on 3 Feb 1962; recovered 30 m, 1 f on 28 Apr 1962; recovered 12 m, 16 f on 14 Oct 1962; recovered 10 m, 32 f on 27 Jan 1963; recovered 4 m, 4 f on 24 Feb 1963; recovered 2 f on 10 Mar 1963; recovered 2 f on 22 Mar 1963; recovered 1 m on 7 Apr 1963; foreign recovery, 1 m on 22 Jul 1962 at 2 mile N Kaiser Spring Wash [G 53]; foreign recovery, 3 f on 2 Jul 1962 at 0.25 mile S Rawhide. Banded 1 m on 17 May 1961; recovered 1 Oct 1961. Banded 28 m, 21 f on 1 Oct 1961; recovered 1 m, 6 f on 3 Feb 1962; recovered 4 m on 28 Apr 1962; recovered 1 m, 1 f on 14 Oct 1962; recovered 4 f on 27 Jan 1963; recovered 1 m on 24 Feb 1963; recovered 1 f on 10 Mar 1963. Banded 36 m, 62 f on 3 Feb 1962; recovered 8 m on 28 Apr 1962; recovered 5 f on 14 Oct 1962; recovered 3 m, 7 f on 27 Jan 1963; recovered 1 m on 7 Apr 1963; foreign recovery, 3 f on 2 Jul 1962 and 1 f on 25 Jul 1963 at 0.25 mile S Rawhide Mine [A 67]. Banded 5 m on 28 Apr 1962; recovered 1 m on 27 Jan 1963. Banded 22 m, 15 f on 14 Oct 1962; recovered 2 m on 27 Jan 1963; 1 f on 24 Feb 1963. Banded 15 m, 39 f on 27 Jan 1963; recovered 1 m, 3 f on 24 Feb 1963; recovered 2 f on 22 Mar 1963; foreign recovery, 2 f on 25 Jul 1963 at 0.25 mile S Rawhide Mine [A 67]. 7. Upper tunnel, 1 mile N Rawhide Mine [A 61]. Banded 13 m, 40 f on 10 Jul 1960; recovered 1 m, 3 f on 25 Jul 1963; foreign recovery, 1 m, 5 f on 16 Apr 1961 and 1 f on 27 Jan 1963 at Burro Creek [A 64j]; foreign recovery, 8 f on 2 Jul 1962 and 3 f on 3 Jul 1963 at 0.25 mile S Rawhide Mine [A 67]; foreign recovery,

1 f on 5 Nov 1960 at Mountaineer Mine, 8 miles S Vidal, Riverside County, California by Al Beck. Banded 16 m, 16 f on 25 Jul 1963. 7b. tunnel, 1 mile N Rawhide Mine [A 64]. Banded 1 m on 10 Jul 1960. 7c. Mine, 0.5 mile W Rawhide Mine [A 66]. Banded 36 m on 10 Jul 1960. 7d. Tunnels, 0.25 mile S Rawhide Mine [A 67]. Banded 20 m, 213 f on 2 Jul 1962; recovered 1 m, 80 f on 25 Jun 1963; foreign recovery, 11 f on 25 Jul 1963 at 1 mile N Rawhide Mine [A 61]; foreign recovery, 2 f on 14 Oct 1962 at Burro Creek [A 64]; foreign recovery, 1 f on 29 Jan 1964 at N side Riverside Mountains, 5 miles W Vidal, San Bernardino County, California by Al Beck; and foreign recovery, 1 f on 28 Aug 1962, about 85 miles ESE at Carl Pleasant Lake, Maricopa County, Arizona by Steve Gallezioli. Banded 70 m, 127 f on 25 Jul 1963.

CHOERONYCTERIS MEXICANA TSCHUDI,
MEXICAN LONG-TONGUED BAT

Choeronycteris mexicana Tschudi, Untersuchungen über die fauna Peruana..., p. 72, type from Mexico.

Comments

This nectar-feeding bat is a native of Mexico but routinely occurs in southeastern Arizona in the summer months and occasionally in southwestern California. Constantine (1987) reported a male taken after it "flew to a block wall in central Las Vegas," Clark County, Nevada, at 1:00 PM on 8 Sep 1983. As has been reported for other bats (e. g. *Leptonycteris* by Cockrum and Petryszyn, 1991; *Nyctinomops macrotis* from British Columbia, Iowa and Kansas in Hall, 1981:246), migratory species tend to have some individuals that move, in late summer, to areas far from their normal ranges. It appears probable that the long-tongued bat will eventually be recorded from Mohave County.

MYOTIS YUMANENSIS (H. ALLEN),
YUMA MYOTIS

Vespertilio yumanensis H. Allen, Smithsonian Misc. Coll., 7

(165):58, Jun, 1864, type from Old Fort Yuma, Imperial County, California, on right bank of Colorado River, opposite present town of Yuma, Arizona.

Myotis yumanensis, Miller, North American Fauna, 13:66, Oct 16, 1897.

Vespertilio macropus H. Allen, Proc. Acad. Nat. Sci., Philadelphia, p 288, 1866, type from Fort Mohave [near Fort Majaor, Colorado River, New Mexico], Mohave County, Ariz. (not *Myotis macropus* Gould, 1854, from Australia).

Myotis yumanensis yumanensis, Miller and Allen, U.S. National Museum Bulletin, 144:65, 1928; Cockrum, Mammals of Arizona, Univ. Az. Press, 1960, p. 35; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 190; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 71.

Myotis yumanensis, Suttkus, Clemmer and Jones, Tulane Univ., Belle Chasse, La., Museum Nat. Hist., Occas Papers, 2:4, 1978.

Comments

Sometime in 1864-65, "in the Colorado Desert, near Fort Mojave" Elliott Coues (1867:284) shot a bat as "it was industriously capturing insects over a small pool, in broad daylight." This specimen became the type of the new species, *Vespertilio macropus* of H. Allen (1866:288). Later it was determined that this specimen was the same as the earlier named *M. yumanensis*.

This species is noted for feeding almost exclusively over flowing water (Herd and Fenton, 1983:2029). Most of the records presented here are from sites within easy flight of running water and most are near the Colorado River.

Only three of the 241 *M. yumanensis* were taken in mist nets over water. Two females were taken on 6 Jun 1961 in a net at Burro Creek bridge; another was taken on 25 Aug 1963 in a net over a tank at Alamo Crossing. None were taken over small pools such as water tanks and pools at the entrance to mines. All others were taken from day roosts. Large numbers were seen in crevices of Davis Dam on the Colorado River where an estimated 3500 were present on 15 Apr 1962 and an estimated 10,000 were present on 17 Sep 1960. Since that time, various efforts have been made by professional pest control groups on

Table 5. *Myotis yumanensis* captures by month and sex. The numbers are the totals of specimen examined, bats banded and bats observed captures by month and sex.

Month	Males	Females	Total
January	0	0	0
February	1	1	2
March	0	1	1
April	7	99	106
May	0	0	0
June	1	53	54
July	0	1	1
August	14	32	46
September	26	2	28
October	1	0	1
November	0	0	0
December	0	2	2
Totals	50	191	241

behalf of the U. S. Army Corps of Engineers to eliminate bats from Davis Dam.

Table 5 summarizes by month and sex the individuals handled. Less than 3% of the total reported were taken between 1 Oct and 31 Mar. Obviously, no major winter roosts were found, even though some Yuma myotis were probably present throughout the winter.

No maternity colonies and no hibernals were encountered in Mohave County. Crevices in the bridge over the spillway at Davis Dam as well as various construction joints served as transient roosts in both the spring and fall. None were observed there in mid-summer nor the winter.

A small maternity colony was found in Nevada, only a few miles from Davis Dam (locality A 69, tunnel, Jackass Flat). None were present in this tunnel on 9 Apr 1961 but on 29 Jun 1963, 48 females and 1 male of an estimated 100 present were banded. On 10 Jul 1963, both adults and young were present. On 13 Aug 1961 only a single male was present.

A few Yuma myotis were taken in the Burro Creek area, mainly in

the spring and fall. All 17 foreign recoveries (11 m, 6 f) were taken within 10 miles of the banding site.

Records of occurrence

Specimens examined:— Total, 29 (8 m, 21 f), as follows:

3. 1 mile N Katherine Landing [A 18], 1 m on 12 Apr 1962, UA. [+3, UI, Telephone Pole Cove, 1 mile N Katherine Landing, of Davis Dam, Hoffmeister, 1986:72]. 4. Old Clack Ranch barn, 6 miles N Kingman, 1 m, 25 Sep 1959, UA. [= Hoffmeister, 1986:71.] 5. Davis Dam [A 26], 24 (1 m, 12 Apr 1960; 2 m, 1 f, 13 Aug 1961; 2 m, 18 f, 15 Apr 1962; UA). [+4, UI, Hoffmeister, 1986:72.] 8. Fort Mohave, 1 f, 14 Mar 1911, US. [Miller and Allen, 1928:67; Hoffmeister, 1986:72.] 9. Needle Rock Tunnel, 5 miles SE Topock, 1 m, 12 Apr 1962, UA. 10. Lower tunnel, Burro Creek, 1 f, 28 Apr 1962, UA. [+1, UI, Lower Burro Creek, 63 miles S Kingman, Hoffmeister, 1986:72.]

Literature:—

1. Sand Point, River Mile 294.5, left bank, 1, Suttkus, *et al.*, 1978:4. 7. 4.5 miles SE Kingman, Twin Wind Mills, 1, UI, Hoffmeister, 1986:72.

Banding records:— Total banded, 199 (38 m, 161 f); total local recoveries 2 (1 m, 1 f); total foreign recoveries, 7 (4 m, 3 f); as follows: 2. Tunnel, Clark Co., Nev. [A 69]. Banded 1 m, 48 f on 29 Jun 1962. 3. Tunnel, Katherine Landing [A 18]. Banded 1 m, 3 f on 30 Aug 1959. Banded 4 m on 17 Sep 1960; recovered 1 m on 13 Aug 1961; foreign recovery, 1 m at Tunnels, Union Pass [A 20] on 26 Feb 1961. Banded 10 m, 28 f on 13 Aug 1961; foreign recoveries, 2 m at Davis Dam [A 26] on 15 Apr 1962 and 1 m at Tunnel, Clark Co., Nevada [A 69] on 29 Jun 1962. 5. Davis Dam [A 26]. Banded 21 m, 2 f on 17 Sep 1960. Banded 78 f on 15 Apr 1963; recovery, 1 f on 10 Jul 1963; foreign recoveries, 2 f, Tunnel, Clark Co. Nev. [A 69] on 29 Jun 1962. 6. Tunnel j, Burro Creek [A 54j]. Banded 1 m on 1 Oct 1961. 6. Net, Burro Creek [A 56]. Banded 2 f on 6 Jun 1961. 11. Net, Alamo Crossing, Bill Williams River [A 68]. Retained 1 f taken on 25 Aug 1963 [specimen was at Kingman High-school].

MYOTIS VELIFER VELIFER (ALLEN).
CAVE MYOTIS

Vespertilio velifer J. A. Allen, Bull. American Museum Nat Hist., 3:177, 10 Dec 1890, type Santa Cruz del Valle, from near Guadalajara, Jalisco.

Myotis velifer, Miller, North American Fauna, 13,56, 16 Oct 1897.

Myotis velifer brevis, Vaughan, Univ. Kansas Publ., Mus. Nat. Hist., 7:509, Jul 23, 1954, type from Madera Canyon, 5000 ft., Santa Rita Mts., Pima County [=Santa Cruz County], Ariz.; Cockrum, Mammals of Arizona, Univ. Az. Press, 1960, p. 37; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 196.

Myotis velifer velifer, Miller and Allen, U.S. National Museum Bulletin, 144:89, 1928; Hayward, Western New Mexico University (Silver City) Research in Science 1(1): 11, 15 Feb 1970; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 74.

Comments

Only one of the more than 1400 individuals taken in this study was captured in a mist net. Ten were taken from a day roost in a building. All others were taken in mine tunnels. When only a few cave myotis are present, they usually roost in a small crevice, often a drill hole in a mine tunnel (as in Burro Creek [A 54b], 16 Apr 1961 when 4 males were taken). As others join the roost, they usually cluster around the site where the first were roosting, even though they are in a less-sheltered situation.

As shown in Table 6, none were taken during the winter (Nov - Mar). The earliest taken was 7 Apr, the latest was 1 Oct. The mine tunnel 3.5 miles E HWY 73 bridge over Burro Creek [A 57], served as a transient roost in early spring (Apr) and as a maternity colony later in the summer. On 7 Mar 1960, no cave myotis, but about 500 *Tadarida brasiliensis*, were present. On 19 Apr 1960 the estimated population of cave myotis was 25. On 28 Apr 1962, Twenty two (8 m, 14 f) were present along with about 2500 *T. brasiliensis*. On 17 May 1961, 65 m and 31 f were present. On 16 Jul 1960, over 1000 cave myotis were present, including 462 ad m, 331 ad f, and 300

Table 6. *Myotis velifer* captures by month and sex. The numbers are the totals of specimen examined, bats banded and bats observed.

Month	Males	Females	Total
January	0	0	0
February	0	0	0
March	0	0	0
April	180	141	321
May	128	100	228
June	113	20	33
July	464	333	797
August	24	22	46
September	3	7	10
October	11	3	14
November	0	0	0
December	0	0	0
Totals	823	626	1449

young. On 7 Aug 1960, only a single male was present.

Some temperatures associated with roosting bats include: locality A 52, 8 Apr, 2:30 PM—96° outside, 69° in roost; locality A 57, 16 Jul, 12:00 noon—111°, 81°, and on 7 Aug—120°, 80°.

The summer distribution of cave myotis is similar to that of the California leaf-nose bat. From the few records of banding and recoveries, we speculate that cave myotis spend the winter in some undiscovered hibernals in Yavapai or Coconino county and move down Burro Creek and the Bill Williams drainages during the spring. Some spend the summer months in this area while others move across the Colorado River, spending the summer in the Riverside Mountains in California (2 males, 1 female taken Jul 16-18, 1909 in an old building, Grinnell, 1918:261), in the Needles area or upstream in the lower part of Nevada (locality A 69). Individuals banded in the Burro Creek area were recovered in mines near Vidal Junction, San Bernardino County, California by A. J. Beck (see records below).

Records of Occurrence

Specimens examined:— Total, 13 (11 m, 2 f), as follows: 4. Big

Sandy Creek, 50 miles E Topock, 1 m, 2 f, 21 Jul 1902), US. [3 skins, 16 alcoholics, Miller and Allen, 1928:91; Hall, 1981:196; Hoffmeister, 1986:74.] 6. Tunnel, 3.5 miles E Burro Creek, 3500 ft., 9 m, 19 Apr 1960, UA. [Hoffmeister, 1986:74.] 7. Net, tank, N side Bill Williams R., Alamo Crossing, 1 m, 8 Apr 1966, UA.

Banding records:— Total banded, 1342 (740 m, 602 f); total local recoveries, 60 (39 m, 21 f); foreign recoveries, 31 (29 m, 2 f); as follows: 1. Tunnel, Clark Co., Nev. [A 69]. Banded 24 m, 22 f on 13 Aug 1961; recovered 4 m, 10 f on 29 Jun 1962; recovered 1 m on 10 Jul 1963. Banded 3 m, 16 f of 70 on 29 Jun 1962. 2. Building, 43 miles S Kingman [A 59]. Banded 3 m, 7 f on 15 Sep 1962. 3. Tunnel, Needle Rock [A 52]. Banded 19 m, 5 f on 8 Apr 1962. 5. Tunnel b, Burro Creek [A 54b]. Banded 4 m on 16 Apr 1961; foreign recovery, at tunnel f, Burro Creek [A 54f], 1 m on 17 May 1961; foreign recovery, at tunnel g, Burro Creek [A 54g], 1 m on 28 Apr 1962; foreign recovery, at tunnel j, Burro Creek [A 54j], 1 m on 28 Apr 1962. 5. Tunnel d, Burro Creek [A 54d]. Banded 1 m, 1 f on 17 May 1961. 5. Tunnel e, Burro Creek [A 54e]. Banded 1 m on 17 May 1961. 5. Tunnel f, Burro Creek [A 54f]. Banded 12 m, 4 f on 17 May 1961; foreign recovery, at tunnel j, Burro Creek [A 54j], 2 m on 28 Apr 1962.

5. Tunnel h, Burro Creek [A 54h]. Banded 18 m, 11 f on 16 Apr 1961; foreign recovery, 1 m at tunnel, S side Burro Creek [A 54 h] on 17 May 1961; foreign recoveries, 7 m at tunnel, S side Burro Creek [A 54h] on 28 Apr 1962. 5. Tunnel, S side Burro Creek [A 54j]. Banded 47 m, 55 f of 700 on 17 May 1961; recovered 3 m, 1 f on 28 Apr 1962; foreign recovery, 1 f at mine tunnel, 2 miles SW Vidal, San Bernardino, County, California on 30 Jul 1961 by A. J. Beck. Banded 10 m, 3 f on 1 Oct 1961; banded 94 m, 111 f of 232 on 28 Apr 1962; foreign recovery, 1 f at 7 miles SW Vidal Junction, San Bernardino County, California on 4 Aug 1964 by A. J. Beck. Banded 2 m, 1 f on 7 Apr 1963. 6. Tunnel, 3.5 miles E Burro Creek Bridge [A 57]. Banded 462 m, 331 f on 16 Jul 1960; recovered, 31 m, 10 f on 17 May 1961; foreign recovery, 1 m at tunnel f, Burro Creek [A 54f] on 17 May 1961; foreign recoveries, 14 m at tunnel j, Burro Creek [A 54j] on 28 Apr 1961; foreign recovery, 1 m in State Highway patrol car, parked in Phoenix, Maricopa County, Arizona, on 5 Dec 1962. Banded 33 m,

23 f of 102 on 17 May 1961. Banded 7 m, 12 f on 28 Apr 1962.

MYOTIS LUCIFUGUS OCCULTUS HOLLISTER.
LITTLE BROWN BAT

Myotis occultus Hollister, Proc. Biol. Soc. Washington, 22:43, 10 Mar 1909, type from west side Colorado River, 10 miles above Needles, San Bernardino Co., California; Miller and Allen, U.S. National Museum Bulletin, 144:97, 1928; Cockrum, Mammals of Arizona, Univ. Az. Press, 1960, p. 38; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 74.

Myotis lucifugus occultus, Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 193.

Comments

One specimen of this species, taken on the 1875 Wheeler Expedition, is on deposit in the United States National Museum. Its origin is obscure. Miller and Allen (1928:97,100) reported that it consisted of a skin only and was from the "Mojave Desert." In 1953, when Cockrum examined the mammals from Arizona in that collection, he did not see this specimen. In the early 1960's Cockrum examined a skin with skull, in the United States National Museum, that may have been this specimen. It had been taken from the Mohave Desert, Arizona, on 18 Jul 1875. Hoffmeister (1986) did not report this specimen. Robert D. Fisher of the US Fish and Wildlife Service (in lit, 29 Oct 1990) wrote us that "USNM 12693 was catalogued on 29 Mar 1877 as an alcoholic collected in Jul (no date given) 1875 at Mohave Desert, Arizona." There is no sex given. The 'received from' information is given as 'Exp. W. of 100th M. Dr. O Loew'. ...The museum number given above ... is physically on the skull of this specimen even though it is a skin number. The other museum number (37446) is a bone number and is on the partial skeleton of this specimen. It was entered in the bone catalog on 17 Aug 1898. Here however, all data remained the same ... except that a complete collecting date (18 Jul 1875) was given and the specimen was attributed to H W Henshaw. ...I can find no evidence that there ever was a standard skin for this specimen, even though Allen (1928) indicates

that he examined one.”

That only three records of this species occurring in Mohave County are available is surprising in view of their long-known presence along the Colorado River, in California. The type of the species, from 10 miles N Needles, in San Bernardino Co. California, is an adult male taken on 14 May 1905; an adult female was taken at the same locality on 15 May 1905. “They were shot in the dense cottonwood bottomlands of the Colorado River” (Hollister, 1909:44). Miller and Allen (1928:101) listed a female as a topotype; 4 females and one male from 5 miles NE Yuma, Imperial Co., California, taken on 3-4 May 1910 and one female from 4 miles S Potholes, Imperial Co., California, taken on 1 May 1910. The one from Pothole “was shot at late dusk close to the river bank between files of cottonwoods, in just the same association as those taken by Hollister [the type and cotype]” (Grinnell, 1914:263). The five from northeast of Yuma “were shot over the water in a back eddy of the river.” (Grinnell, *op. cit.*). Grinnell was reporting on a collecting trip along the lower Colorado, accomplished by floating downstream from Needles. The trip began on the evening of 14 Feb 1910, and ended near Pilot Knob, California, on 15 May. Concerning this bat, he speculated: “The fact that our ... expedition failed to detect the presence of this bat until the first week in May would point towards its late spring arrival in the region generally.” Stager (1943:197-8) reported finding an adult male in a shallow pocket in a large abandoned copper mine in the Riverside Mountains, Riverside County, Ca. on 16 Aug 1937 and documented a maternity colony of about 800 in crevices of a bridge near Blythe, Riverside County. He found them to be present at least from 20 Apr through 13 Aug and absent in Feb.

Myotis occultus is thought by some to be a subspecies of *Myotis lucifugus*, a species noted for feeding over water surfaces (*e. g.* Barbour and Davis, 1969:44). Since the above records are all along the Colorado River, it appears probable that these bats also feed over open water. Grinnell (1914:263) reported that the bats “arrived in considerable numbers at early dusk to drink flitting down to the water’s surface and dipping several times before flying off among the willows and cottonwoods. We used a boat in shooting and retrieving the specimens.” Perhaps these bats were feeding as well as drinking.

Hoffmeister (1986:76) pointed out that the records cited by him were at higher elevations, either in riparian situations or in oak woodland or Ponderosa Pine forests. Probably all were within feeding range of permanent water.

We speculate that the Colorado River populations move to higher elevations for hibernation, probably along the Bill Williams, Big Sandy and Burro Creek drainage to unknown sites in Yavapai or Coconino County. The female taken on 28 Apr in the Burro Creek area was moving from the winter range to the summer range.

Records of Occurrence

Specimens examined:— 1, as follows:

1. Mohave Desert, 1 ♀, 18 Jul 1875, US. [Hoffmeister, 1986:77.]

Banding records:—

The banding records indicate that two were taken. Both were apparently retained and presumably prepared as specimens for the Kingman High School collection. Cockrum did not see these specimens. Data follows:— 2. Tunnel j, Burro Creek [A 54j]. Took 1 f on 28 Apr 1962. 2. Tunnel, 3.5 miles E Burro Creek [A 57]. Took 1 m on 16 Jul 1960.

MYOTIS THYSANODES THYSANODES MILLER. FRINGED MYOTIS

Myotis thysanodes Miller, North American Fauna, 13:80, 16 Oct. 1897, type from Old Fort Tejon, Tehachapi Mts., Kern Co., Calif.

Myotis thysanodes thysanodes, Miller and Allen, Bull. U. S. Nat. Museum, 144:126, 1928; Cockrum, Mammals of Arizona, Univ. Az. Press, 1960, p. 41; Hoffmeister and Durham, Museum of Northern Az., Flagstaff, Tech. Series 11:26, 1971; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 204; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 81.

Comments

A thesis by David Wright, completed in 1966 under Cockrum's direction, was never published. Most of it was an evaluation of

geographic variations in morphological features. Several Comments in this thesis reflected Cockrum's opinions concerning various aspects of this bat. The following observations concerning ecological distribution are pertinent.

"That the habitat of *Myotis thysanodes* is the oak and pine forests of the Upper Sonoran and Transition Life Zones has been reported many times [five references, none to Mohave County, and the general statement..."and many others"]. Data obtained through the bat banding program carried out by E. L. Cockrum and others at The University of Arizona (personal communication with E. L. Cockrum) indicate behavioral patterns within the oak-pine habitat that are important in a taxonomic evaluation of this species."

"*Seasonal variations.* Data primarily from colonies in Mohave County, Arizona, show that these bats separate into maternity colonies and male colonies during the spring and summer, although a few male individuals are usually present in the maternity colonies. Male colonies are found at higher elevations than the female roosts and are more numerous but contain fewer individuals. Normally both males and females show a high preference for a specific cave as a summer roost, but males taken from maternity colonies show less preference for the cave from which they were taken than do individuals taken from all-male colonies. Both males and females also seem to prefer particular watering places.... Hackberry Consolidated Mine represents a maternity colony, as shown by the high percentage of females to males and the presence of newborn young on 3 Jul 1960. Other maternity colonies not yet located are probably present... [in the following areas]... as mist net records show high ratios of females to males at watering sites at Democrat and Flag mines (Hualapai Mountains), Stockton Hills mine (Cerbat Mountains), and in the Union Pass area (Black Mountains). ..."

"Banding records also demonstrate that there is some movement from one day roost to another in the summer months, but that this movement is not over a great distance and is within the same general ecological situation...."

"Homing experiments, however, have shown that with this species there is a strong tendency to return to a particular roost, not only from one year to the next... but also during the same summer.

Table 7. *Myotis thysanodes* captures by month and sex. The numbers are the totals of specimen examined, bats banded and bats observed. Net and roost refer to type of location.

Month	net		roost		total	
	m	f	m	f	m	f
January	0 +	0 = 0	2 +	0 = 2	2 +	0 = 2
February	0 +	0 = 0	0 +	0 = 0	0 +	0 = 0
March	0 +	0 = 0	0 +	2 = 2	0 +	2 = 2
April	0 +	0 = 0	0 +	0 = 0	0 +	0 = 0
May	0 +	4 = 4	0 +	1 = 1	0 +	5 = 5
June	24 +	46 = 70	0 +	0 = 0	24 +	46 = 70
July	113 +	229 = 342	143 +	286 = 429	256 +	511 = 567
August	11 +	3 = 14	81 +	229 = 31	92 +	232 = 324
September	0 +	0 = 0	1 +	4 = 5	1 +	4 = 5
October	2 +	0 = 2	2 +	0 = 2	4 +	0 = 4
November	0 +	0 = 2	0 +	0 = 0	0 +	0 = 0
December	0 +	0 = 0	0 +	0 = 0	0 +	0 = 0
Totals	150 +	282 = 432	229 +	504 = 733	379 +	786 = 1165

[Examples from Cochise County are given]. ...It seems likely therefore, that although more than one day roost in the same general vicinity can be, and are, utilized by individuals when necessary, one particular day roost is preferred."

"In late summer and early fall, dormant individuals of both sexes have been found in cool damp mine tunnels in Mohave County. These include the following: One female was taken on 1 Sep 1961 in the OK Mine, 68 miles north of Kingman in a desert area at 4000 feet elevation. Air temperature in the tunnel was 16.7 degrees Centigrade. On 17 Sep 1961, a single dormant male was taken in Sulphur tunnel (air temperature 21.7 degrees centigrade), 4 miles northwest of Oatman, and one male was taken in a wet tunnel 5 miles northwest of Oatman. On 25 Sep 1961, three females were taken from the wet Jim Kane Mine in the Cerbat Mountains northwest of Kingman."

"Some active individuals have also been found in early fall in Mohave County, but these have been in drier and warmer situations. On 1 Oct 1961, a single male was taken in the mine tunnel on Lower Burro Creek where *Myotis velifer* and *Macrotus californicus* are usually

found. A single male was taken on 22 Oct 1960 in the attic of an abandoned house at Cave [=Cane] Springs, Big Sandy River. Ten *Plecotus townsendii* and one *Myotis californicus* were also present. These two *M. thysanodes* were possibly young of the year or adults that had not yet accumulated enough body fat to undergo hibernation, and were seeking a warmer environment in an attempt to prolong their feeding period.”

“Few Fringed myotis have been found in this general area during the winter. Two males were found on 21 Jan 1962 in Flag Mine, elevation 7000 feet, in the Hualapai Mountains. Two females were found on 25 Mar 1961 in Hackberry Consolidated Mine. All of these animals were torpid at the time of capture.”

Some of the supporting data for these statements are given in Table 7. As shown all but 18 of 1165 individuals were captured in the months of Jun, Jul and Aug. Four hibernating males were taken between 22 Oct and 15 May. About two-thirds were taken from day roosts. Sex ratios were about 2:1 in both situations.

Temperatures associated with roosting bats include: Roost 42a, at 1200 on 20 Jan—34° outside, 44° in roost, 8.1°C body temperature.

Records of Occurrence

Specimens examined:— Total, 11 (4 m, 7 f), as follows: 1. Jun Tank, S of Findlay Knolls, 5500 ft., 1 f, 16 Jul 1975, MNA. 2. Nixon Spring, Mount Trumbull, 2 (1 f, 16 Jul 1964, UA; 1 m, 4 Aug 1969, MNA). [= Nixon Spring, 9 miles ESE Trumbull P. O., 6500 ft., 2, Hoffmeister and Durham, 1971:26; [Hoffmeister, 1986:81.] 5. Hackberry Consolidated Mine, Peacock Mtns, 26 miles NE Kingman, 2 (1 m, 1 f, 3 Jul 1960), UA. [Hoffmeister, 1986:81.] 6. Cohenour Springs, Cohenour Canyon, 11 miles N Kingman, 4200 ft., 1 f, 25 May 1976, MNA. [Hoffmeister, 1986:81.] 7. Stockton Hills Mine, N of Kingman, 1 f, 4 Oct 1962, UA. [Hoffmeister, 1986:81.] 9. Beale's Spring, 1 f, US. [Miller and Allen, 1928:127; =Beale Spring, Hoffmeister, 1986:81.] 10. 1 mile SW Union Pass, 1 f, 10 Jul 1962, UA. [+ 1, UI, Hoffmeister, 1986:81.] 10. Tunnel, 2 miles W Bowelli [=Bohelli Ranch], 16 miles W Kingman, 1, Hoffmeister, 1986:81. 13. Twin Windmills, 4.5 miles SE Kingman, 1 m, 5 Jul 1960, UA.

[Hoffmeister, 1986:81.] 14. Flag Mine, 7000 ft., Hualapai Mts., 1 m, 3 Jul 1962, UA. [Hoffmeister, 1986:81.]

Literature:— 3. 0.5 mile NE Vulcan's Throne, 4600 ft., 1, UI. Hoffmeister and Durham, 1971:26; Hoffmeister, 1986:81. 13. Tunnel, N end Hualpai [sic] Mts., 9 miles SE Kingman, 1, UI. Hoffmeister, 1986:81. 16. Beside Democrat Mine, 13 miles ESE Kingman, Hualpai [sic] Mts., 1, UI, Hoffmeister, 1986:81.

Banding records:— Total banded, 1162 (321 m, 741 f); total local recoveries, 189 (3 m, 186 f); total foreign recoveries, 17 (4 m, 13 f); as follows: 4. Tunnel, 68 miles N Kingman [A 1]. Banded 1 f on 1 Sep 1961. 5. Tunnel, 28.5 miles NE Kingman [A 5]. Banded 32 m, 82 f on 3 Jul 1960 and released in Kingman; recovered 32 f on 26 Jul 1960; recovered 72 f on 14 Aug 1961; recovered 42 f on Aug 1963; foreign recovery, 1 f at 3 miles S Hackberry [A 8] on 15 May 1961; foreign recovery, 1 f at net, 4.5 miles SSE Kingman [A 37] on 5 Jul 1960. Banded 26 m, 154 f on 26 Jul 1961. Banded 2 f on 25 Mar 1961. Banded 10 m, 50 f on 14 Aug 1961; recovered 17 f on 3 Aug 1963. Banded 36 m, 65 f on 3 Aug 1963. 6. Net, tunnel 17 miles NW Kingman [A 10]. Banded 1 m on 28 Jun 1963. 7. Net, tunnel Cerbat Mts. [A 6]. Banded 2 m, 7 f on 8 Jul 1962; recovered 1 f at Tunnel, 8 miles N Kingman on 18 Jul 1962. 7. Net, tunnel 2.5 miles N Stockton Hills Mine [A 7]. Banded 2 m, 4 f on 27 Jun 1963. 9. Net, Tunnel 8 miles N Kingman [A 11]. Banded 4 m, 12 f of 20 on 6 Jul 1962; recovered 1 f on 8 Jul 1962; recovered 1 f on 1 Jul 1963; recovered 1 f on 17 Jul 1963. Banded 9 m, 21 f on 8 Jul 1962; recovered 1 f on 18 Jul 1962; recovered 1 m on 1 Jul 1963; recovered 1 f on 17 Jul 1963. Banded 5 m, 13 f on 18 Jul 1962; recovered 1 f on 17 Jul 1963. Banded 1 m, 11 f on 1 Jul 1963; recovered 1 m on 17 Jul 1963. Banded 7 m, 13 f on 17 Jul 1963. 8. Tunnel, 16 miles NW Kingman [A 13]. Banded 3 f on 24 Sep 1961. 8. Net, tunnel 1 mile W Stockton Hills mine [A 15]. Banded 2 m on 26 Jun 1963; foreign recovery, 1 m at tunnel, 8 miles N Kingman [A 11] on 1 Jul 1963. 10. Net, tunnel 1 mile SW Union Pass [A 19a]. Banded 2 m, 20 f on 10 Jul 1962; recovered 10 f on 26 Jul 1962. Banded 13 m, 42 f on 26 Jul 1962. Banded 1 m on 3 Jul 1963. Banded 1 m, 1 f on 23 Jul 1963. 11. Net, 1.5 miles SE Kingman [A 31]. Banded 1 f on 26 Aug 1961. 12. Net in tunnel, 9 miles SE Kingman [A 24]. Banded 4 m on 19

Aug 1959. Banded 6 m on 7 Aug 1960. Banded 6 m on 15 Jul 1962; foreign recovery, 1 m at tunnel 8 miles N Kingman [A 11] on 25 Jun 1963. 12. Tunnel a, 11 miles SE Kingman [A 25a]. Banded 1 m on 13 Jul 1961. Banded 1 m on 7 Aug 1963. 12. Tunnel b, 11 miles SE Kingman [A 25b]. Banded 2 m on 13 Jul 1961. Banded 14 m on 7 Aug 1963. 13. Net, 7.5 miles SE Kingman [A 30]. Banded 1 m on 5 Jul 1962. 13. Tunnel, 11 miles SE Kingman and then 1.25 miles W up wash [A 33]. Banded 1 m on 13 Jul 1961. 13. Net, 4.5 miles SSE Kingman [A 37]. Banded 1 m on 25 Aug 1960. Banded 1 m on 6 Jul 1962. 11. Tunnel, 1.5 miles SW Kingman [A 38]. Banded 1 m on 11 Aug 1960. Banded 1 m on 20 Aug 1960. 12. Net, 8 miles SSE Kingman [A 39]. Banded 1 m on 4 Aug 1960. Banded 1 f on 10 Aug 1960. Banded 1 f on 23 Jul 1962. 12. Net, 6.5 miles SSE Kingman [A 40]. Banded 1 f on 4 Aug 1960. 14. Net, entrance Flag Mine [A 43b]. Banded 6 m, 4 f on 12 Jun 1962; recovered 1 f on 23 Jul 1962. Banded 4 m, 10 f on 3 Jul 1962; foreign recovery 1 m at tunnel, 5 miles S Hualapai Mountain Park [A 46] on 28 Jul 1963. Banded 15 m, 20 f on 11 Jul 1962; foreign recovery, 1 f at tunnel, 5 miles S Hualapai Mountain Park [A 46] on 12 Jul 1963. Banded 10 m, 10 f on 23 Jul 1962; recovery 1 m on 4 Jul 1963; foreign recovery, 1 f at tunnel 5 miles S Hualapai Mountain Park [A 46] on 12 Jul 1963. Banded 2 m on 10 Oct 1962. Banded 4 f on 20 May 1963; foreign recovery, 1 f at tunnel 5 miles S Hualapai Mountain Park [A 46] on 12 Jul 1963; foreign recoveries, 1 m, 1 f at tunnel 5 miles S Hualapai Mountain Park, on 28 Jul 1963. Banded 21 m, 32 f on 4 Jul 1963; foreign recoveries 2 f at tunnel 5 miles S Hualapai Mountain Park [A 46] on 12 Jul 1963; foreign recoveries, 3 f at tunnel 5 miles S Hualapai Mountain Park [A 46] on 28 Jul 1963. Banded 16 m, 12 f on 27 Jul 1963; foreign recoveries, 2 f at tunnel 5 miles S Hualapai Mountain Park [A 46] on 28 Jul 1963. 15. Tunnel, 5 miles N Oatman [A 44]. Banded 1 m on 17 Aug 1961. 16. Net, tunnel 5 miles S Hualapai Mtn. Park [A 46]. Banded 1 m, 16 f on 7 Jul 1963. Banded 6 m, 30 f on 12 Jul 1963. Banded 17 m, 51 f on 28 Jul 1963. 15. Tunnel, 4 miles N Oatman [A 48]. Banded 1 m on 17 Sep 1961. 16. Net, tunnel, 5 miles S Hualapai Mountain Park [A 45]. Banded 1 m, 16 f on 7 Jul 1963; recovered 1 f on 28 Jul 1963. Banded 6 m, 30 f on 12 Jul 1963; recovered 4 f on 28 Jul 1963. Banded 17 m, 51 f on 27 Jul 1963. 17.

Table 8. *Myotis volans* captures by month and sex. The numbers are the totals of specimen examined, bats banded and bats observed.

Month	Males	Females	Total
January	2	0	2
February	0	0	0
March	0	0	0
April	0	0	0
May	2	3	5
June	2	21	23
July	85	128	213
August	8	18	26
September	0	1	1
October	0	0	0
November	0	0	0
December	0	0	0
Totals	99	171	270

Building, Cane Springs [A 50]. Banded 1 m on 22 Oct 1960. 18.
Tunnel j, Burro Creek [A 54j]. Banded 1 m on 1 Oct 1961.

MYOTIS VOLANS INTERIOR MILLER.
LONG-LEGGED MYOTIS

Myotis longicrus interior Miller, Proc. Biol. Soc. Washington, 27:211, 31 Oct. 1914, type from 5 miles S Twining [11300 ft.], Taos Co., New Mexico.

Myotis volans interior, Miller and Allen, Bull. U. S. National Museum, 144:142, 25 May 1928; Cockrum, Mammals of Arizona, Univ. Az. Press, 1960, p.43; Hoffmeister and Durham, Museum of Northern Az., Flagstaff, Tech. Series 11:26, 1971; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 198. Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 83.

Comments

The only *Myotis volans* taken in this study were in or near the high

elevation mountains: Black Rock Mountain, Mt. Trumbull, and Hualapai Mountain.

As indicated in Table 8, about 270 were captured. All but three or four were taken in flight. Two hibernating males were recorded in Flag Mine on 20 Jan 1962. Temperature 300' into the tunnel was 44°F; rectal temperature was 10.0°C.

Active individuals were recorded as early as 1 May [G 39] and as late as 27 Sep [G 37]. Day roosts have not yet been identified.

Records of Occurrence

≈**Specimens examined**:— Total, 17 (6 m, 11 f), as follows: 1. Trails End, Black Rock Mtn., 11.5 miles SE Littlefield, 7100 ft., 1 f, 3 Aug 1969, MNA. [Hoffmeister, 1986:84.] 2. Nixon Spring, 6250 ft., Mt. Trumbull, 1 f, 16 Jul 1964, UA; 2 m, 24-25 May 1933, MVZ; 4 f, 4 Aug 1969, MNA. [Hoffmeister and Durham, 1971:26; 4, MNA, 1, UI, Hoffmeister, 1986:84.] 2. Mt. Trumbull, 1 m, 30 Jul 1937, SDSNH. 4. Twin Windmill, 4.5 miles SSE Kingman, 1 f, 18 Jul 1959; 1 f, 5 Jun 1961; 1 m, 1 f, 15 Aug 1961; 1 m, 1 f, 8 Aug 1963, UA. [Hoffmeister, 1986:84.]

5. Flag Mine, Hualapai Mts., 1 m, 1 f, 3 Jul 1962, UA. [+ 4, UI, =Flag Mine, Hualpai [sic] Mts., Hoffmeister, 1986:84.]

Literature:—

4. 8 miles SE Kingman, 1, UI, Hoffmeister, 1986:84.

Banding records:— Total banded, 240 (87 m, 153 f); total local recoveries, 10(2 m, 8 f); total foreign recoveries, 1 f; as follows: 3. Net, tunnel 9 miles SE Kingman [A 24]. Banded 1 m on 7 Aug 1960. Banded 1 f on 15 Jul 1962. 3. Tunnel b, 11 miles SE Kingman [A 25b]. Banded 1 f on 7 Aug 1963. 4. Net, 4.5 miles SSE Kingman [A 37]. Banded 1 f on 13 Sep 1960. Banded 1 m, 1 f on 8 Aug 1961. Banded 1 m, 1 f on 11 Aug 1961. Banded 1 f on 12 Aug 1961. Banded 2 m on 13 Aug 1961. Banded 1 f on 23 May 1962. 4. Net, 8 miles SSE Kingman [A 39]. Banded 3 f on 4 Aug 1960. Banded 1 m, 4 f on 16 Aug 1961. Banded 2 f on 1 May 1962. Banded 2 f on 10 Jun 1962. Banded 1 m, 4 f on 23 Jul 1962. 5. Net, entrance Flag Mine [A 43b]. Banded 2 m, 18 f on 12 Jun 1962. Banded 3 m, 7 f on 3 Jul 1962; recovered 2 f on 23 Jul 1962; recovered 2 f on 4 Jul 1963. Banded 9 m, 7 f on 11 Jul 1962; recovered 1 m on 23 Jul 1962; recovered 1 f on

4 Jul 1963. Banded 9 m, 9 f on 23 Jul 1962; foreign recovery, 1 f at tunnel, 5 miles S Hualapai Mountain Park [A 46] on 28 Jul 1963. Banded 39 m, 73 f on 4 Jul 1963; recovered 1 m, 2 f on 27 Jul 1963. Banded 1 f on 12 Jul 1963; recovered 1 f on 27 Jul 1963. Banded 16 m, 8 f on 27 Jul 1963. 6. Net, tunnel 5 miles S Hualapai Mtn. Park [A 46]. Banded 2 m, 5 f on 12 Jul 1963. Banded 3 f on 28 Jul 1963.

MYOTIS CALIFORNICUS STEPHENSI DALQUEST.
CALIFORNIA MYOTIS

Myotis californicus stephensi Dalquest, Proc. Biol. Soc. Washington, 59:67, Mar. 11, 1946 (to replace *pallidus* Stephens, Proc. Biol. Soc. Washington, 13:153, Jun 12, 1900 (which is preoccupied); Cockrum, Mammals of Arizona, Univ. Az. Press, 1960, p. 44; Hoffmeister and Durham, Mus. Northern Az., Flagstaff, Technical Series 11:25, 1971; Bogan, U. S. Dept. Interior, Fish and Wildlife Service, Wildlife Research Report 3:22, 1975; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 187; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 87.

Myotis californicus pallidus, Miller and Allen, Bull. U. S. Nat. Museum, 144:157, 1928.

Myotis californicus californicus, Hoffmeister and Durham, Mus. Northern Az., Flagstaff, Technical Series 11:25, 1971 (from 0.5 miles NE Vulcan's Throne, 4600 ft.).

Comments

California myotis occur throughout the area. Most were taken in mist nets over water (Table 9). Only 29 were taken in roosts and these were usually solitary individuals hanging in a crevice near the front of a mine tunnel or in a building. Small clusters in rock crevices probably are the usual roosting situation. Most were taken in the dry season of Jun and Jul. None were taken in the Nov, Dec or Jan and no hibernals were found.

Records of Occurrence

Specimens examined:— Total, 69 (30 m, 39 f), as follows: 1.

Table 9. *Myotis californicus* captures by month, sex, and place of collecting activities. The numbers are the totals of specimen examined, bats banded and bats observed.

Month	net		roost		total	
	m	f	m	f	m	f
January	0 +	0 = 0	0 +	0 = 0	0 +	0 = 0
February	0 +	0 = 0	1 +	1 = 2	1 +	1 = 2
March	0 +	0 = 0	0 +	0 = 0	0 +	0 = 0
April	1 +	0 = 1	0 +	1 = 1	1 +	1 = 2
May	6 +	3 = 9	0 +	0 = 0	6 +	3 = 9
June	13 +	21 = 34	0 +	2 = 2	13 +	23 = 36
July	32 +	83 = 115	9 +	0 = 9	41 +	83 = 124
August	0 +	3 = 3	2 +	5 = 7	2 +	8 = 10
September	5 +	1 = 6	2 +	5 = 7	7 +	6 = 13
October	0 +	1 = 1	0 +	1 = 1	1 +	1 = 2
November	0 +	0 = 0	0 +	0 = 0	0 +	0 = 0
December	0 +	0 = 0	0 +	0 = 0	0 +	0 = 0
Totals	57 +	112 = 169	14 +	15 = 29	71 +	127 = 198

Limekiln Canyon, 5000 ft, W slope Virgin Mts., 1 f, 14 Oct 1936, US. [Hoffmeister, 1986:87.] 2. Buckhorn Spring, T 34 N, R 16 W, Sec 26, 1600 ft., 3 m, 4 May 1976; 3 m; 2 f, 19 May 1978, MNA. 7. 2.5 miles N Stockton Hills, 2 f, 26-27 Jun 1963; 1 m, 17 Jul 1963, UA. 9. Old Clack Ranch barn, 6 miles N Kingman, 1 f, 25 Sep 1959, UA. [Hoffmeister, 1986:87.] 9. Beale's Spring, 2 m, US. [Miller and Allen, 1928:158; Hoffmeister, 1986:87.] 11. 1 mile SW Union Pass, 1 m, 10 Jul 1962, UA. 12. Twin Windmills, 4.5 miles SE Kingman, 2 f, 13 Jul 1959; 1 f, 18 Jul 1959; 1 f, 5 Jul 1960; 1 f, 5 Jun 1961; m, 2 f, 6 Jul 1962, UA. 13. 6.5 miles SE Kingman, 2 f, 5 Jul 1962, UA. 13. 7.5 miles SE Kingman, 1 f, 9 Jul 1963, UA. 14. 4.5 miles N Oatman, 1 m, 31 Jul 1961, UA. 14. Sulfur tunnel, 4 miles N Oatman, 2 m, 31 Jul 1961, UA. 16. Flag Mine, 7000 ft., Hualapai Mts, 8 m, 11 f, 4 Jul 1963; 1 f, 28 Jul 1963; UA. [=1, UI, Flag Mine, Hualpai (*sic*) Mts., Hoffmeister, 1986:87.] 17. King Mine, Stone Bldg., S slope Hualapai Mts, 1 f, 17 Sep 1960, UA. [= King Mine, stone Bldg., S slope Hualpai (*sic*) Mts., 2 f, UI, Hoffmeister, 1986:87.] 19. Little

Meadows, alcohol, 2 m, 4 f, 20 Jun 1902, US. [Hoffmeister, 1986:87.] 20. Big Sandy Creek, 50 miles E Topock, 1 m, US. [Miller and Allen, 1928:158; Hoffmeister, 1986:87.] 21. Mellen, Colorado River, 2, MVZ. [Miller and Allen, 1928:158; Hoffmeister, 1986:87.] 22. Burro Creek Bridge, 1 f, 6 Jun 1961, UA. 23. Gold Spring, 1950 ft., Chemehuevis Mts., 1 m, 1 f, 22, 25 Feb 1938, SDSNH. 24. Bill Williams River, 3 m, 2 f, US. [Miller and Allen, 1928:158]. 25. N side Bill Williams River, Alamo Crossing, 1 m, 19 Apr 1966, UA.

Literature:—

3. 3 miles W Lower Pigeon Spring, 4400 ft., 1, UI, Hoffmeister and Durham, 1971:25; Hoffmeister, 1986:87. 5. Mile 179.8, N side Colo. R., Grand Canyon Natl. Mon., 1, MNA, Hoffmeister, 1986:87. 4. 0.5 mile NE Vulcan's Throne, 4600 ft., 1, Hoffmeister and Durham, 1971:25; Hoffmeister, 1986:87. 9. Cohenour Springs, Cohenour Canyon, 11 miles N Kingman, 1, MNA, Hoffmeister, 1986:87. 7. Chloride, 2, UI, Hoffmeister, 1986:87. 10. 1 mile N Katherine Landing, 1, UI, Hoffmeister, 1986:87. 10. Davis Dam, 30 mi W Kingman, 1, UI, Hoffmeister, 1986:87. 11. 1 mile SW Union Pass, 11, UI, Hoffmeister, 1986:87. 12. 1 mile N Kingman, 2, UI, Hoffmeister, 1986:87. 13. 6.5 miles SE Kingman, 2, UI, Hoffmeister, 1986:87. 13. Upper Windmill, 8 miles SSE Kingman, 1, UI, Hoffmeister, 1986:87. 18. Cane Springs Area, Big Sandy [exact locality not known], 1, UI, Hoffmeister, 1986:87. 22. 3.5 miles E Burro Creek Bridge, 76 miles S Kingman, on highway 93, 3, UI, Hoffmeister, 1986:87.

Banding records:— Total banded, 122 (41 m, 81 f); total local recovery, 1 f; as follows: 6. Tunnel, 68 miles N Kingman [A 1]. Banded 1 m on 1 Sep 1961. Banded 1 m on 8 Jul 1963. 7. Net, tunnel Cerbat Mts. [A 6]. Banded 1 m, 2 f on 8 Jul 1962. 7. Net, tunnel 2.5 miles N Stockton Hills Mine [A 7]. Banded 2 f on 27 Jun 1963. 8. Net, tunnel 17 miles NW Kingman [A 10]. Banded 1 m, 1 f on 28 Jun 1963. 9. Net, tunnel 8 miles N Kingman [A 11]. Banded 1 m, 1 f on 8 Jul 1962. Banded 1 f on 18 Jul 1962. Banded 2 f on 25 Jun 1963. Banded 1 m, 3 f on 1 Jul 1963. Banded 4 f on 17 Jul 1963. 10. Tunnel, 7.5 miles E Davis Dam [A 17c]. Banded 1 f on 9 Sep 1961. 10. Davis Dam [A 26]. Banded 1 f on 15 Apr 1962. 11. Net, tunnel 1 mile SW Union Pass [A 19a]. Banded 1 m on 10 Jul 1962. Banded 3 m, 3 f on

26 Jul 1962. Banded 10 m, 17 f on 3 Jul 1963; recovered 1 f on 23 Jul 1963. Banded 5 m, 14 f on 23 Jul 1963. 11. Tunnels, Union Pass [A 20]. Banded 2 f of 50 on 30 Aug 1960. 12. Net, 1 mile NW Kingman [A 22a]. Banded 5 m on 17 Sep 1961. 12. Building, 4 miles E Kingman [A 23a]. Banded 2 f on 25 Sep 1960. 12. Net, 1.5 miles SE Kingman [A 31]. Banded 1 f on 26 Aug 1961. 12. Net, 3.5 miles SSE Kingman [A 34]. Banded 1 f on 13 Aug 1961. 12. Net, 4.5 miles SSE Kingman [A 37]. Banded 3 m, 3 f on 13 Jul 1960. Banded 2 f on 16 Jul 1960. Banded 4 f on 11 Jul 1961. Banded 2 f on 13 Aug 1961. Banded 2 f on 8 Jun 1962. 12. Tunnel, 1.5 miles SW Kingman [A 38]. Banded 1 m on 11 Aug 1960. 13. Net, 6.5 miles SSE Kingman [A 40]. Banded 4 f on 9 Jun 1962. 14. Tunnel, 5 miles N Oatman [A 44]. Banded 1 f on 17 Aug 1961. 14. Tunnel, 4 miles N Oatman [A 48]. Banded 1 m, 1 f of 3 on 17 Sep 1961. 15. Tunnel, 4.5 miles E Oatman [A 47]. Banded 1 m, 3 f on 25 Aug 1960. 18. Building, Cane Springs [A 50]. Banded 1 f on 22 Oct 1960. 25. Upper tunnel, 1 mile N Rawhide Mine [A 61]. Banded 4 m on 25 Jul 1963. 25. Tunnel, 600 ft above Rawhide Mine [A 63]. Banded 1 m on 25 Jul 1963.

MYOTIS CILIOLABRUM MELANORHINUS (MERRIAM).
WESTERN SMALL-FOOTED MYOTIS

Vespertilio melanorhinus Merriam, North American Fauna, 3:46, 11 Sep, 1890, type from Little Spring, north base San Francisco Mountain, 8250 ft., Coconino County, Ariz.

Myotis ciliolabrum melanorhinus, Van Zyll de Jong, Canadian Zool. Jour., 62:2526, 1984.

Myotis leibii melanorhinus, Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 89.

Myotis subulatus melanorhinus, Hoffmeister and Durham, Museum of Northern Az., Flagstaff, Tech. Series 11:26, 1971. Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 188.

Comments

During this study no *Myotis ciliolabrum* were found in day roosts

Table 10. *Myotis ciliolabrum* captures by month and sex. The numbers are the totals of specimen examined, bats banded and bats observed.

Month	Males	Females	Total
January	1	1	2
February	0	0	0
March	1	0	1
April	0	5	5
May	1	1	2
June	3	7	10
July	24	10	34
August	3	4	7
September	0	1	1
October	0	0	0
November	0	0	0
December	0	2	2
Totals	33	31	64

in Mohave County. All taken were captured in nets over water. The nets were very inefficient in capturing these small *Myotis*. For example, on the night of 13 Jul 1959 at Twin Windmills, 63 bats, including five small *Myotis*, were captured. Notes at that time include: "probably over 1,000 bats take water here each evening." Musgrove observed about 50 small *Myotis* coming to drink at this same water tank between 7:45 and 9:00 PM on 17 Apr 1962. The only two taken were this species. On 17 Apr 1962, at Twin Windmills, Musgrove noted: "estimated 50 [*M. ciliolabrum*] came in between 7:45 and 9:00 PM." However, only two were captured in the nets.

On 6 Mar 1963, at Flag Mine, only one of several small *Myotis* was taken and it was a male of this species. The number of specimens examined taken from this locality were 23 males and 10 females. In contrast, the ratio at lower elevations was 17 females to five males, taken mainly in the warm months.

The actual population present in the Hualapai Mountain region is probably much larger than the banding and collecting records indicate. As shown in Table 10, most small-footed myotis were taken in Jun and Jul—the dry season when bats concentrate at the few available sources of water. Some were taken each month except Feb,

Oct and Nov. Air temperatures recorded at the time of capture (in flight, at water source) ranged from 28°F at 6:30 PM on 14 Dec to 78°F at 10:00 PM on 10 Aug.

Records of Occurrence

Specimens examined:— Total, 49 (21 m, 28 f), as follows: 3. Jun Tank, S of Findlay Knolls, 5500 ft., 4 m, 16 Jul 1975, MNA. 4. Nixon Spring, Mt. Trumbull, 1 m, 16 Jul 1964, UA. 5. 2.5 miles N Stockton Hills, 2 f, 27 Jun 1963, UA. 5. 1 mile N Stockton Hills, 2 f, 26 Jun 1963, 1 m, 27 Jun 1963, UA. 5. Stockton Hills, 1 m, 17 Jul 1963, UA. 6. Union Pass, 1 f, 23 Jul 1963, UA. 7. Twin Windmills, 4.5 miles SSE Kingman, 2 f, 13 Jul 1959; 2 m, 3 f, 5 Jul 1960; 2 f, 16 Jul 60; 1 m, 11 Aug 61; 2 f, UA. [+ 7, UI, Hoffmeister, 1986:89.] 7. 6.5 miles SE Kingman, 1 f, 5 Jul 1962, UA. [+ 1, UI, Hoffmeister, 1986:89.] 7. 7.5 miles SE Kingman, 2 f, 5 Jul 1962; 1 f, 16 Jul 1962, UA. 8. Mist net, Flag Mine, 7000 ft., Hualapai Mts, 2 m, 1 f, 3 Jul 1962; 2 m, 11 Jul 1962; 4 m, 1 f, 23 Jul 1962; 2 f, 14 Dec 1962; 3 f, 30 Jan 1962; 12 m, 3 f, 4 Jul 1963; 3 m, 27 Jul 1963, UA. [+ Flag Mine, Hualpai (*sic*) Mts., 3, UI, Hoffmeister, 1986:89.]

Literature:—

1. Pipe Spring Nat'l. Mon., 5000 ft., 1, UI, Hoffmeister and Durham, 1971:26; Hoffmeister, 1986:89. 2. Diamond Butte, 4700 ft., 2, UI, Hoffmeister and Durham, 1971:26. 5. 16 miles NW Kingman, SE edge Mineral Park, 1 UI, Hoffmeister, 1986:89. 7. 5 miles SE Kingman, 1, UI, Hoffmeister, 1986:89. 7. 8 miles SE Kingman, 2, UI, Hoffmeister, 1986:89.

Banding records:— Total banded, 7 (3 m, 4 f), as follows: 8. Net, entrance Flag Mine [A 43b]. Banded 2 m, 4 f on 12 Jun 1962; recovered 1 m on 4 Jul 1963. Banded 1 m on 6 Mar 1963.

LASIONYCTERIS NOCTIVAGANS (LE CONTE).
SILVER-HAIRED BAT

[*espertilio*]. *noctivagans* Le Conte, in McMurtrie, *The Animal Kingdom...by The Baron Cuvier...*, 1:[app.] 431, Jun 1831,
type from eastern United States.

Lasionycteris noctivagans, Peters, *Monatsber. k. Preuss. Akad. Wissensch.*

Berlin for 1865, p. 648; Hoffmeister and Durham, Museum of Northern Az., Flagstaff, Tech. Series 11:26, 1971; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 104.

Comments

This species occurs from the southern parts of Alaska and Canada southward through most of the United States to northeastern Mexico. Kunz (1982:2), in his summary, indicated that a seasonal north-south migration was usual and that day roosts were probably in crevices in the bark and boles of various trees.

Silver-haired Bats may occur in most of Mohave County only during the migratory season, but this is not certain. Only a single record is available and none were taken by us. Probably they occur routinely every winter along the Colorado River.

Records of Occurrence

Specimens examined:— None.

Literature:— 1. Pakoon Springs, 1, May 1, Nevada Southern University), Hoffmeister and Durham, 1971:26.

Banding records:— None.

PIPISTRELLUS HESPERUS HESPERUS (H. ALLEN). WESTERN PIPISTRELLE

Scotophilus hesperus H. Allen, Smithsonian Misc. Coll., 7:43, Jun, 1864, type from Old Ft. Yuma, Imperial County, California, on right bank of Colorado River, opposite present town of Yuma, Arizona.

Pipistrellus hesperus, Miller, North American Fauna, 13:88, 16 Oct. 1897.

Pipistrellus hesperus hesperus, Cockrum, Mammals of Arizona, Univ. Az. Press, 1960, p. 48; Hoffmeister and Durham, Museum of Northern Az., Flagstaff, Tech. Series 11:26, 1971; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 211; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 93.

Table 11. *Pipistrellus hesperus* captures by month and sex. The numbers are the totals of specimen examined, bats banded and bats observed.

Month	Males	Female	Total
January	0	0	0
February	6	0	8
March	3	2	5
April	1	15	16
May	8	7	15
June	31	78	109
July	205	628	833
August	62	90	152
September	1	0	1
October	0	0	0
November	0	0	0
December	0	0	0
Totals	317	820	1137

Pipistrellus hesperus, Suttkus, Clemmer and Jones, Tulane Univ., Belle Chasse, La., Museum Nat. Hist., Occas Papers, 2:4, 978.

Comments

Few pipistrelles have been found in day roosts. Of the hundreds of visits to mine tunnels during this study only one [locality A 17] contained a pipistrelle—a single male. A female was taken from a rock crevice in the Burro Creek area. Some of the museum specimens may have been taken from day roosts but most were probably shot as they flew about in the early evening.

The bats banded by us were taken in mist nets. Pipistrelles are adept at avoiding nets, perhaps in part because they often fly in early twilight when the net is probably detected by vision as well as by echolocation. Usually they avoid the net but they occasionally hit and bounce or flutter off—sometimes landing in the water. Most were taken in Jun and Jul, the dry season when the bats are forced to use the few available water sources. Many females are gravid during the dry season, with greatly reduced maneuverability, hence the sex ratio of captures shown in Table 11. After the rainy season arrives, the numbers seen and captured dropped dramatically.

Records of Occurrence

Specimens examined:— Total, 57 (14 m, 23 f, 20 ?), as follows:

1. Beaverdam, 1, US. [Miller, 1897:89. =Beaver Dam, 1, US, Hoffmeister, 1986:93].
2. 2.5 miles SE Moccasin, 2 f, 30 May 1960, UA. [Hoffmeister, 1986:93.]
2. Pakoon Spring Ranch, near Grand Wash, 1 f. 12 Aug 1964; 4, UA. [= Pakoon Spgs., 2300 ft., 3, UI, Hoffmeister and Durham, 1971:26; Hoffmeister, 1986:93.]
3. 10 miles N Wolf Hole, 3800 ft., 2800 ft., 1 m, 1 f, 3, 20 May 1933, MVZ.
6. Nixon Spring, 6250 ft., Mt. Trumbull, 1 m, 27 May 1933, MVZ. [Hoffmeister and Durham, 1971:26.]
7. Buckhorn Spring, T 34 N, R 16 W, Sec 26, 1600 ft., 2 f, 4 May 1978, MNA.
13. 4 miles SW Pierce Ferry, 1 m, 4 May 1942, US. [Hoffmeister, 1986:93.]
16. Stockton Hills Mine, 8 miles N Kingman 1 f, 8 Jul 1962, UA.
20. Kingman, 1 f, 26 Jun 1924, UM.
20. 1 mile S Kingman, 1 f, 25 Jul 1967, UA.
20. Beale Springs, 2, US. [Hoffmeister, 1986:93.]
21. 4.5 miles SW Kingman, 1 f, 6 Jul 1962, UA.
22. Twin Windmills, 4.5 miles SSE Kingman, 2 f, 13 Jul 1959; 3 f, 5 Jun 1961; 1 f, 6 Jul 1962, UA. [+ 6, UI, Hoffmeister, 1986:93.]
24. Riverbank, Ft. Mohave, 1 f, 19 May 1904, US. [= Ft. Mohave, Arizona, Hoffmeister, 1986:93.]
25. 10 miles SE Yucca, 1 f, 22 Apr 1973, MNA. [Hoffmeister, 1986:93.]
26. Mellen [=Topock], Colorado R., 4 m, 2 f, 23-28 Feb 1910, MVZ. [Hoffmeister, 1986:93.]
27. Colorado River, foot of Needles, 2 f, 5 Mar 1910, MVZ. [= 4, MVZ, Hoffmeister, 1986:93.]
28. Big Sandy Creek, 50 miles E Topock, 10, US. [Hoffmeister, 1986:93.]
30. Burro Creek Bridge, State Highway 93, 2 m, 1 f, 6 Jun 1961, UA.
31. Gold Spring, Chemehuevis Mts., 1950 ft., 2 m, 25-26 Feb 1938, SDSNH.
32. Colorado R., above Bill Williams Ranch, 3 m, 14 Mar 1910, MVZ. [Hoffmeister, 1986:93.]

Literature:—

2. Pipe Spg. Nat'l. Mon., 5000 ft., 1, UI, Hoffmeister and Durham, 1971:26; Hoffmeister, 1986:93.
4. Diamond Butte, 4700 ft., 1, UI, Hoffmeister and Durham, 1971:26; Hoffmeister, 1986:93.
8. Foot Broad Canyon, 5050 ft., 1, UI, Hoffmeister and Durham, 1971:26; Hoffmeister, 1986:93.
9. Toroweap Point, 6300 ft., 1 mile SE ranger station, 1, UI, Hoffmeister and Durham, 1971:26; Hoffmeister, 1986:93.
10. 0.5 miles NE Vulcan's Throne, 4600 ft.,

1, UI, Hoffmeister and Durham, 1971:26; Hoffmeister, 1986:93. 11. Scorpion Island, River Mile 279.5, left bank, 4, Suttkus, Clemmer and Jones, Tulane Univ., Belle Chasse, La., Museum Nat. Hist., Occas Papers, 2:4, 1978. 12. Sand Point, River Mile 294.5, left bank, 1, Suttkus, Clemmer and Jones, Tulane Univ., Belle Chasse, La., Museum Nat. Hist., Occas Papers, 2:4, 1978. 19. 1 mile N Kingman, 3, UI, Hoffmeister, 1986:93. 23. Hualapai Mts., 5, UA, per Hoffmeister, 1986:93 [not found in collection or catalog, 1990]. 27. Mohave Mts., 1, US, Hoffmeister, 1986:93.

Banding records:— Total banded, 1080 (300 m, 780 f); total local recoveries, 36 (3 m, 33 f); total foreign recoveries, 7 f; as follows: 14. Net, Red Lake [A 2]. Banded 1 f on 8 Jul 1963. 15. Net, tunnel Cerbat Mts. [A 6]. Banded 2 m, 54 f on 8 Jul 1962; foreign recovery, 1 f on 18 Jul 1962 and 1 f on 1 Jul 1963 at net, tunnel 8 miles N Kingman [A 11]. 16. Net, tunnel 8 miles N Kingman [A 11]. Banded 11 m, 77 f on 8 Jul 1962; recovered 3 f on 18 Jul 1962; recovered 1 m on 25 Jun 1963; recovered 3 f on 1 Jul 1963; recovered 7 f on 17 Jul 1963. Banded 9 m, 26 f on 18 Jul 1962; recovered 2 f on 17 Jul 1963. Banded 5 m, 7 f on 25 Jun 1963. Banded 11 m, 23 f on 1 Jul 1963; recovered 1 f on 17 Jul 1963. Banded 31 m, 89 f on 17 Jul 1963. 16. Net, 5.5 miles N Kingman [A 14]. Banded 1 f on 5 May 1962. Banded 5 m on 1 Jun 1962. 17. Tunnel, Katherine Landing [A 18]. Banded 1 f on 13 Aug 1961. 18. Net, tunnel 1 mile SW Union Pass [A 19a]. Banded 3 m, 1 f on 10 Jul 1962. Banded 9 m, 1 f on 26 Jul 1962. Banded 1 m on 3 Jul 1963. Banded 5 m on 23 Jul 1963. 19. Net, 12 miles W Kingman [A 45]. Banded 4 m, 14 f on 28 Jun 1960. 20. Net, 1 mile N Kingman [A 22c]. Banded 11 m, 20 f on 15 Jul 1959. 20. Net, City Tank, Kingman [A 27]. Banded 1 m on 18 Apr 1962. 20. Net, 1.5 miles SE Kingman [A 31]. Banded 1 m, 1 f on 26 Aug 1961. 20. Net, 3.5 miles SSE Kingman [A 34]. Banded 1 m, 3 f on 13 Aug 1961. 21. Net, 4.5 miles SSE Kingman [A 37]. Banded 2 m, 16 f on 13 Jul 1959; recovered 1 f on 29 Jun 1960. Banded 3 f on 14 Jul 1959. Banded 3 m, 18 f on 18 Jul 1959; recovered 1 f on 23 Jul 1963. Banded 10 m, 41 f on 29 Jun 1960; recovered 2 f on 5 Jul 1960; recovered 1 f on 21 Jul 1960; recovered 1 f on 8 Jun 1962. Banded 26 m, 52 f on 5 Jul 1960; recovered 2 f on 13 Jul 1960; recovered 1 f on 23 Jul 1960; recovered 1 f on 5 Jun 1961. Banded 13

m, 56 f on 13 Jul 1960; foreign recovery, 1 f on 16 Jul 1962 at net, 8 miles SSE Kingman [A 39]. Banded 19 m, 30 f on 16 Jul 1960; foreign recovery, 1 f on 9 Jul 1963 at net, 8 miles SSE Kingman [A 39]. Banded 5 m, 10 f on 21 Jul 1960; recovered 1 f on 25 Aug 1960. Banded 3 f on 23 Jul 1960. Banded 11 m, 5 f on 25 Aug 1960; recovered 2 f on 8 Aug 1961; recovered 1 m on 6 Jul 1962. Banded 1 m on 13 Sep 1960. Banded 1 m, 4 f on 5 Jun 1961. Banded 20 m, 53 f on 11 Jul 1961; recovered 2 f on 7 Aug 1961; recovered 1 f on 5 Jul 1962; foreign recovery, 1 f on 19 Jul 1961 from car antenna in Kingman [A 29c]. Banded 1 m, 5 f on 7 Aug 1961; recovered 1 m on 13 Aug 1961; recovered 1 f on 5 Jul 1962. Banded 2 m, 11 f on 8 Aug 1961. Banded 2 m on 12 Aug 1961. Banded 1 f on 13 Apr 1962. Banded 5 m, 5 f on 8 Jun 1962; foreign recovery, 1 f on 16 Jul 1962 at net, 8 miles SSE Kingman [A 39]. Banded 8 m, 33 f on 6 Jul 1962. 22. Net, 7.5 miles SE Kingman [A 30]. Banded 2 m, 23 f on 5 Jul 1962. Banded 6 m, 16 f on 16 Jul 1962. 22. Net, 8 miles SSE Kingman [A 39]. Banded 9 m, 14 f on 4 Aug 1960. Banded 4 m, 8 f on 10 Aug 1960; foreign recovery, 1 f on 9 Jun 1962 from net, 6.5 miles SSE Kingman [A 40]. Banded 23 m, 12 f on 13 Aug 1960. Banded 1 m, 3 f on 16 Aug 1961. Banded 7 m on 10 Jun 1962. Banded 4 m, 19 f on 23 Jul 1962. Banded 3 f on 9 Jul 1963. 22. Net, 6.5 miles SSE Kingman [A 40]. Banded 2 m, 2 f on 4 Aug 1960. Banded 1 m, 7 f on 9 Jun 1962. 23. Net, entrance Flag Mine [A 43b]. Banded 3 f on 3 Jul 1962. Banded 1 m, 1 f on 11 Jul 1962. Banded 1 f on 4 Jul 1963. Banded 2 f on 27 Jul 1963. 30. Net, Burro Creek [A 56]. Banded 1 m, 1 f on 6 Jun 1961.

EPTESICUS FUSCUS PALLIDUS YOUNG.

BIG BROWN BAT

Eptesicus pallidus Young, Proc. Acad. Natural Sci., Philadelphia, 1908:408, 2 Oct. 1908, type from Boulder, Boulder County, Colorado.

Eptesicus fuscus pallidus, Miller, Bull. U. S. National Mus., 79:62, 31 Dec. 1912; Cockrum, Mammals of Arizona, Univ. Az. Press, 1960, p. 51; Hoffmeister and Durham, Museum of Northern Az., Flagstaff, Tech. Series 11:26, 1971; Hall, Mammals of North

Table 12. *Eptesicus fuscus* captures by month, sex, place of collecting activities. The numbers are the totals of specimen examined, bats banded and bats observed.

Month	net		roost		total	
	m	f	m	f	m	f
January	0 +	0 = 0	0 +	4 = 4	0 +	4 = 4
February	0 +	0 = 0	0 +	0 = 0	0 +	0 = 0
March	0 +	0 = 0	0 +	0 = 0	0 +	0 = 0
April	3 +	1 = 4	0 +	1 = 1	3 +	2 = 5
May	3 +	14 = 17	0 +	0 = 0	3 +	14 = 17
June	31 +	54 = 85	0 +	1 = 1	31 +	55 = 86
July	80 +	284 = 364	0 +	0 = 0	80 +	284 = 364
August	16 +	24 = 40	0 +	1 = 1	16 +	25 = 41
September	0 +	0 = 0	3 +	3 = 6	3 +	3 = 6
October	0 +	0 = 0	0 +	0 = 0	0 +	0 = 0
November	0 +	0 = 0	0 +	0 = 0	0 +	0 = 0
December	0 +	0 = 0	4 +	7 = 11	4 +	7 = 11
Totals	133 +	377 = 510	7 +	18 = 25	140 +	395 = 535

America, John Wiley, New York, 3 Apr 1981, p. 216; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 96.

Comments

Although some Big Brown bats were found in day roosts in most of the year, the majority taken by us were captured in mist nets over water (Table 12). They were captured between Apr and Aug. Most were females (overall, 8 females to 3 males), probably because of the decreased maneuverability of the gravid females. Surprisingly none were taken in the southern part of the county, either in nets or in roosts.

Records of Occurrence

Specimens examined:—Total, 20 (5 m, 15 f), as follows: 1. Trails End, Black Rock Mtn., 11.5 miles SE Littlefield, 1 m, 3 Aug 1969, MNA. [+ 1, UI, Hoffmeister and Durham, 1971:26; Hoffmeister, 1986:96.] 2. Pakoon Spring Ranch, Grand Wash, 1 f, 12 Aug 1968, UA. 3. Jun Tank, S of Findlay Knolls, 5500 ft, 2 f, 16 Jul 1975, MNA. 4. Nixon Spring, 6250 ft., Mt. Trumbull, 3 f, 16 Jul 1964, UA; 2 f,

24, 27 May 1933, MVZ; 2 m, 3 f, 4 Aug 1969, MNA. [Hoffmeister, 1986:96.] 4. Lookout Point, 7500 ft., Mt. Trumbull, 1 m, 7 Aug 1936, CM. 5. Buckhorn Spring, T 34 N, R 16 W, Sec 26, 1600 ft., 1 f, 4 May 1978, MNA. 11. 1 mile S Kingman's Hilltop, 1 f, 20 Jul 1967, UA. 11. Beale's Spring, 3400 ft., 2 f, 27 Jun 1902, US. [= 11, US, Hoffmeister, 1986:96.] 15. Fort Mohave, 1 m, 26 Jun 1904, US. [Hoffmeister, 1986:96.]

Literature:— 6. 3 miles N Mt. Dellenbaugh, 6200 ft., 1, UI, Hoffmeister and Durham, 1971:26; Hoffmeister, 1986:96. 12. Twin Mills, 5 miles SE Kingman, 8, UI, Hoffmeister, 1986:96. 14. Hualpai [sic] Mts., 1, US, Hoffmeister, 1986:96.

Banding records:— Total banded, 499 (127 m, 372 f); total local recoveries, 22 (8 m, 14 f); total foreign recoveries, 5 (1 m, 4 f); as follows: 7. Tunnel, Mineral Park [A 4]. Banded 1 m, 1 f of 15 on 17 Sep 1961. 7. Net, tunnel Cerbat Mts. [A 6]. Banded 2 m, 7 f on 8 Jul 1962. 7. Net, tunnel 2.5 miles N Stockton Hills Mine [A 7]. Banded 1 m, 1 f on 27 Jun 1963. 8. Net, tunnel 8 miles N Kingman [A 11]. Banded 2 m, 18 f on 8 Jul 1962; recovered 2 f on 18 Jul 1962; recovered 2 f on 25 Jul 1963; recovered 1 m, 1 f on 17 Jul 1963; recovered 1 f on 21 Jul 1963; foreign recovery, 1 f on 13 Jan 1963 in Tunnel, 9 miles NW Kingman [A 9]; foreign recovery, 1 f on 26 Jun 1963 in net, tunnel 1 mile W Stockton Mine [A 16]. Banded 4 m, 27 f on 18 Jul 1962; recovered 1 f on 25 Jun 1963. Banded 4 m, 12 f on 25 Jun 1963; recovered 1 m on 1 Jul 1963; foreign recovery, 1 f on 26 Jun 1963 in net, tunnel 1 mile W Stockton Mine [A 16]. Banded 1 m, 1 f on 1 Jul 1963. Banded 2 f on 17 Jul 1963. 7. Net, tunnel 1 mile W Stockton Hills mine [A 15]. Banded 1 m on 26 Jun 1963. 9. Net, tunnel 1 mile SW Union Pass [A 19a]. Banded 2 m, 7 f on 10 Jul 1962. Banded 1 m, 3 f on 26 Jul 1962. Banded 2 m on 3 Jul 1963. Banded 1 m, 1 f on 23 Jul 1963. 11. Net, 1 mile N Kingman [A 22c]. Banded 3 m, 10 f on 15 Jul 1959. 13. Net in tunnel, 9 miles SE Kingman [A 24]. Banded 1 f on 19 Aug 1959. 13. Net, 7.5 miles SE Kingman [A 30]. Banded 1 f on 5 Jul 1962. Banded 2 f on 16 Jul 1962. 12. Net, 4.5 miles SSE Kingman [A 37]. Banded 1 m, 27 f on 11 Jul 1959. Banded 6 f on 14 Jul 1959. Banded 2 m, 5 f on 18 Jul 1959. Banded 6 f on 25 Jun 1960; foreign recovery, 1 f on 25 Aug 1960 in net, 8 miles SSE Kingman [A 39]. Banded 8 f on 29 Jun 1960. Banded 2 m, 21 f on

5 Jul 1960. Banded 2 m, 17 f on 13 Jul 1960. Banded 1 m, 16 f on 16 Jul 1960; recovered 1 f on 25 Aug 1960. Banded 4 m, 9 f on 23 Jul 1960. Banded 4 m, 6 f on 25 Aug 1960. Banded 1 m, 3 f on 5 Jun 1961. Banded 3 m, 14 f on 11 Jul 1961. Banded 1 f on 7 Aug 1961. Banded 1 m, 4 f on 8 Aug 1961. Banded 1 f on 11 Aug 1961. Banded 1 m, 3 f on 12 Aug 1961. Banded 2 m, 3 f on 13 Aug 1961. Banded 2 m, 1 f on 13 Apr 1962; recovered 1 f on 17 Apr 1962. Banded 10 f on 23 May 1962. Banded 1 m on 8 Jun 1962. Banded 1 m, 40 f on 6 Jul 1962. 13. Net, 8 miles SSE Kingman [A 39]. Banded 1 m on 4 Aug 1960. Banded 2 m on 13 Aug 1960; foreign recovery, 1 m on 25 Aug 1960 in net, 4.5 miles SSE Kingman [A 37]. Banded 1 f on 1 May 1962. Banded 1 m on 10 Jun 1962. Banded 2 f on 9 Jul 1963. 13. Net, 6.5 miles SSE Kingman [A 40]. Banded 1 m, 1 f on 4 Aug 1960. Banded 1 m on 9 Jun 1962. 14. Flag Mine [A 43a]. Banded 2 m, 7 f on 5 Dec 1961. Banded 2 m on 10 Dec 1961. Banded 4 f on 20 Jan 1962. 14. Net, entrance Flag Mine [A 43b]. Banded 19 m, 16 f on 12 Jun 1962; recovered 2 m, 1 f on 11 Jul 1962; recovered 1 m on 20 May 1963; recovered 2 m, 3 f on 4 Jul 1963. Banded 3 m, 6 f on 3 Jul 1962; recovered 1 m on 11 Jul 1962; recovered 1 f on 20 May 1963. Banded 8 m, 12 f on 11 Jul 1962. Banded 6 m, 6 f on 23 Jul 1962. Banded 2 m on 20 May 1963. Banded 17 m, 14 f on 4 Jul 1963. Banded 5 m, 1 f on 27 Jul 1963. 10. Net, 12 miles W Kingman [A 45]. Banded 2 m, 2 f on 28 Jun 1960. 16. Tunnel, 4.5 miles E Oatman [A 47]. Banded 1 f on 16 Apr 1960. Banded 1 f on 25 Aug 1960. Banded 1 m, 2 f on 30 Sep 1960. Banded 1 m, 1 f on 17 Sep 1961.

LASIURUS BLOSSEVILLII TELIOTIS (ALLEN).

WESTERN RED BAT

Atalapha teliotis H. Allen, Proc. Amer. Philos. Soc., 29:5, 10 Apr.

1891, type from unknown locality, probably from California.

Lasiurus blossevillii teliotis, R. J. Baker, et al, Occas. Pap. Museum Texas Tech Univ, 17:9, 1988.

Lasiurus borealis teliotis, Miller, North American Fauna, 13:110, 16 Oct. 1897; Cockrum, Mammals of Arizona, Univ. Az. Press, 1960, p. 53; Hoffmeister, Mammals of Arizona, Univ. Az. Press,

1986, p. 99.

Nycteris borealis teliotis, Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 224.

Comments

Red bats roost in trees. No Red bats have been taken in Mohave County since three were taken in 1902. Probably a few could be found if efforts were concentrated around the edges of wooded areas, especially in the lower riparian situations. Relatively few have been taken in Arizona.

Records of Occurrence

Specimens examined:— Total, 3, as follows: 1. Big Sandy Creek, 50 miles E Topock, 2 f, 23 Jul 1902; 1 f, 21 Jul 1902, US. [Hoffmeister, 1986:100.]

Banding records:— None.

LASIURUS XANTHINUS (THOMAS). WESTERN YELLOW BAT

Dasyurus ega xanthinus Thomas, Ann. Mag. Nat. Hist., ser 6, 20:544, Dec. 1897, type from Sierra Laguna, Baja California.

Lasiurus ega xanthinus, Dalquest, Louisiana State Univ. Studies, Biol. Ser., 1:61, 1953.

Lasiurus xanthinus, Baker et al., 1988. Occas. Pap. Mus., Texas Tech Univ., 117.

Comments

Not recorded for Mohave County, but Southern yellow bats have been found in several locations in southern and southeastern Arizona, especially associated with palm trees. In southern Texas they have been reported as having expanded their ranges northward into areas where palm trees have been introduced. The planting of palms along the Colorado River makes us suspect that these bats can be expected as summer residents in Mohave County.

LASIURUS CINEREUS CINEREUS (PALISOT DE
BEAUVOIS).
HOARY BAT

Vespertilio linereus [misspelling of *cinereus*] Palisot de Beauvois, Catalogue raisonné du musée de Mr. C. D. Peale, Philadelphia, 1796, type from Philadelphia, Philadelphia Co., Pa.

Lasiurus cinereus, H. Allen, Smithsonian Misc. Coll., 7(165):21, 1864.

Lasiurus cinereus cinereus, Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 102.

Nycteris cinerea cinerea, Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 226.

Comments

Hoary bats also roost in trees and have a seasonal migration. Cockrum and Petryszyn (in preparation) has compiled much information about the seasonal and sexual distribution of tree bats in the southwest. Their findings suggest that adult males and females probably occur in Mohave during the spring and fall. Probably all females and most males move farther south, into Mexico, during the winter. In the summer, females are found north of Mohave County but some males spend the summer here.

Records of Occurrence

Specimens examined:— Total, 2, as follows: 1. Beaver Dam Creek at Beaver Dam Resort, 1 mile N Littlefield, 2 f, 16 May 1975, MNA. [Hoffmeister, 1986:103.]

Banding records:— Total, 2 (1 m, 1 f), as follows: 2. Net, City Tank, Kingman [27]. 18 Apr 1962, 1 f. 3. Net, 6.5 miles SSE Kingman [40]. 9 Jun 1962, 1 m.

EUDERMA MACULATUM (J. A. ALLEN).
SPOTTED BAT

Histiotus maculatus J. A. Allen, Bull. Amer. Mus. Nat. Hist., 3:195, 20 Feb. 1891, type from near Piru, Ventura Co., Calif.

Euderma maculata, H. Allen, Bull. U. S. Nat. Mus., 43, 61, 14 Mar 1894.

Euderma maculatum, Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 231; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 104.

Comments

No Spotted bats were observed by us. Current literature suggests that these highly maneuverable bats roost in high rock crevices in areas of extensive cliffs, where biologists rarely look!! Their agility in flight enables them to avoid most mist nets set over watering places.

Records of Occurrence

Specimens examined:— Total, 2, as follows: 1. Beaver Dam Creek, at Beaver Dam Resort, 1 mile N Littlefield, 1 m, 1 f, 16 May 1975, MNA. [Hoffmeister, 1986:104.]

IDIONYCTERIS PHYLLOTIS (G. M. ALLEN). ALLEN'S BIG-EARED BAT

Corynorhinus phyllotis G. M. Allen, Bull. Mus. Comp. Zool., 60:352, Apr. 1916, type from San Luis Potosi (probably from near city of the same name), Mexico.

Idionycteris phyllotis, Handley, Proc. Biol. Soc. Washington, 69:53, 1956; Cockrum and Musgrove, Journal of Mammalogy, 45:472, 1964; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 104.

Plecotus phyllotis, Genoways and Jones, Southwestern Naturalist, 12:477, 1967; Hoffmeister and Durham, Museum of Northern Az., Flagstaff, Tech. Series 11:27, 1971; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 232.

Comments

Details of the Mohave County populations were discussed by Cockrum and Musgrove (1964:472). As shown in Table 13, we found this species only in the summer months and mostly in maternity colonies. Almost all examined by us were females.

Table 13. *Idionycteris phyllotis* captures by month and sex. The numbers are the totals of specimen examined, bats banded and bats observed.

Month	Males	Females	Total
January	0	0	0
February	0	0	0
March	0	0	0
April	0	5	5
May	1	0	1
June	0	0	0
July	24	268	292
August	0	17	17
September	0	3	3
October	0	0	0
November	0	0	0
December	0	0	0
Totals	25	293	318

Since the time of this study, the major roost in the tunnel at Union Pass has been destroyed by the relocation of the highway and destruction of the tunnel.

Records of Occurrence

Specimens examined:— Total, 20 (6 m, 14 f), as follows: 1. Beaver Dam Creek, at Beaver Dam Resort, 1 mile N Littlefield, 1 m, 16 May 1975, MNA. [Hoffmeister, 1986:106.] 2. Vicinity Pipe Spring Nat. Monument, 5000 ft., 1 f, 8 Jul 1964, UA. [Genoways and Jones, 1967; Hoffmeister, 1986:106.] 4. Tunnel, Chalk Peak, 2 miles W Union Pass, Black Mts., 5 f, 11 Apr 1966; 5 m, 5 f, 20 Jul 1967, UA. [+ 1, UI; + 1, SIU, Hoffmeister, 1986:106.]

4. 1 mile S Union Pass, 3 f, 10 Jul 1962, UA. [+ 4, UI, Hoffmeister, 1986:106.]

Literature:—

3. OK Mine, 3000 ft., 68 miles N Kingman, 1, UA. [Cockrum and Musgrove, 1964:472; Hoffmeister, 1986:107.]

Banding records:— Total banded, 145 (18 m, 127 f); total local recoveries, 26 (1 m, 25 f); total foreign recoveries, 27 f; as follows: 3. Tunnel, 68 miles N Kingman [A 1]. Banded 3 f on 1 Sep 1961. 4. Net,

tunnel 1 mile SW Union Pass [A 19a]. Banded 1 m, 22 f on 10 Jul 1962; recovered 3 f on 26 Jul 1962; recovered 4 f on 3 Jul 1963. Banded 5 f on 26 Jul 1962; recovered 1 f on 3 Jul 1963; recovered 2 f on 23 Jul 1963; foreign recovery, 1 f on 3 Jul 1963 in tunnel, 1 mile SW Union Pass [A 19b]. Banded 1 f on 3 Jul 1963. 4. Tunnel b, 1 mile SW Union Pass [A 19b]. Banded 13 m, 71 f of 97 on 10 Jul 1962; recovered 12 f on 3 Jul 1963; foreign recovery, 15 f on 10 Jul 1962 in net in tunnel, 1 mile SW Union Pass [A 19a]; foreign recovery 1 m, 1 f on 26 Jul 1962 in net in tunnel, 1 mile SW Union Pass; foreign recovery, 7 f [A 19a]. Banded 3 f on 3 Jul 1963; foreign recoveries, 2 f on 23 Jul 1963 in net in tunnel 1 mile SW Union Pass [A 19a]. 4. Tunnels, Union Pass [A 20]. Banded 15 f of 20 on 17 Aug 1960; recovered 2 f on 30 Aug 1960; recovered 3 f on 31 Jul 1961. Banded 4 m, 7 f on 31 Jul 1961; foreign recovery, 1 f on 10 Jul 1962 in net in tunnel 1 mile SW Union Pass [A 19a].

PLECOTUS TOWNSENDII PALLESCENS (MILLER)
TOWNSEND'S BIG-EARED BAT

Corynorhinus macrotis pallescens Miller, North American Fauna, 13:52, 16 Oct 1897, type from Keams Canyon, Navajo Co., Ariz.

Plecotus townsendii pallescens, Handley, Proc. U. S. Nat. Mus., 110:190, 3 Sep 1959; Hoffmeister and Durham, Museum of Northern Az., Flagstaff, Tech. Series 11:26, 1971; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 235. Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 111.

Plecotus townsendii, Suttkus, Clemmer and Jones, Tulane Univ., Belle Chasse, La., Museum Nat. Hist., Occas Papers, 2:4, 1978.

Corynorhinus rafinesquii pallescens, Hardy, Jour. Mamm., 30:434, 1949.

Comments

Big-eared bats were taken in every month of the year, both in roosts and in flight (Table 14). Even in hibernals the sex ratio was skewed in favor of the females (more than 2 to 1) and overall the ratio approached four to one. A group of about 200 seen on 16 Jul 1959 at the OK Mine (locality 5) consisted of adult females and young of the

Table 14. *Plecotus townsendii* captures by month, sex, place of collecting activities. The numbers are the totals of specimen examined, bats banded and bats observed.

Month	net		roost		total	
	m	f	m	f	m	f
January	14 +	7 = 21	77 +	209 = 286	91 +	216 = 307
February	3 +	12 = 15	1 +	6 = 7	4 +	18 = 22
March	1 +	0 = 1	1 +	142 = 143	2 +	142 = 144
April	0 +	0 = 0	8 +	291 = 299	8 +	291 = 299
May	1 +	0 = 1	3 +	0 = 3	4 +	0 = 4
June	10 +	29 = 39	1 +	4 = 5	11 +	33 = 44
July	40 +	70 = 110	48 +	226 = 274	88 +	296 = 384
August	4 +	2 = 6	3 +	9 = 12	7 +	11 = 18
September	0 +	0 = 0	7 +	37 = 44	7 +	37 = 44
October	4 +	7 = 11	6 +	56 = 62	10 +	63 = 73
November	6 +	0 = 6	0 +	0 = 0	6 +	0 = 6
December	2 +	2 = 4	145 +	451 = 596	147 +	453 = 600
Totals	85 +	129 = 214	300 +	1431 = 1731	385 +	1560 = 1945

year.

As detailed in the account of *Macrotus*, at least one was taken from a crevice in the ceiling, about 100 yards in from the entrance of an abandoned tunnel on the south side of the Virgin River, to the northeast of Littlefield on 10 Mar 1945.

Records of Occurrence.

Specimens examined:— Total, 9 (4 m, 5 f), as follows: 2. Nixon Spring, Mt. Trumbull, 1 f, 16 Jul 1964, UA. 4. Buckhorn Spring, T 34 N, R 16 W, Sec 26, 1600 ft., 1 m, 1 f, 4 May 1978, MNA.. 7. Tunnel, 1 mile N Chloride, 1 m, 19 Jul 1959, UA. [Hoffmeister, 1986:111.] 9. Cohenour Springs, Cohenour Canyon, 11 miles N Kingman, 1 f, 25 May 1976, MNA. [Hoffmeister, 1986:111.] 8. Stockton Hills Mine, 9 miles N Kingman, 1 f, 8 Jul 1962, UA. 10. Mine Tunnel, near Davis Dam, 2 m, 1 f, 25 Sep 1959, UA.

Literature:—

1. Virgin Narrows, NE of Littlefield [1650 ft.], 1, Hardy (1949:434). 3. Mohawk Canyon, mile 171, Colo. R., 1, MNA,

Hoffmeister, 1986:111. 3. Tuckup Canyon, River mile 164.5, right bank, 1, Suttkus, Clemmer and Jones, Tulane Univ., Belle Chasse, La., Museum Nat. Hist., Occas Papers, 2:4, 1978. 9. Telluride Chief Mine, 11 miles ENE Kingman, Hualapai Mts, 1, UI, Hoffmeister, 1986:111. 14. Hualpai [sic] Mts., 1, UI, Hoffmeister, 1986:111. 18. 1 mile N Wikieup, 1, UI, Hoffmeister, 1986:111.

Banding records:— Total banded, 1661 (376 m, 1285 f); total local recoveries, 205 (21 m, 184 f); total foreign recoveries, 17 (3 m, 14 f); as follows: 5. Tunnel, 68 miles N Kingman [A 1]. Banded 2 m, 12 f of 20 on 1 Sep 1961; recovered 3 f on 8 Jul 1963. Banded 2 m, 4 f on 8 Jul 1963. 6. Tunnel, 28.5 miles NE Kingman [A 5]. Banded 37 f on 25 Mar 1961; foreign recovery 2 f, 1 on 10 Dec 1961, 1 on 20 Jan 1962 at Flag Mine [A 43b]. Banded 2 f on 7 Apr 1962. 7. Net, tunnel Cerbat Mts. [A 6]. Banded 6 m on 8 Jul 1962. 7. Net, tunnel 2.5 miles N Stockton Hills Mine [A 7]. Banded 4 m, 4 f on 27 Jun 1963. 8. Tunnel, Clark Co., Nev. [A 69]. Banded 1 m, 1 f on 29 Jun 1962; recovered 1 f on 10 Jul 1963. Banded 2 m on 10 Jul 1963. 9. Net, tunnel 8 miles N Kingman [A 11]. Banded 5 f on 8 Jul 1962; recovered 1 f on 25 Jun 1963. Banded 4 m, 6 f on 18 Jul 1962; recovered 1 f on 1 Jul 1963. Banded 3 m, 16 f on 25 Jun 1963; recovered 1 f on 1 Jul 1963. Banded 7 m, 7 f on 1 Jul 1963. Banded 3 m, 4 f on 17 Jul 1963. 9. Tunnel, 16 miles NW Kingman [A 13]. Banded 1 m on 24 Sep 1961. 9. Net, tunnel 1 miles W Stockton Hills mine [A 15]. Banded 1 m, 3 f on 26 Jun 1963. 9. Tunnel, Katherine Landing [A 18]. Banded 1 m, 1 f on 26 Feb 1961. 10. Tunnel a, 7 miles E Davis Dam [A 17a]. Banded 2 f on 5 Mar 1961; foreign recovery, 1 f on 9 Sep 1961 in tunnel b, 7 miles E Davis Dam [A 17b]. 10. Tunnel b, 7 miles E Davis Dam [A 17b]. Banded 1 m on 5 Mar 1961. Banded 2 m, 14 f on 9 Sep 1961. 10. Tunnel, 7.5 miles E Davis Dam [A 17c]. Banded 1 f on 4 Mar 1961. 11. Net, tunnel 1 mile SW Union Pass [A 19a]. Banded 5 f on 10 Jul 1962. Banded 2 m, 2 f on 26 Jul 1962. Banded 5 f on 3 Jul 1963. Banded 4 m, 4 f on 23 Jul 1963. 11. Tunnels, Union Pass [A 20]. Banded 2 m, 50 f of 72 on 16 Apr 1960; recovered 7 f on 17 Sep 1960; recovered 2 f on 26 Feb 1961; recovered 5 f on 5 Mar 1961; recovered 1 m on 31 Jul 1961; recovered 1 f on 26 Jul 1962; recovered 1 f on 3 Jul 1963; foreign recovery, 4 f on 26 Jul 1962 in net in tunnel, 1 mile SW Union Pass [A 19a];

recovered 3 f on 23 Jul 1963; foreign recovery, 1 f on 10 Dec 1961 in net, Flag Mine, [A 43b]. Banded 4 f of 13 on 17 Aug 1960. Banded 1 m, 1 f of 18 on 30 Aug 1960. Banded 3 f on 26 Feb 1961. Banded 1 m, 5 f on 5 Mar 1961. Banded 1 f on 31 Jul 1961. Banded 1 m, 1 f on 28 Jun 1962. 11. Tunnel, 1 mile S Chalk Peak [A 21]. Banded 1 f on 5 Mar 1961. 11. Tunnel, Power Line Pass [A 35]. Banded 1 f on 30 Aug 1959. 12. Net, 7.5 miles SE Kingman [A 30]. Banded 2 f on 5 Jul 1962; foreign recovery, 1 f on 14 Dec 1962 in net, Flag Mine [A 43b]. Banded 2 f on 16 Jul 1962. 12. Tunnel, 1.5 miles SW Kingman [A 38]. Banded 1 f on 26 Jun 1962. 12. Net, 8 miles SSE Kingman [A 39]. Banded 1 m on 4 Aug 1960. Banded 1 m, 1 f on 10 Aug 1960; foreign recovery, 1 m on 11 Jul 1962 in net, Flag Mine [A 43b]. Banded 1 m on 13 Aug 1960. Banded 1 f on 16 Aug 1961. 12. Net, 6.5 miles SSE Kingman [A 40]. Banded 1 m, 2 f on 9 Jun 1962. 13. Net in tunnel, N end Hualapai Mts, 9 miles SE Kingman [A 24]. Banded 1 m on 7 Aug 1960. 13. Tunnel a, 11 miles SE Kingman [A 25a]. Banded 1 m on 7 Aug 1963. 13. Tunnel c, 12 miles E Kingman [A 25c]. Banded 1 m, 2 f on 7 Aug 1963. 13. Tunnel d, 11 miles SE Kingman [A 25d]. Banded 1 m on 13 Jul 1961; recovery, 1 m on 10 Dec 1961. 13. Tunnel, 11 miles SE Kingman and then 1.25 miles W up wash [A 33]. Banded 1 m on 13 Jul 1961. 13. Tunnel, 16 miles SE Kingman [A 41]. Banded 2 m, 2 f on 23 Sep 1961. Banded 1 f on 30 Sep 1961. 14. Tunnel, County Park headquarters [A 42]. Banded 1 m on 12 May 1962. 14. Flag Mine [A 43a]. Banded 2 f on 5 Dec 1961. Banded 135 m, 380 f of 1000+ on 10 Dec 1961; recovered 2 m, 18 f on 20 Jan 1962; recovered 4 f on 14 Dec 1962; recovered 2 f on 26 Jan 1963; recovered 1 m on 30 Jan 1963; foreign recovery, 1 f on 3 Jul 1963 in net in tunnel, 1 mile SW Union Pass [A 19a]; foreign recovery, 1 f on 26 Jun 1962 in tunnel, 5 miles SW Kingman [A 38]; foreign recovery, 1 f on 9 Jun 1962 in net, 6.5 miles SSE Kingman [A 40]. Banded 64 m and 178 f of 1500+ on 20 Jan 1962; recovered 15 f on 14 Dec 1962; foreign recovery, 1 m on 11 Jul 1963 in net, Flag Mine [A 43b]; recovered 2 m on 10 Oct 1962; recovered 1 m on 11 Nov 1962; recovered 1 m on 14 Nov 1962; recovered 3 f on 17 Jan 1963; recovered 1 m, 1 f on 26 Jan 1963; recovered 1 m on 30 Jan 1963; recovered 1 m on 27 Feb 1963; recovered 1 m on 20 May 1963; recovered 2 m, 2 f on 4 Jul 1963;

foreign recovery, 1 m on 9 Jun 1962 in net, 6.5 miles SSE Kingman [A 40]. Banded 10 m, 48 f on 14 Dec 1962; recovered 1 f on 30 Jan 1963. Banded 10 m, 9 f of 100+ on 26 Jan 1963. 14. Net, entrance Flag Mine [A 43b]. Banded 2 m on 12 May 1962; recovered 2 m on 14 Dec 1962. Banded 1 f on 3 Jul 1962. Banded 2 m, 4 f on 11 Jul 1962. Banded 1 m, 1 f on 23 Jul 1962. Banded 2 m, 7 f on 10 Oct 1962; recovered 1 f on 26 Jan 1963. Banded 4 m on 14 Nov 1962. Banded 1 f on 17 Jan 1963. Banded 12 m, 1 f on 30 Jan 1963; recovered 1 m on 4 Jul 1963. Banded 4 f on 21 Feb 1963. Banded 2 m, 8 f on 27 Feb 1963. Banded 1 m on 6 Mar 1963. Banded 6 m, 10 f on 4 Jul 1963. 15. Tunnel, 4 miles N Oatman [A 48]. Banded 1 m on 4 Feb 1962. 15. Tunnels, 1 mile W Oatman [A 49]. Banded 1 m on 14 Apr 1961. 16. Tunnel, 4.5 miles E Oatman [A 47]. Banded 1 f of 300 on 10 Apr 1960. Banded 1 m on 16 Apr 1960. Banded 1 f on 31 Jul 1961. 17. Building, Cane Springs [A 50]. Banded 1 m, 2 f on 22 Oct 1960. 19. Tunnel on Kaiser Springs Wash at Burro Creek [A 54a]. Banded 12 m, 10 f on 14 Oct 1962. 19. Tunnel b, Burro Creek [A 54b]. Banded 134 f; of 230 on 16 Apr 1961. 19. Tunnel f, Burro Creek [A 54f]. Banded 1 m on 1 Oct 1961. 19. Tunnel g, Burro Creek [A 54g]. Banded 94 f of 100 on 19 Mar 1961; recovered 12 f on 16 Apr 1961; recovered 12 f on 1 Oct 1961; recovered 3 f on 28 Apr 1962; foreign recovery, 1 f on 28 Apr in tunnel, 3.5 miles E Burro Creek Bridge [A 57]. Banded 48 f on 16 Apr 1961; recovered 28 f on 1 Oct 1961; recovered 1 f on 23 Apr 1962; recovered 2 m, 3 f on 28 Apr 1962; foreign recovery, 1 f on 6 Jun 1961 in net, Burro Creek Bridge. Banded 2 m, 4 f of 46 on 1 Oct 1961; recovered 1 m, 1 f on 28 Apr 1962. Banded 1 m, 1 f on 28 Apr 1962. 19. Tunnel j, Burro Creek [A 54j]. Banded 5 f on 7 Apr 1963. 20. Tunnel, 3.5 miles E Burro Creek Bridge [A 57]. Banded 1 m, 3 f of 30 on 28 Apr 1962. 21. Tunnel, 7 miles N Rawhide Mine [A 60]. Banded 1 f on 25 Jul 1963. 21. Upper tunnel, 1 mile N Rawhide Mine [A 61]. Banded 1 m on 25 Jul 1963. 21. Mine tunnel, 5.25 miles N [=NW] Alamo Crossing, 0.25 mile N [=NW] Rawhide Mine [A 62]. Banded 1 m on 10 Jul 1960. 21. Tunnel, 600 ft above Rawhide Mine [A 63]. Banded 12 m, 53 f on 10 Jul 1960; recovered 31 f on 2 Jul 1962; recovered 12 f on 25 Jul 1963. Banded 17 m, 44 f on 2 Jul 1962; recovered 8 f on 25 Jul 1963. Banded 7 m, 14 f on 25 Jul 1963. 21.

Tunnel, 1 mile N Rawhide Mine [A 64]. Banded 1 m on 2 Jul 1962. 21. Mine tunnel [=Cactus Queen Mine?], 1 mile W [WSW] Rawhide Mines [A 65]. Banded 1 m on 10 Jul 1960. 21. Mine, 0.5 mile W Rawhide Mine [A 66]. Banded 1 m on 10 Jul 1960.

ANTROZOUS PALLIDUS PALLIDUS (LE CONTE).
PALLID BAT

Vespertilio. *pallidus* Le Conte, Proc. Acad. Nat. Sci., Philadelphia, 7:437, 1856, type from El Paso, El Paso County, Texas.

Antrozous pallidus, H. Allen, Smithsonian Misc. Coll., 7:68, Jun, 1864.

Antrozous pallidus pallidus, Cockrum, Mammals of Arizona, Univ. Az. Press, 1960, p. 59; Hoffmeister and Durham, Museum of Northern Az., Flagstaff, Tech. Series 11:27, 1971; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 237; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 114.

Comments

No Pallid bats were taken during the winter (Oct-Apr), either in roosts or in nets over water (Table 15). We suspect that they move to the higher elevations to the eastward and hibernate during the winter. In the summer, most were taken over water. As indicated on the map, they seem to occur throughout the area.

Records of Occurrence

Specimens examined:— Total, 20 (4 m, 16 f), as follows: 1. Vicinity Pipe Springs National Monument, 1 f, 7 Jul 1964, UA. 2. Pakoon Spring Ranch, Grand Wash, 1 m, 7 Jul 1964, UA. 3. Nixon Springs, Mt. Trumbull, 2 f, 4 Aug 1969, MNA; 1 m, 1 f, 16 Jul 1964, UA. [Hoffmeister and Durham, 1971:27; Hoffmeister, 1986:114.] 4. Buckhorn Spring, T 34 N, R 16 W, Sec 26, 1600 ft., 1 m, 2 f, 4 May 1978, MNA. 5. 1 mile W Toroweap Ranger Station, Grand Canyon Nat. Mon., 2 f, 17 Jul 1964, UA. 8. Cohenour Springs, Cohenour Canyon, 11 miles N Kingman, 1 m, 1 f, 25 May 1976, MNA. [Hoffmeister, 1986:114.] 9. Old Clack Ranch barn, 6 miles N

Table 15. *Antrozous pallidus* captures by month, sex, place of collecting activities. The numbers are the totals of specimen examined, bats banded and bats observed.

Month	net		roost		total	
	m	f	m	f	m	f
January	0+	0= 0	0+	0= 0	0+	0= 0
February	0+	0= 0	0+	0= 0	0+	0= 0
March	0+	0= 0	0+	0= 0	0+	0= 0
April	0+	0= 0	2+	5= 7	2+	5= 7
May	7+	7= 14	1+	0= 1	8+	7= 15
June	15+	26= 41	0+	1= 1	15+	27= 42
July	93+	156=249	0+	0= 0	93+	156= 249
August	16+	22= 38	1+	11= 12	17+	33= 50
September	1+	4= 5	11+	12= 23	12+	16= 28
October	0+	0= 0	0+	0= 0	0+	0= 0
November	0+	0= 0	0+	0= 0	0+	0= 0
December	0+	0= 0	0+	0= 0	0+	0= 0
Totals	332+	215= 347	15+	29= 44	147+	244= 391

Kingman, 3 f, 25 Sep 1959, UA. [Hoffmeister, 1986:114.] 10. 1 mile S Kingman, 1 f, 25 Jul 1967, UA. 17. Ft. Mohave, 1 f, 1 May 1861, US; 1 f, 9 Jun 1904, MVZ. [Hoffmeister, 1986:114.] 18. Bill Williams River, 1 f, 28 Jul 1902, US. [= Yuma County: Bill Williams R., 9, US, Hoffmeister, 1986:114.]

Literature:—

6. 0.5 mile S Dry Lake, 4350 ft., 1, UI, Hoffmeister and Durham, 1971:27; Hoffmeister, 1986:114. 10. 6 miles E Beale Spring, 1, US, Hoffmeister, 1986:114. 14. Twin Mills, 5 miles SE Kingman, 7, UI, Hoffmeister, 1986:114.

Banding records:— Total banded, 370 (146 m, 224 f); total local recoveries, 24 (4 m, 20 f); total foreign recoveries, 6 f; as follows: 7. Net, tunnel Cerbat Mts. [A 6]. Banded 9 m, 5 f on 8 Jul 1962. 7. Net, 2.5 miles N Stockton Hills Mine [A 7]. Banded 5 m, 2 f on 27 Jun 1963. 7. Tunnel, 17 miles NW Kingman [A 12]. Banded 8 m, 27 f of 40 on 24 Sep 1961. 8. Net, tunnel 8 miles N Kingman [A 11]. Banded 5 m, 19 f on 8 Jul 1962. Banded 14 m, 29 f on 18 Jul 1962. Banded 9 m, 6 f on 25 Jun 1963. Banded 1 f on 1 Jul 1963. Banded

3 m, 4 f on 17 Jul 1963. 8. Net, tunnel 1 mile W Stockton Hills mine [A 15]. Banded 1 m on 26 Jun 1963. 9. Net, 5.5 miles N Kingman [A 14]. Banded 1 f on 5 May 1962. 10. Building, Airport NE of Kingman [A 16]. Banded 1 m, 11 f on 26 Aug 1962; recovered 3 f on 8 Sep 1962. Banded 3 m on 8 Sep 1962. 10. Net, 1 mile NW Kingman [A 22a]. Banded 1 m, 4 f on 3 Sep 1961. 10. Building, 1 mile N Kingman [A 22b]. Banded 2 m, 5 f of 35 on 24 Apr 1962; foreign recovery, 3 f on 5 May 1962 in net, 5.5 miles N Kingman [A 14]; foreign recovery, 3 f on 30 Jul 1962 in net, yard, Kingman [A 28a]. 10. Net, 1 mile N Kingman [A 22c]. Banded 1 m, 1 f on 15 Jul 1959. 10. Net, yard, Kingman [A 28a]. Banded 3 m, 5 f on 1 Jul 1960; recovered 2 f on 11 Jul 1960; recovered 1 m on 18 Aug 1961; recovered 1 m on 2 Aug 1963. Banded 1 m, 1 f on 9 Jul 1960; recovered 1 f on 11 Jul 1960; recovered 1 f on 18 Aug 1961; recovered 1 f on 29 Jul 1963. Banded 3 m, 6 f on 11 Jul 1960; recovered 2 f on 18 Aug 1961. Banded 6 m, 11 f on 18 Jul 1961; recovered 2 f on 23 Jul 1961; recovered 1 m, 1 f on 24 Jul 1961; recovered 1 m on 20 Jul 1962. Banded 1 f on 23 Jul 1961. Banded 1 m, 9 f on 24 Jul 1961. Banded 5 m, 7 f on 29 Jul 1963. 11. Tunnel, Katherine Landing [A 18]. Banded 6 f on 17 Sep 1960. 12. Net, tunnel 1 mile SW Union Pass [A 19a]. Banded 19 m, 6 f on 10 Jul 1962. Banded 3 m on 26 Jul 1962. Banded 8 m, 3 f on 3 Jul 1963. Banded 6 m, 1 f on 23 Jul 1963. 13. Net, 12 miles W Kingman [A 45]. Banded 2 f on 28 Jun 1960. 14. Net, 7.5 miles SE Kingman [A 30]. Banded 1 f on 5 Jul 1962. Banded 1 m on 16 Jul 1962. 14. Net, 1.5 miles SE Kingman [A 31]. Banded 3 m, 3 f on 26 Aug 1961. 14. Net, 4.5 miles SSE Kingman [A 37]. Banded 1 f on 18 Jul 1959. Banded 1 m, 2 f on 25 Jun 1960. Banded 1 m, 3 f on 29 Jun 1960. Banded 7 f on 5 Jul 1960; recovered 1 f on 11 Jul 1961; recovered 1 f on 23 May 1962; recovered 2 f on 6 Jul 1962. Banded 1 m on 13 Jul 1960. Banded 1 f on 16 Jul 1960; recovered 1 f on 12 Aug 1961. Banded 2 m on 25 Aug 1960. Banded 3 f on 5 Jun 1961. Banded 2 f on 11 Jul 1961. Banded 1 m, 2 f on 8 Aug 1961; recovered 2 f on 6 Jul 1962. Banded 1 f on 11 Aug 1961. Banded 1 m on 12 Aug 1961. Banded 3 m, 4 f on 13 Aug 1961. Banded 2 f on 8 Jun 1962. Banded 5 f on 6 Jul 1962. 14. Net, 6.5 miles SSE Kingman [A 40]. Banded 2 m, 2 f on 9 Jun 1962. 15. Net, 8 miles SSE Kingman [A 39]. Banded 1 m on 4 Aug 1960. Banded 2 m, 2

f on 10 Aug 1960. Banded 2 m, 1 f on 13 Aug 1960. Banded 1 f on 16 Aug 1961. Banded 5 m on 1 May 1962. Banded 2 m, 1 f on 23 Jul 1962. Banded 4 f on 9 Jul 1963. 15. Net in tunnel, 9 miles SE Kingman [A 24]. Banded 1 m on 13 Jul 1961. Banded 2 f on 15 Jul 1962. 16. Net, entrance Flag Mine [A 43b]. Banded 1 f on 23 Jul 1962.

TADARIDA BRASILIENSIS MEXICANA (SAUSSURE).
BRAZILIAN FREE-TAILED BAT

Molossus mexicanus Saussure, Revue et Magasin de Zoologie, Paris, (Ser.2)12:283, Jul, 1860, type from Cofre de Perote, 13000 ft., Vera Cruz.

Tadarida brasiliensis mexicana, Schwartz, Jour. Mamm., 36:108, 1955; Cockrum, Mammals of Arizona, Univ. Az. Press, 1960, p. 61; Hoffmeister and Durham, Museum of Northern Az., Flagstaff, Tech. Series 11:27, 1971; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 242; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 116.

Nyctinomus mohavensis Merriam, North American Fauna, 2:25, 30 Oct. 1889, type from Ft. Mohave, Mohave County, Arizona.

Comments

These bats are known to be migratory in other parts of their range. Probably these populations move southward, spending the winter months (Oct-Feb) in Mexico. Most examined by us were taken in a maternity colony (Table 16).

In the spring (15 Apr 1962) and again in the fall (17 Sep 1962) relatively large numbers roosted in crevices over the spillway at Davis Dam. About 500 were present in Apr together with large numbers (up to 10,000) of *Myotis yumanensis*. In Sep an estimated 10,000 *Tadarida* were present. On 14 Sep 1961 two (m and f) were taken from a tunnel 17 miles NW Kingman. A tunnel 3.5 miles E Burro Creek Bridge is used as a transient roost, mainly by males. On 27 Mar 1960, 57 m and 3 f of 500 were banded. On 19 Apr 1960, 752 m and 94 f of 2,500 were banded. None were found during visits to this tunnel in May, Jul and Aug.

Table 16. *Tadarida brasiliensis* captures by month, sex, place of collecting activities. The numbers are the totals of specimen examined, bats banded and bats observed.

Month	net			roost			total		
	m	f		m	f		m	f	
January	0 +	0 =	0	0 +	0 =	0	0 +	0 =	0
February	0 +	0 =	0	0 +	0 =	0	0 +	0 =	0
March	2 +	0 =	2	57 +	3 =	60	59 +	3 =	62
April	11 +	0 =	11	755 +	94 =	849	766 +	94 =	860
May	0 +	0 =	0	0 +	8 =	8	0 +	8 =	8
June	2 +	3 =	5	0 +	0 =	0	2 +	3 =	5
July	0 +	4 =	4	740 +	1226 =	1966	740 +	1230 =	1970
August	16 +	189 =	205	83 +	164 =	247	99 +	353 =	452
September	1 +	0 =	1	5 +	8 =	11	6 +	8 =	14
October	0 +	0 =	0	0 +	0 =	0	0 +	0 =	0
November	0 +	0 =	0	0 +	0 =	0	0 +	0 =	0
December	0 +	0 =	0	0 +	0 =	0	0 +	0 =	0
Totals	32 +	196 =	228	1640 +	1503 =	3143	1672 +	1699 =	3371

A maternity colony of 400-500 was in the crevices of the sides of a sinkhole 8 miles NE Topock on 13 May 1961.

A volcanic bubble cave, Power Line Cave [A 58], once housed a large maternity colony of *Tadarida*. Musgrove was told by a local resident that about 132 tons of guano were harvested from this cave in 1942 or 1943. Guano removal was begun during the summer and completed sometime during the winter. During the summer, bats were so numerous that the entire ceiling was covered. To facilitate working in the cave, the entrance was enlarged to let in light and an air vent was blasted in the ceiling. In spite of the blasting, bats persisted in using the cave. Many thousands were killed by dynamite supported on long poles and exploded near the ceiling. Two elderly men working in the cave developed fever and died within a few days.

When Musgrove first visited this cave (16 Aug 1960) little guano and only about 2000 bats were present. The bats occupied only a small, dark crevice in the ceiling. In an effort to increase use of the cave, Musgrove used some timbers and metal roofing to close most of the entrance and plugged the air vent in the ceiling with debris. On 10 Jul

Table 17. Analysis of guano taken from Tramway Cave, Grand Canyon National Recreation Area. Depth of sample from surface is indicated on left (00 = surface, assumed to be Modern). Among insect remains only beetles (C = Coleoptera) and moths (L = Lepidoptera) could be identified. Some brief notes indicate nature of other materials seen.

Depth (inches)	%C	%L	Other	notes
0	3	97	<i>Tadarida</i> hair	microlepidoptera
0	54	46	—	mostly fine bits
4	28	72	large stones	some dermestids
8	3	37	—	—
12	47	53	—	some dermestid
16	25	75	40% dirt	—
22	57	43	some dirt	—
23	53	47	—	insects diff. diff bat species?
25	16	84	—	"
27	22	78	50 % pellets	" ? . Lighter color.
31	18	72	75% pebbles.	1/3 of pellets diff.
35	19	81	pebbles/fine	few pellets
39	12	88	35% pebbles	few pellets
45	17	83	25% dirt	few pellets
50	10	90	15% pebbles	mainly fine matter
55	56	44	—	—
60	68	32	some pebbles	few pellet, most fine
67	63	47	some pebbles	—

1961 the population was estimated at 8,000; on 25 Jul 1962, at 10,000. Populations were equally high, if not higher, when Cockrum and Musgrove visited the cave on 2 Jul 1963.

The following information is primarily from Dr. Paul Martin, Geochronology Laboratories, University of Arizona. Tramway Cave, [6 on map] is the site of a bat roost that was also a bat guano mining operation in the mid-1950s. A group known as U. S. Guano Corp., operating from Kingman, Arizona, invested considerable time and capital in the operation (Anon. 1957:103/106; Grater, 1951). The cave is on the north bank of the Colorado River, near the lower end of the Grand Canyon. It is in the Granite Gorge area, about 10 miles east

of Pierce Ferry, and is part of the Lake Mead National Recreation Area. The cave, elevation of about 2200 ft., is in a limestone layer and is about 1400 feet deep.

On Jun 10-11, 1958, Dr. Martin and B. C. Arms took samples from two sections: section 1 consisted of 16 samples at depths ranging from the surface to 67 inches; section 3 consisted of samples taken at depths up to 84 inches. The deepest sample was 12,900 ± 500 years BP, according to a radioactive carbon dating analysis recorded by Dr. Martin.

Anthony Ross examined the samples for insect parts. His results are summarized in Table 17. Examination of the table suggests that the first sample (00) is the only part of the material that is very recent. In it, hair (*Tadarida*) is evident and enough structure of the insect material remains for identification of microlepidoptera. Evidence of dermestid beetles (scavengers that feed on dead organic material including hair and guano) occurs to a depth of 12 inches in the samples examined.

Some of the samples contain large amounts (to 75%) of pebbles and dirt, suggesting that material from the roof of the cavern had fallen down. This suggests to us that long periods of time were involved, with few or no bats present for much of the time. Based on observations of rates of guano deposit made at the Eagle Creek Cave in Greenlee County, three to five inches are deposited in one summer season all across the area under the bats. If we assume that only 1 inch per year were deposited in this cave, then the whole deposit of 68 inches represents only 68 years. However carbon dating indicates that in excess of 11,400 years were involved. Surely much of the time no bats were present. Further, the differing nature of the insect remains (some fine, some coarser—probably the result of different tooth structure and chewing techniques on the part of the bats) as well as the differences in percentages of beetles/moths, strongly suggests that different species of bats were involved in the deposit.

That some large roosts of *Tadarida brasiliensis* still occur in Mohave County north of the Colorado River is indicated by some findings of Hoffmeister and Durham (1971). They reported taking about 50 in a net over a tank in Black Rock Mountain in early Aug. Of the 29 of these on deposit in the Museum of Northern Arizona, 9 are

males, and 20 are females. It appears probable that a sizable maternity colony of *Tadarida* is nearby.

Records of Occurrence

Specimens examined:— Total, 42 (17 m, 24 f, 1 ?), as follows: 1. Trails End, Black Rock Mtn., 11.5 miles SE Littlefield, 9 m, 20 f, 3 Aug 1969, MNA. [Hoffmeister and Durham, 1971:27; Hoffmeister, 1986:116.] 2. Pakoon Spring Ranch, vicinity Grand Wash, 1 m, 12 Aug 1964, UA. 3. Jun Tank, S of Findlay Knolls, 5500 ft, 2 f, 16 Jul 1975, MNA. 4. Nixon Springs, 9 miles ESE Mt. Trumbull P.O., 2 m, 24 Apr 1978, MNA. [Hoffmeister and Durham, 1971:27; Hoffmeister, 1986:116.] 5. Buckhorn Spring, T 34 N, R 16 W, Sec 26, 1600 ft., 1 m, 24 Apr 1978, MNA. 9. Stockton Hill Mine, N of Kingman, 1 m, 17 Oct 1962, UA. 16. Stouts Well, T 15 N, R 15 W, sect 35, 3064 ft., 1 m, 9 Mar 1979, UA. 14. Colorado River, Mellen [=Topock], 2 f, 26 Feb 1910, MVZ. 13. Ft. Mohave, 1 m, 26 May 1904, US. [Hoffmeister, 1986:116.] 15. 15 miles SE Yucca on Dutch Flats, 1 m, 22 Mar 1973, MNA. 19. N side Bill Williams River, Alamo Crossing, 1, ?, 10 Apr 1966, UA.

Banding records:— Total banded, 3335 (1656 m, 1679 f); no recoveries; as follows: 7. Net, Red Lake area [A 2]. Banded 1 f on 8 Jul 1963. 8. Tunnel, 17 miles NW Kingman [A 12]. Banded 1 m, 1 f on 24 Sep 1961. 10. Davis Dam [A 26]. Banded 4 m, 2 f on 17 Sep 1960. Banded 5 f on 15 Apr 1962. 11. Net, 1 mile NW Kingman [A 22a]. Banded 1 m on 17 Sep 1961. 11. Net, 1 mile N Kingman [A 22c]. Banded 2 f on 15 Jul 1959. 11. Net, City Tank, Kingman [A 27]. Banded 7 m on 18 Apr 1962. 11. Net, swimming pool, Kingman [A 29b]. Banded 5 f on 2 Aug 1960. 11. Net, 1.5 miles SE Kingman [A 31]. Banded 3 m, 1 f on 26 Aug 1961. 12. Net, 4.5 miles SSE Kingman [A 37]. Banded 1 f on 16 Jul 1960. Banded 1 f on 8 Aug 1961. 14. Sinkhole, 5 miles NE Topock [A 51]. Banded 8 f on 13 May 1961. 18. Net, Burro Creek [A 56]. Banded 2 m, 3 f on 6 Jun 1961. 18. Tunnel, E Burro Creek Bridge [A 57]. Banded 57 m, 3 f on 27 Mar 1960. Banded 752 m, 94 f on 19 Apr 1960. Banded 3 m on 28 Apr 1962. 17. Cave, Chemehuevi Mts. [A 58]. Banded 80 m, 157 f on 16 Aug 1960. Banded 740 m, 826 f on 25 Jul 1962. Banded 400 f on 2 Jul 1963. 19. Net, tank, Alamo Crossing [A 68].

Banded 6 m, 169 f on 25 Aug 1963.

NYCTINOMOPS FEMOROSACCUS (MERRIAM).
POCKETED FREE-TAILED BAT

Nyctinomus femorosaccus Merriam, North American Fauna, 2:23, 30 Oct 1889, type from Agua Caliente [= Palm Springs], Riverside County, Calif.

Nyctinomops femorosaccus, Miller, Proc. Acad. Nat. Sci. Philadelphia, 54:393, 1902.

Nyctinomops femorosacca, Freeman, Fieldiana: Zoology, n.s. 7:162, 1981.

Tadarida femorosacca, Cockrum and Musgrove, Jour. Mamm. 46:509, 26 Aug 1965; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 243; Hoffmeister, Mammals of Arizona, Univ. Az. Press, Apr 1986, p. 118.

Comments

Six individuals were captured the evening of 25 Aug 1963 in mist nets set over a large water tank at Alamo Crossing. Two were saved as specimens at the University of Arizona collection.

Records of Occurrence

Specimens examined:— Total, 2 (m, f), as follows: 1. Alamo Crossing, Bill Williams River, 1000 ft., 1 m, 1 f, 25 Aug 1963, UA. [Cockrum and Musgrove, 1965:509; Hall, 1981:243; Hoffmeister, 1986:119.]

NYCTINOMOPS MACROTIS (GRAY).
BIG FREE-TAILED BAT

Nyctinomus macrotis Gray, Ann. Nat. Hist., 4:5, Sep. 1839, type from Cuba.

Nyctinomops macrotis, Miller, Proc. Acad. Nat. Sci. Philadelphia, 54:393, 1902; Freeman, Fieldiana: Zoology, n.s. 7:163, 1981.

Tadarida macrotis, Hoffmeister and Durham, Museum of Northern Az., Flagstaff, Tech. Series 11:27, 1971; Hall, Mammals of

North America, John Wiley, New York, 1981, p 280; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 119.

Comments

None were taken. No observations.

Records of Occurrence

Specimens examined:— Total, 10 (1 m, 9 f), as follows: 1. Trails End, Black Rock Mtn., 11.5 miles SE Littlefield, 2 f, 3 Aug 1969, MNA. [Hoffmeister and Durham, 1971:27; Hoffmeister, 1986:120.] 2. Nixon Springs, Mt. Trumbull, 9 miles ESE Trumbull P.O., 4 f, 17 Jul 1964, UA, 3 f, 4 Aug 1969, MNA. [Hoffmeister and Durham, 1971:27; + 1, UI, Hoffmeister, 1986,:120.] 3. Net, 1.5 miles SE Kingman, 1 m, 26 Aug 1961, KHS.

Banding records:— None.

EUMOPS PEROTIS CALIFORNICUS (MERRIAM). WESTERN MASTIFF BAT

Molossus californicus Merriam, North American Fauna, 4:31, 8 Oct 1890, type from Alhambra, Los Angeles Co., Calif.

Eumops perotis californicus, Sanborn, Jour. Mamm., 13:351, 2 Nov 1932; Cox, Jour. Mamm., 46:687, 1965; Hall, Mammals of North America, John Wiley, New York, 3 Apr 1981, p. 247; Hoffmeister, Mammals of Arizona, Univ. Az. Press, 1986, p. 121.

Comments

A maternity colony was found in a cave in a cliff in the Secret Pass area west of Kingman at an elevation of 2500 ft. The bottom of the cave is 45 feet above the foot of the cliff and the opening is 65 feet high. The cave is about 150 feet deep. The roost is a crevice at the top of the cave. On 16 Aug 1959, 3 ad f were shot from the crevice. On 30 Aug 1959, nine more were taken, 1 juv m, 4 juv f and 4 ad f. On 4 Sep 1960, 3 m and 4 f were taken. The males were young of the year. On 26 Jul 1962, 10 were taken—5 ad f and 5 one-fourth grown young (3 m, 2 f) were taken of “many.”

Records of Occurrence

Specimens examined:— Total, 10 (1 m, 9 f), as follows: 1. Cave #1, Secret Pass, 20 miles W Kingman, 9 f (1 f, 16 Aug 1959; 4 f, 30 Aug 1959; 3 f, 26 Sep 1959; 1 f, 16 Oct 1959, UA. [Cox, 1965:687; Hall, 1981:247.] 2. Crevice, Burro Creek, 1 m, 14 Oct 1962, KHS.

ACKNOWLEDGMENTS

The large number of students and associates of Bill Musgrove listed in the detailed banding records given in the Appendix, as well as Bill's wife and sons, provided many hours of effort in this banding project. Financial support for field work was provided in part by a National Science Foundation grant (G-20463) to the senior author and by a National Science Foundation Training Grant to Musgrove. Dr. Arthur Phillips of the Museum of Northern Arizona kindly permitted Cockrum to examine material in that collection. Tom Huels, of the University of Arizona Department of Ecology and Evolutionary Biology provided editorial and other support during the preparation of the manuscript. Publication was supported by the Arizona Heritage Fund through the Arizona Game and Fish Department. Without all of this help this report would not have been possible.

LITERATURE CITED

- Allen, H. 1866. Notes on the Vespertilionidae of Tropical America. Proc. Acad. Nat. Sci. Philadelphia for 1866, pp 279-288.
- Anon. 1957. A bounty from Ancient bats. Miners find \$15 million fortune in fertilizer in Grand Canyon Cave. *Life*, 43(23):103/106, 2 Dec.
- Baker, R. J., J. C. Patton, H. H. Genoways and J. W. Bickham. 1988. Genic studies of *Lasiurus* (Chiroptera: Vespertilionidae). *Occas Pap., Museum, Texas Tech Univ.*, 117:1-14.
- Barbour, R. W., and W. H. Davis. 1969. *Bats of America*. Univ. Press of Kentucky, Lexington, pp. 1-286.
- Bogan, M. A. 1975. Geographic variation in *Myotis californicus* in the southwestern United States and Mexico. U. S. Fish and Wildlife Serv.: Wildlife Res. Rep., 3: iv + 31 pp.

- Cockrum, E. L. 1960. The Recent mammals of Arizona: their taxonomy and distribution. Univ. Arizona Press, Tucson, viii + 276 pp.
- Cockrum, E. L. and B. Musgrove. 1964. Additional records of the Mexican big-eared bat, *Plecotus phyllotis* (Allen), from Arizona. J. Mamm., 45:472-474.
- . 1965. Extension of known range of the pocketed free-tailed bat. J. Mamm., 46:509.
- Cockrum, E. L. and Y. Petryszyn. 1991. The long-nosed bat, *Leptonycteris*: An endangered species in the Southwest? Occas. Pap. Museum, Texas Tech Univ., 142:1-32.
- Constantine, D. G. 1987. Long-tongued bat and spotted bat at Las Vegas, Nevada. J. Mamm., 32:392.
- Coues, E. 1867. The Quadrupeds of Arizona. Amer. Nat. 1:284
- Cox, T. J. 1965. Behavior of the mastiff bat. J. Mamm., 46:687-688.
- Freeman, P. W. 1981. A multivariate study of the family Molossidae (Mammalia, Chiroptera): Morphology, Ecology, Evolution. Fieldiana (Zool.), n.s. 7:vii+173
- Genoways, H. H., and J. K. Jones, Jr. 1967. Notes on distribution and variation in the Mexican Big-eared bat, *Plecotus phyllotis*. Southwestern Nat., 12:477-480.
- Grater, R. K. 1951. Black Gold. Arizona Highways 27:2-3/26-27, Jun.
- Grinnell, H. W. 1918. A synopsis of the bats of California. Univ. California Publ. Zool., 17(12):223-404.
- Grinnell, J. 1914. An account of the mammals and birds of the lower Colorado valley with especial reference to the distributional problems presented. Univ. California Publ. Zool., 12:51-294.
- Hall, E. R. 1981. The Mammals of North America. John Wiley & Sons, New York. 2nd edition, vol. 1, xv + 600 + 90 pp.
- Hardy, R. 1949. Notes on mammals from Arizona, Nevada, and Utah. J. Mamm., 30:434-435.
- Herd, R. M. and M. B. Fenton. 1983. An electrophoretic, morphological, and ecological investigation of a punative hybrid zone between *Myotis lucifugus* and *Myotis yumanensis* (Chiroptera: Vespertilionidae). Canadian J. Zool., 61(9):2029-2050.
- Hoffmeister, D. R. 1986. Mammals of Arizona. Univ. Arizona Press, Tucson, xx + 602 pp.
- Hoffmeister, D. F. and F. E. Durham. 1971. Mammals of the Arizona Strip including Grand Canyon National Monument. Mus. Northern Arizona, Flagstaff. Tech. Series 11:1-44.
- Hollister, N. 1909. Two new bats from the southwestern United States. Proc. Biol. Soc. Washington, 22:43-44.

- Irwin, D. W. and R. J. Baker. 1967. Additional records of bats from Arizona and Sinaloa. *Southwestern Nat.*, 12:189-205.
- Kunz, T. H. 1982. *Lasionycteris noctivagans*. Mammalian Species No. 172, pp 1-5.
- Miller, G. S., Jr. 1897. Revision of the North American bats of the family Vespertilionidae. *N. Amer. Fauna* 13:1-136.
- Miller, G. S., Jr. and G. M. Allen. 1928. The American bats of the genera *Myotis* and *Pizonyx*. *Bull. U. S. Nat. Mus.*, 144:viii+218.
- Sellers, W. F. and R. H. Hill. 1974. *Arizona Climate, 1931-1972*. Univ. Arizona Press, viii+616 pp.
- Stager, K. L. 1943. Remarks on *Myotis occultus* in California. *J. Mamm.*, 24: 197-199.
- Suttkus, R. D., G. H. Clemmer and C. Jones. 1978. Mammals of the riparian region of the Colorado River in the Grand Canyon area of Arizona. *Occas. Pap., Tulane Univ. Mus. Nat. Hist.*, 2:1-23.
- Wright, D. T. 1966. Morphological variation in the fringed myotis, *Myotis thysanodes* Miller (Vespertilionidae). Unpublished M. S. Thesis, Univ. Arizona, viii + 32 pp.

APPENDIX

Banding localities.

These are the sites where bats were banded and the dates and personnel involved. The banding activities are given above in the text. The material within brackets was added in 1988. Most additions result from examinations of the various topographic maps indicated. Unless otherwise indicated, the maps were of the 7.5 minute series of the US Department of the Interior, Geological Survey. In a few cases, the precise locality could not be identified on the map. In such cases the symbols \pm and ? and the term "about" are used to indicate the lack of precision.

1. OK Mine, 68 miles N Kingman, 4000 feet. [Not found, perhaps White Hills Q., 15' series, 1960: 3600 \pm feet, 35° 44' 30" N, 114° 22' 30" N.] A long, dry tunnel with high rooms, side tunnels and vertical stopes. 16 Jul 1959: (Bill Musgrove). 1 Sep 1961: air temperature, 62°F (Bill Musgrove). 8 Jul 1963: air temperature, 86°F (Bill and Kent Musgrove). 2. Mist net [=Lake Tank?], Red Lake area. [Red Lake Q., 1968. 2760 feet, 35° 39' 38" N, 114° 06' 24" W.] 8 Jul 1963: (Bill and Kent Musgrove). 3. Mine tunnels, 1 mile N Chloride. [Chloride Q., 1968. 4400 feet, 35° 25' 46" N, 114° 11' 00" W.] A total of 21 tunnels checked. In dry tunnel near bottom of canyon 1 bat found. 10 Jul 1959: (Bill Musgrove). 4. Mine tunnel, SE edge Mineral

Park. [Cerbat Q., 1968. 4200 feet, 35° 22' 15" N, 114° 09' 30" W.] A 1500 foot tunnel, with shafts and air holes. 17 Sep 1961: (Bill Musgrove, Dennis Poyner, Bill Logas). 5. Hackberry Consolidated Mine, 28.5 miles NE Kingman. [Peacock Peak Q. 4250 feet, 35° 21' 02" N, 113° 45' 56" W]. Mine on E slope of Peacock Mts. in piñon pine area. 3 Jul 1960: air temperature, 76°F; (Bill Musgrove and Jon Coppa). 26 Jul 1960: air temperature at 3:30 PM, 103°F outside, 83°F inside (Bill and Terry Musgrove, Jon Coppa). 25 Mar 1961: air temperature, 46°C; (Bill Musgrove). 14 Aug 1961: (Bill Musgrove, Tom Cox, Jaime Maya). 7 Apr 1962: air temperature, ground level, 20 feet inside tunnel, 76°F; (Bill, Kent and Terry Musgrove).

6. Mist net at water tank and at wet mine tunnel entrance [= Rico Mine?], 3 miles NW Stockton Hills Mine, Cerbat Mts. [Stockton Hill Q., 1980. 5600 feet, 35° 20' 50" N, 114° 06' 50" W.] Water tank 6 feet in diameter, most bats caught over water at entrance of wet tunnel. 8 Jul 1962: (Bill Musgrove). 7. Mist net, mouth of wet mine tunnel [= C O D Mine?], 2.5 miles N Stockton Hills Mine, [Stockton Hill Q., 1980. 5000 feet, 35° 20' 44" N, 114° 06' 28" W.] 27 Jun 1963: (Bill and Kent Musgrove). 8. 3 miles S Hackberry. [Hackberry Q., 1968. 3940 feet, 35° 20' 10" N, 113° 42' 48" W.] 15 May 1961: (Dudley and Tribble). 9. Mine tunnel [De la Fortaine Mine?], 1 mile NW Stockton Hills Mine, about 9 miles NW Kingman, [Stockton Hill Q., 1980. 5300 feet, 35° 19' 06" N, 114° 06' 50" W.]. 13 Jan 1963: Ice on water at entrance; air temperature in tunnel, 3.5°C; (Bill Musgrove). 10. Tunnel, near Jim Kane Mine, 17 miles NW Kingman. [Stockton Hills Q., 1968. 4640 feet, 35° 18' 34" N, 114° 06' 52" W.] Mist net over water at entrance of mine tunnel. 28 Jun 1963: (Bill, Kent and Terry Musgrove). 11. Mist net, entrance Stockton Hills Mine, 8 miles N Kingman. [Stockton Hill Q., 1980. 5000 feet, 35° 18' 34" N, 114° 05' 30" W.] This tunnel is 700± feet long, with water standing in front 300± feet. At times, many moth wings floating on water from night roost activities. 6 Jul 1962: day roost (Bill Musgrove). 8 Jul 1962: (mist net) (Bill Musgrove). 18 Jul 1962: (mist net) (Bill Musgrove, Bill Logas). 25 Jun 1963: (mist net) (Bill, Kent and Terry Musgrove, Wayne Rutchman). 1 Jul 1963: (Mist net) (Bill, Kent and Terry Musgrove, E. L. Cockrum). 17 Jul 1963: (mist net) (Bill and Kent Musgrove). 12. Tunnel, Jim Kane Mine area, 17 miles NW Kingman. [Stockton Hills Q., 1968. 4550 feet, 35° 18' 28" N, 114° 06' 52" W.] Short tunnel, about 100 feet long. An enlarged area about 30 feet from entrance was bat roost. 24 Sep 1961: (Bill Musgrove). 13. Tunnel [=Golden Gem Mine?], 1.5 miles W Jim Kane Mine, 16± miles NW Kingman. [Cerbat Q., 1968. 4150 feet, 35° 18' 16" N, 114° 08' 16" W.] Tunnel 500 to 600 feet long, with 6 inches of water in first 100 feet. 24 Sep 1961: (Bill Musgrove). 14. 5.5 miles

N Kingman. [Kingman Q., 1967. 3600 feet, 35° 17' 30"N, 114° 08' 30"W.] Mist net over a small water hole. 5 May 1962: (Bill Musgrove, Charles Glancy). 1 Jun 1962: (Bill Musgrove). 15. Mist net, mouth mine tunnel [=Western Union Mine], 1 mile W Stockton Hills mine, [Stockton Hill Q., 1980. 5000 feet, 35° 18' 30"N, 114° 06' 30"W.]. Water in tunnel. 26 Jun 1963: (Bill, Kent and Terry Musgrove). 16. Airport, NE of Kingman. [Kingman Airport Q., 1968. 3350 feet, 35° 16'N, 113° 57'W.] In old building. 26 Aug 1962: (Bill Musgrove, Bill Logas). 8 Sep 1962: (Bill Musgrove). 17a. Lower tunnel [=Tyro mine?], N side ridge near bottom of canyon, Katherine Wash, 7 miles E Davis Dam. [Union Pass Q., 1967. 2800 feet, 35° 13' 36"N, 114° 26' 52"W.] Tunnel above wash bank, near the canyon bottom, 7-800 feet long and with a side tunnel of 100 feet. One vertical shaft near the back. Some sign of bat activity. 5 Mar 1961: (Bill, Kent and Terry Musgrove, Larry Ross, Earl Chambers, Dale Nichols). 17b. Upper tunnel, N side ridge near top of canyon, Katherine Wash, 7 miles E Davis Dam. [See 17a above]. Complex of three levels of drifts, air shafts and extensive side tunnels. About 1/2 mile of tunnels and drifts. Scattered small piles of bat guano in all tunnels and drifts. May be a *Plecotus townsendii* maternity colony. 5 Mar 1961: (Bill, Kent and Terry Musgrove, Larry Ross, Earl Chambers, Dale Nichols). 9 Sep 1961: (Bill and Terry Musgrove). 17c. Main tunnel and pits, Katherine Wash, 7.5 miles E Davis Dam. [See 17a above]. Complex of tunnels, shafts and stopes, with about one mile of tunnels, all with 6 to 8 feet ceilings. Little guano present. 4 Mar 1961: (Bill, Kent and Terry Musgrove, Larry Ross, Earl Chambers, Dale Nichols). 9 Sep 1961: (Bill Musgrove). 18. Mine tunnel, 700 feet from Lake Havasu, Telephone Pole Cove, 1 mi N Katherine Landing, 600 ft. [Davis Dam Q., 1983. 35° 13' 32" N, 114° 34' 04" W.] 30 Aug 1959: (Joe and Jon Coppa, Bill Musgrove). 16 Apr 1960: (Bill Musgrove, Jon Coppa, E. L. Cockrum). 17 Sep 1960: (Bill Musgrove and High School Science Class). 26 Feb 1961: (Bill Musgrove, Larry Ross, Dale Nickols). 13 Aug 1961: (Bill Musgrove, Tom Cox, Jaime Maya). 19a. Mist net, mouth wet mine tunnel, 1 mile SW Union Pass. [Union Pass Q., 1967. 3320 feet, 35° 12' 58"N, 114° 24' 12"W.] Mine tunnel at foot of low, rocky cliff at edge of open desert. Tunnel 9 feet wide, 8.5 feet tall and over 150 feet long. 10 Jul 1962: (Bill Musgrove). 26 Jul 1962: (Bill Musgrove). 3 Jul 1963: (Bill and Kent Musgrove, E. L. Cockrum). 23 Jul 1963: (Bill, Kent and Terry Musgrove, John Coppa). 19b. Dry tunnel, 1 mile SW Union Pass. [See 19a above]. Tunnel, 150 feet deep, facing W, half way up side of cliff. Open desert below. Little vegetation on low hills. This is about 100 feet north of site 19a. 10 Jul 1962: (Bill Musgrove). 3 Jul 1963: (Bill and Kent Musgrove, E. L. Cockrum). 20 Jul

1967: (Clay Mitchell and James Mascarello). 20. Mine tunnels, Chalk Peak, 2 miles W Union Pass, 2800 feet. [Union Pass Q., 1967. 3400 feet, 35° 12' 52"N, 114° 25' 00"W.] Entire peak honey-combed with tunnels; highest room in tunnel very large, 75 x 100 feet. 16 Apr 1960: (Bill Musgrove). 17 Aug 1960: air temperature 79°F; (Bill Musgrove and Science Class). 30 Aug 1960: (Bill Musgrove, Bill Logas, Mike and Gary Smith, Dennis Poyner). 26 Feb 1961: (Bill Musgrove, Larry Ross, Dale Nichols). 5 Mar 1961: (Bill, Kent and Terry Musgrove, Larry Ross, Earl Chambers, Dale Nichols). 31 Jul 1961: (Larry Ross, Derl Walker). 13 Aug 1961: Nothing. Fires had been built in all tunnels. All timbering and one chute burned in the big room. Much smoke in all tunnels. 28 Jun 1962: (Bill Musgrove). 21. Mine tunnel, Little Butte, 1 mile S Chalk Peak, 2 miles W Union Pass. [Union Pass Q., 1967. 3200 feet, 35° 12' 30"N, 114° 24' 44"W.] No guano present. 5 Mar 1961: (Bill, Kent and Terry Musgrove, Larry Ross, Earl Chambers, Dale Nichols). 22a. 1 mile NW Kingman. [Kingman Q., 1967. 3500 feet, near 35° 12' 30"N 114° 03'W.] Mist net over water tanks. 3 Sep 1961: (Bill Musgrove, Science Class). 17 Sep 1961: (Bill Musgrove, Science Class). 22b. 1 mile N Kingman. [See 22a]. Night roost in a garage. 24 Apr 1962: (Bill Musgrove, Charles Glancy). 22c. 1 mile N Kingman. [See 22a]. Mist net over water hole, desert area near rock cliffs. 15 Jul 1959: (Bill Musgrove, Jon Coppa). 23a. Rock building, S side state highway 93, 4 miles E Kingman. [Rattlesnake Hill Q., 1968. 113°N, 57°W.] Bats in crevices of wall. 25 Sep 1960: (Bill Musgrove, Dennis Poyner, Mike Smith). 23b. Peoples Cave, Buzzards Roost, 2 miles S of stone bldg. [Rattlesnake Hill Q., 1968]. "An old *Tadarida* cave, 25 feet deep, 30 feet wide, 20 feet high. Guano had been 6 feet deep. Cave not used by any number of bats for nearly 30 years. A rough 2 mile walk over a ridge and down a steep canyon." 7 Aug 1960: (Bill and Terry Musgrove, Joe and Jon Coppa). 24. Net in tunnel, Getz tunnel, N end Hualapai Mts, 9 miles SE Kingman. [Hualapai Peak NE, 1968. 5200 feet, 35° 09' 04"N, 113° 50' 22"W.] Mine tunnel, 200 feet long, with water in last 75 feet. 19 Aug 1959: (Bill Musgrove). 7 Aug 1960: air temperature, 71°F (Bill and Terry Musgrove, Joe and Jon Coppa). 13 Jul 1961: (Bill Musgrove). 15 Jul 1962: (mist net at entrance) (Bill Musgrove, Charles Glancy, Wayne Rutchman). 25a. Forked tunnel, 600 ft SW of pass, 11 mi SE Kingman, 3700 ft. [Rattlesnake Hill Q., 1980. 35° 12' 00"N, 113° 54' 30" W.] A cool tunnel about 250 feet long, with a large room in left fork. N end Hualapai Mts. 13 Jul 1961: (Bill Musgrove). 10 Dec 1961: air temperature. 58°F (Bill Musgrove, Science Class). 7 Aug 1963: (Bill and Kent Musgrove). 25b. Tunnel, 500 feet S of pass, 11 miles SE Kingman, [see 25a above]. Damp tunnel, one small pool of water. 13 Jul 1961: air temperature,

63°F (Bill Musgrove). 7 Aug 1963: (Bill and Kent Musgrove). 25c. Mine tunnel, 12 miles E Kingman on highway 93, 0.25 mile S highway [same as 25b?]. A cool tunnel with an airshaft. 7 Aug 1963: (Bill and Kent Musgrove). 25d. Tunnel at divide, 11 miles SE Kingman, [see 25a above]. Short (about 50 feet) tunnel opening N on N slope of divide. 13 Jul 1961: (Bill Musgrove). 26. Davis Dam, [Davis Dam Q., 1983. 560 feet. 35° 11' 56"N, 114° 34' 10"W]. Bats roost in crevices over the spillway and in various construction seams. 17 Sep 1960: (Bill Musgrove and Science Class). 9 Apr 1961: (Bill Musgrove). 15 Apr 1962: (Bill Musgrove). 27. City Water Tank, hill top, Kingman. [Kingman Q., 1967. 3650 feet, 35° 11' 44"N, 114° 02' 10"W.] 18 Apr 1962: (Bill Musgrove, Science Class). 28a. Mist net, 2501 Marlene Ave, Kingman. [Kingman Q., 1967. 3560 feet, 35° 11' 35"N, 114° 01' 12"W.] Net set in front yard. 1 Jul 1960: (Bill and Terry Musgrove). 9 Jul 1960: (Bill and Terry Musgrove). 11 Jul 1960: (Bill and Terry Musgrove). 9 Sep 1960: (Bill Musgrove). 18 Jul 1961: (Bill Musgrove). 23 Jul 1961: (Bill Musgrove). 24 Jul 1961: 29 Jul 1963: (Bill Musgrove). 2 Aug 1963: (Bill and Kent Musgrove). 28b. East Kingman [see 28a above]. Goldsteins, caught and killed by a house cat. 20 Jul 1962: (reported by Bill Musgrove). 28c. East Kingman [see 28a above]. 30 Jul 1962: (Bill Musgrove). 29a. Gold and First Streets, Kingman [Kingman Q., 1967. 3300 feet, 35° 11' 20"N, 114° 03' 00"W.] Captured with hand net under street light. 17 Sep 1960: (Bill Musgrove, Mike Finnegan). 29b. City swimming pool, Kingman. Mist net over shallow end of pool. 2 Aug 1960: (Bill Musgrove, Jon Coppa, Larry Ross). 29c. Downtown Kingman. Caught on antenna of police car. 19 Jul 1961: (Bill Musgrove, Harold Hanna—chief of police). 30. 7.5 miles SE Kingman. [Kingman Q., 1967. 4680 feet, 35° 11' 10"N, 113° 54' 28"W.] Mist nets over 15 feet diameter water tank and over 2 water troughs. 5 Jul 1962: (Bill Musgrove). 16 Jul 1962: (Bill Musgrove, Charles Glancy). 31. 1.5 miles SE Kingman. [Kingman Q., 1967. 3650 feet, 35° 11' 04"N, 114° 00' 32"W.] Mist net over almost dry water hole. 26 Aug 1961: (Bill Musgrove). 33. Big Wash tunnel [=Frost Mine?], 11 miles SE Kingman and then 1.25 miles W up wash. [Hualapai Peak NE Q., 1968. 4600 feet, 35° 10' 14"N, 113° 51' 07"W.] Damp tunnel, about 500 feet long. 13 Jul 1961: (Bill Musgrove). 34. 3.5 miles SSE Kingman. [Rattlesnake Hill Q., 1968. 4040 feet, 35° 09' 52"N, 113° 58' 48"W.] Mist net over cattle trough. 13 Aug 1961: (Bill and Kent Musgrove). 35. Mine tunnel, Power Line Pass of Secret Pass. [Secret Pass Q., 1967. 3600. 35° 09' 48"N, 114° 21' 56"W.] Tunnel facing west. 30 Aug 1959: (Bill Musgrove, Joe and Jon Coppa). 36. Rock crevices, Secret Pass (7 miles [by road] S Union Pass). [Secret Pass Q., 1968. 3300 feet, 35° 23' 58"N, 114° 22' 16"W.] Three caves here: 1.

Southernmost of the three. Bottom of cave 45 feet above ground level, with 65 feet opening and extending 150 feet into cliff. Opening to the east. 2. No signs of bats. 3. Northernmost of the three. At edge of valley, at foot of 350 feet high cliff; opening 65 feet high, depth about 150 feet. Light and warm. Cave 1. 16 Aug 1959: (Bill Musgrove, Joe and Jon Coppa). 30 Aug 1959: (Bill Musgrove, Jon and Joe Coppa). 4 Sep 1960: (Bill and Terry Musgrove; Joe and Jon Coppa). 26 Jul 1962: (Bill Musgrove). Cave 3. 16 Aug 1959: (Bill Musgrove, Jon Coppa). 37. Mist net, Twin windmills, 4.5 miles SSE Kingman. [Rattlesnake Hill Q., 1980. 4360 feet, 35° 09' 28"N, 113° 57' 24"W.] Water tank, 20 feet diameter and 5 feet deep, surrounded by desert willow, catsclaw, mesquite and piñon pine. Estimated that in Jun and Jul over 1000 bats visit this tank each night. 11 Jul 1959: (Bill Musgrove). 13 Jul 1959: (Bill Musgrove, Joe and Jon Coppa). 14 Jul 1959: (Bill Musgrove). 18 Jul 1959: (Bill Musgrove, Jon Coppa). 25 Jun 1960: (Bill Musgrove; Joe and Jon Coppa). 29 Jun 1960: (Bill Musgrove and Jon Coppa). 5 Jul 1960: (Bill, Kent and Terry Musgrove, Jon Coppa). 13 Jul 1960: (Bill, Kent and Terry Musgrove, Jon Coppa). 16 Jul 1960: (Bill Musgrove and Jon Coppa). 21 Jul 1960: (wire stretched over trough) (Bill and Terry Musgrove, Joe and Jon Coppa). 23 Jul 1960: (Bill Musgrove, Jon Coppa). 25 Aug 1960: (Bill and Terry Musgrove, Joe and Jon Coppa). 13 Sep 1960: (Bill Musgrove). 27 Sep 1960: (Bill, Kent and Terry Musgrove). 5 Jun 1961: (Steve Cross, Jaime Maya). 11 Jul 1961: (Bill and Kent Musgrove, Larry Ross, Tom Peterson, Derl Walker). 7 Aug 1961: (Net over water trough only) (Bill Musgrove). 8 Aug 1961: (Bill Musgrove, Larry Ross, Derl Walker). 11 Aug 1961: (Tom Cox, Jaime Maya). 12 Aug 1961: (Tom Cox, Jaime Maya). 13 Aug 1961: (Tom Cox and Jaime Maya). 13 Apr 1962: (Bill Musgrove). 16 Apr 1962: (Bill Musgrove, Science Class). 17 Apr 1962: (Bill Musgrove and Science Class). 23 May 1962: (Bill Musgrove). 8 Jun 1962: (Bill Musgrove). 6 Jul 1962: (Bill Musgrove). 38. S side Santa Fe RR, 1.5 miles SW Kingman. [Kingman Q., 1967. 3040 feet, 35° 09' 18"N, 114° 04' 52"W.] Mine tunnel and shaft, tunnel 50 feet, shaft 20 feet, tunnel 30 feet. 11 Aug 1960: (Bill Musgrove, Dennis Poyner, Bill Logas). 20 Aug 1960: (Bill Musgrove, Dennis Poyner). 26 Jun 1962: (Bill Musgrove, Pat Legg). 39. Upper Windmill, 8 miles SSE Kingman. [Hualapai Peak W. Q., 1968. 5000± feet, 35° 07' 30"N, 113° 54' 54"W.] Mist nets over water trough. 4 Aug 1960: (Bill and Terry Musgrove, Joe and Jon Coppa). 10 Aug 1960: (Bill and Terry Musgrove, Joe and Jon Coppa). 13 Aug 1960: (Bill and Terry Musgrove, Joe and Jon Coppa). 16 Aug 1961: (Bill Musgrove). 1 May 1962: (Bill Musgrove, Charles and Richard Glancy). 10 Jun 1962: (Bill Musgrove). 23 Jul 1962: (Bill Musgrove, Wayne Rutchman). 9 Jul 1963: (Bill, Kent and

Terry Musgrove). 40. 6.5 miles SSE Kingman. [Kingman Q., 1967. 4680 feet, 35° 08' 42"N, 113° 35' 30"W.] Mist net over water trough at windmills at bldgs at foot of Hualapai Mts. 4 Aug 1960: (Bill, and Terry Musgrove, Joe and Jon Coppa). 9 Jun 1962: (Bill Musgrove). 41. Enterprize Mine, 16 miles by road SE Kingman. [Hualapai Peak NE Q., 1968. 5000 feet, 35° 08' 40"N, 113° 49' 22"W.] Dry tunnel, several small piles of guano. 23 Sep 1961: (Bill Musgrove). 30 Sep 1961: (Bill Musgrove). 42. Park tunnel, 1500 feet below caretaker quarters, Mohave County Park headquarters. [6600± feet, Hualapai Peak Q., 1968. About 35° 06'N, 113° 52'W.] Damp tunnel. 12 May 1962: (Bill Musgrove). 43a. Flag Mine, 13 miles S Kingman, Hualapai Mtn. [Hualapai Peak Quadrangle, 7000 feet, 35° 04' 40" N, 113° 52' 58" W]. This mine tunnel is in the yellow pine, Douglas fir zone. Water on the floor of the tunnel, about 250 feet in from entrance. The mine is a complex of tunnels, some of which have collapsed. Especially during the winter, various bats hibernate in this mine. During the summer, they come to the mine in numbers to drink from the water. At that time they are readily taken in mist nets set at the mine entrance. Results from mist netting activities are listed separately as locality 43b. 5 Dec 1961: Ice over water for first 10-12 feet of tunnel. Many bats on wall, in numerous small clusters. Few taken because not prepared to handle large numbers. (Bill Musgrove, George Walker, Dennis Poyner). 10 Dec 1961: (Bill Musgrove, Science Class). 20 Jan 1962: (Bill and Terry Musgrove). 12 May 1962: (Bill Musgrove). 26 Jan 1963: (Bill Musgrove, Gordon VR Bradshaw). 43b. Mist net, entrance Flag Mine. [See 43a]. 12 Jun 1962: (Bill Musgrove). 3 Jul 1962: (Bill Musgrove). 11 Jul 1962: (Bill Musgrove, Bill Logas). 23 Jul 1962: (Bill Musgrove, Bill Logas). 10 Oct 1962: (Bill Musgrove, Bill Logas). 14 Nov 1962: (Bill Musgrove, Bill Logas). 14 Dec 1962: (Bill Musgrove, Science Class). 17 Jan 1963: (Bill Musgrove, Bill Logas). 30 Jan 1963: (Bill Musgrove, Bill Logas). 21 Feb 1963: (Bill Musgrove, Bill Logas). 27 Feb 1963: (Bill Musgrove, Bill Logas). 6 Mar 1963: (Bill Musgrove). 20 May 1963: (Bill Musgrove). 4 Jul 1963: (Bill and Terry Musgrove, E. L. Cockrum). 27 Jul 1963: (Bill, Kent and Terry Musgrove). 44. Mine tunnel, 5 miles N Oatman on Bullhead road. [Oatman Q., 1967. 2200 feet, 35° 04' 32"N, 114° 26' 20"W.] A very damp, branched tunnel, about 200 feet deep. Burros use this as source of water. 17 Aug 1961: (Bill and Terry Musgrove). 45. Sacramento Wash, 12 miles W Kingman. [Kingman SW Q., 2280 feet, 35° 04' 18"N, 114° 12' 50"W.] Mist net over water hole. 28 Jun 1960: (Bill Musgrove). 46. Mist net, Democrat Mine, 5 miles S Hualapai Mtn. Park. [Dean Peak Q., 1968. 5760 feet, 35° 04' 10"N, 113° 51' 50"W.] Wet tunnel with 100± feet of shallow water at entrance; several large piles of guano. 7 Jul 1963: (Bill Musgrove).

12 Jul 1963: (Bill, Kent and Terry Musgrove). 28 Jul 1963: (Bill, Kent and Terry Musgrove). 47. Half-mile tunnel [=Goldroad mine?], 4.5 miles E Oatman. [Mount Nutt Q., 1967. 3400 feet, 35° 02' 20"N, 114° 22' 10"W.] A dry tunnel. 10 Apr 1960: (Bill Musgrove, E. L. Cockrum, Larry Ross, Dennis Poyner). 16 Apr 1960: (Bill Musgrove, Jon Coppa, E. L. Cockrum). 25 Aug 1960: (Bill Musgrove). 30 Sep 1960: (Bill Musgrove, Mike and Gary Smith, Bill Logas, Dennis Poyner). 31 Jul 1961: (Larry Ross, Derl Walker). 17 Sep 1961: (Bill and Terry Musgrove). 48. Sulphur tunnel, 4 miles N Oatman. [Oatman Q., 1967. 2320 feet, 35° 01' 16"N, 114° 24' 43"W.] Tunnel at side of road. Air temperature 71°F on 17 Sep 1961. 31 Jul 1961: (Larry Ross, Derl Walker). 4 Feb 1962: (Bill Musgrove, Jay Gates). 17 Sep 1961: (Bill and Terry Musgrove). 49. Mine tunnels [=Pioneer Mine?], 1 mile W Oatman. [Union Pass Q., 1967. 2400 feet, 35° 01' 12"N, 114° 24' 22"W.] Two small tunnels and a deep, almost vertical shaft. 15 Apr 1961: (Bill Musgrove). 50. Building, Cane Springs, Big Sandy River. [Pilgrim Wash Q., 1967. 2640 feet, 34° 55' 22"N, 113° 40' 00"W.] In attic of old house. 22 Oct 1960: (Bill Musgrove, Dennis Poyner). 51. Sinkhole, 5 miles NE [by road?] Topock. [Warm Springs SW Q., 600 feet, 34° 44' 42"N, 114° 26' 18"W.] Near old railroad bed; 30 feet diameter, 40 feet deep; bottom of sink larger than top, thus with 15 feet overhang. Bats in crevices. 13 May 1961: (Bill Musgrove). 1 Jul 1961: (Larry Ross and Derl Walker). 52. Mine tunnel [=Gold Dome Mine], Needle Rock, 5 miles SE Topock. [Topock Q., 1970. 1400 feet, 34° 40' 26"N, 114° 26' 18"W.] An extensive tunnel with a great amount of guano. Two nearby tunnels with 200 lbs. guano. 28 Jan 1962: air temperature, 67°F (Bill Musgrove, Science Class). 53. State highway 93, 2 miles N Kaiser Spring Wash. [Greenwood Peak Q., 1980. 2200 feet, 34° 35' 26"N, 113° 30' 40"W.]. 22 Jan 1962: (Suzane Martin reported to Bill Musgrove). 54. [On the Kaiser Spring Q., 1980, near 34° 33' 38"N, 113° 00' 08"W, at an elevation of about 1800 feet, are a series of mine tunnels indicated by the name Burro Mine. The following (54a-54j) banding records refer to mine tunnels in this general region. Perhaps some are the same tunnel listed under a slightly different designation.] 54a. Tunnel on Kaiser Springs Wash at Burro Creek. 14 Oct 1962: (Bill Musgrove, Science Class). 54b. Tunnel, Upper Burro Creek. Tunnel, Upper Burro Creek, 1.5 miles downstream from Kaiser Springs Bridge. "Turned up Burro Cr from Kaiser Springs Wash about 500 yds, across stream and up a small gulch about 300 yds, entrance faces east, well hid. Tunnel 100 feet long and with 20 feet side tunnel." 16 Apr 1961: (Bill Musgrove, Science Class). 54d. L-shaped tunnel, 0.25 mile from Kaiser Springs on Burro Creek. 17 May 1961: (Bill Musgrove and T. Peterson). 54e. Tunnel of Burro Creek, above

Kaiser Spring (upper tunnel). 17 May 1961: (Bill Musgrove and T. Peterson). 54f. Upper tunnel, Burro Creek, 0.25 mile up Burro Cr from Kaiser Springs Wash. 17 May 1961: (Bill Musgrove and T. Peterson). 1 Oct 1961: (Bill Musgrove, Science Class). 54g. No. 1 Mine, Burro Creek, 1.25 mile below Kaiser Springs Bridge, 10 miles E Signal. Tunnel N side stream, 30 feet from edge of bank. Opening to S, 120 feet tunnel with one bend. 19 Mar 1961: (Bill Musgrove, Science Class). 16 Apr 1961: (Bill Musgrove, Science Class). 1 Oct 1961: (Bill Musgrove, Science Class). 28 Apr 1962: (Bill Musgrove and 5 Science students). 54h. Mine tunnel, lower Burro Creek, 1.75 miles below Kaiser Springs Bridge at State highway 93. "Lower tunnel, 150 yds up mtn side from Burro Creek but below Kaiser Springs Wash, tunnel faces NW. Tunnel 900 feet long, easy to work, tons of guano." 16 Apr 1961: (Bill Musgrove, Science Class). 54j. Tunnel, S side Burro Creek, 2.75 miles below Kaiser Spring Bridge at State Highway 93. 16 Apr 1961: (Bill Musgrove, Science Class). 17 May 1961: (Bill Musgrove and T. Peterson). 1 Oct 1961: (Bill Musgrove, Science Class). 3 Feb 1962: (Bill Musgrove). 28 Apr 1962: (Bill Musgrove, Science Students). 14 Oct 1962: (Bill Musgrove, Science Class). 27 Jan 1963: (Bill Musgrove, Gordon VR Bradshaw). 24 Feb 1963: (Bill Musgrove, Bob Wallace, Bill Logas). 10 Mar 1963: (Bill Musgrove). 22 Mar 1963: (Bill Musgrove). 7 Apr 1963: (Bill Musgrove). 26 Jan 1964: (Bill Musgrove). 9 Feb 1964: (Bill Musgrove). 16 Feb 1964: (Bill Musgrove). 23 Feb 1964: (Bill Musgrove). 1 Mar 1964: (Bill Musgrove). 15 Mar 1964: (Bill Musgrove). 29 Mar 1964: (Bill Musgrove). 55. Crevice, Burro Creek, 0.5 mile upstream from Kaiser Springs. [Kaiser Springs Q., 1980 [probably the same as 54]. In larger overhang crevice. 14 Oct 1962: (Bill Musgrove, Science Class). 56. Jct State highway 93 and Burro Creek. [Kaiser Springs Q., 1980. 1960 feet, 34° 32' 25"N, 113° 26' 50"W.] Mist net over creek [at campground]. 6 Jun 1961: (Steve Cross, Jaime Maya). 57. Mine tunnel [=Golden Key Mine], 76 miles from Kingman on State highway 93, 3.5 miles E Burro Creek Bridge. [Kaiser Springs Q., 1980. 2800 feet, 34° 31' 45"N, 113° 23' 50"W.] Tunnel on W slope of rocky hillside with scattered brush. Tunnel 300 feet long, guano up to 1.5 feet deep. 7 Mar 1960: (Bill Musgrove, E. L. Cockrum). 19 Apr 1960: (Bill Musgrove, Joe and Jon Coppa, E. L. Cockrum). 16 Jul 1960: (Bill Musgrove and Jon Coppa). 17 Aug 1960: (Bill and Terry Musgrove, Joe and Jon Coppa). 17 May 1961: (Bill Musgrove, Science Class). 28 Apr 1962: (Bill Musgrove, Science Class). 58. Power-line Cave, W slope Chemehuevi Mts. [Lake Havasu City North, 1970. 1255 feet, 34° 33' 42" N, 114° 19' 12" W.] This is a lava cave. See discussion in *Tadarida brasiliensis* account. 16 Aug 1960: (Bill, Kent and Terry Musgrove, Joe and Jon Coppa). 15 Apr 1961: (Bill Musgrove). 10 Jul 1961: (Bill Musgrove). 25 Jul 1962: (Bill,

Kent and Terry Musgrove, Wayne Rutchman). 2 Jul 1963: (Bill, Kent and Terry Musgrove, E. L. Cockrum). 59. Smith Ranch, 43 miles S Kingman. [Not found on topographic sheet]. Bats caught in old barn. 15 Sep 1962: (Bill Musgrove, Mike Smith, George Watson). 60. Lead Pill Mine, 7 miles N [=NW] Rawhide Mine. [Artillery Peak Quadrangle, 15' series, 1966. 2480 feet, 34° 22' 30" N, 113° 43' 18" W]. Horizontal tunnel. 25 Jul 1963: (Bill, Kent and Terry Musgrove). 61. Upper mine tunnel, 1 mile N [=NW] Rawhide Mine. [Artillery Peak Quadrangle, 15' series, 1966. 2000 feet, 34° 18' 30" N, 113° 39' 42" W.] A tunnel about 250 feet deep, with one side tunnel. 10 Jul 1960: air temperature, 75°F (Bill Musgrove). 25 Jul 1963: (Bill, Kent and Terry Musgrove). 62. Mine tunnel, 5.25 miles N [=NW] Alamo Crossing, 0.25 mile N [=NW] Rawhide Mine. [Artillery Peak Quadrangle, 15' series, 1966. 1920 feet, 34° 18' 12" N, 113° 39' 12" W.] Tunnel about 200 feet long. 10 Jul 1960: (Bill, Kent and Terry Musgrove, Joe and Jon Coppa). 63: Tunnel, 600 feet above Rawhide Mine. [Artillery Peak Quadrangle, 15' series, 1966. 1920 feet, 34° 17' 56" N, 113° 39' 32" W.] A straight tunnel about 150 feet deep. 10 Jul 1960: (Bill Musgrove and Joe Coppa). 2 Jul 1962: (Bill Musgrove). 25 Jul 1963: (Bill, Kent and Terry Musgrove). 64. Mine tunnel, 1 mile N [=NW] Rawhide Mine, 6 miles N [=NW] Alamo Crossing. [Artillery Peak Quadrangle, 15' series, 1966. 1940 feet, 34° 17' 52", 113° 39' 32" W.] A tunnel on E side of road, 200± feet deep. 10 Jul 1960: (Bill, Kent and Terry Musgrove, Joe and Jon Coppa). 2 Jul 1962: (Bill Musgrove). 65. Mine tunnel [=Cactus Queen Mine?], 1 mile W [WSW] Rawhide Mines. [Artillery Peak Quadrangle, 15' series, 1966. 2000 feet, 34° 17' 42" N, 113° 39' 36" W.] 10 Jul 1960: (Bill Musgrove and Jon Coppa). 66. Mine, 0.5 mile W [=SW] Rawhide Mine, 5 miles N [=NW] Alamo Crossing. [Artillery Peak Quadrangle, 15' series, 1966. 1920 feet, 34° 17' 42" N, 113° 40' 12" W.] One tunnel with two side tunnels and two 100 feet air shafts. 10 Jul 1960: (Bill, Kent and Terry Musgrove, Joe and Jon Coppa). 67. Mine tunnels [=Deer Trail Mine], 0.25 mile S Rawhide Mine. [Artillery Peak Quadrangle, 15' series, 1966. 1800 feet, 34° 17' 30" N, 113° 38' 52" W.] A maze of small tunnels and drifts. 2 Jul 1962: (Bill Musgrove). 25 Jul 1963: (Bill, Kent and Terry Musgrove). 68. Mist net, dirt dam tank, Alamo Crossing, Bill Williams River. [Artillery Peak Quadrangle, 15' series, 1966. 1050 feet, 34° 15' 42", 113° 34' 54" W. Now under the water of Alamo Lake.] 25 Aug 1963: (Bill and Kent Musgrove). 69. Jackass Flat Mine tunnel, 4.5 miles N Davis Dam, 0.75 mile W Lake Mohave, Clark County, Nevada. [1000± feet]. Mine with many shafts and rooms, extensive guano. 9 Apr 1961: (Bill Musgrove, Science Class). 13 Aug 1961: (Bill Musgrove, Tom Cox, Jaime Maya). 29 Jun 1962: (Bill Musgrove). 10 Jul 1963: (Bill, Kent and Terry Musgrove).

E. LENDELL COCKRUM, Professor Emeritus, Department of Ecology and Evolutionary Biology, 113 Biological Sciences East, University of Arizona, Tucson, AZ 85721. E-mail: cockrum@CCIT.ARIZONA.EDU
YAR PETRYSYN, Senior Curatorial Specialist, Department of Ecology and Evolutionary Biology, 123 Biological Sciences East, University of Arizona, Tucson, AZ 85721. (520) 621-7291.
BILL MUSGROVE, Retired, 874 Highway 170, Farmington, NM 87401. (505) 327-1039.

SEND ALL CORRESPONDENCE TO YAR PETRYSYN.

PUBLICATIONS OF THE MUSEUM
TEXAS TECH UNIVERSITY

It was through the efforts of Horn Professor J Knox Jones, as Director of Academic Publications, that Texas Tech University initiated several publications series including the *Occasional Papers of the Museum*. This and future editions in the series are a memorial to his dedication to excellence in academic publications. Professor Jones enjoyed editing scientific publications and served the scientific community as an editor for the *Journal of Mammalogy*, *Evolution*, *The Texas Journal of Science*, *Occasional Papers of the Museum*, and *Special Publications of the Museum*. It is with special fondness that we remember Dr. J Knox Jones.

Institutional subscriptions are available through The Museum of Texas Tech University, Texas Tech University, Lubbock, Texas 79409. Individuals may also purchase separate numbers of the Occasional Papers directly from The Museum of Texas Tech University.



ISSN 0149-175X

The Museum of Texas Tech University • Lubbock, TX 79409-3191