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Bats of the Genus *Myotis* from Western Mexico, with a Key to Species

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Distribution and variation in Mexican representatives of the vespertilionid bat genus *Myotis* have not been well documented. The most complete modern systematic treatment of these bats is that of Miller and Allen (1928), although these authors examined relatively few specimens and some of their taxonomic conclusions have been modified by more recent studies (see especially Findley, 1960; Findley and Jones, 1967; Genoways and Jones, 1969). In the past two decades, field representatives of the Museum of Natural History at The University of Kansas have obtained large collections of mammals in western México, principally in the states of Jalisco and Sinaloa. Bats of eight species of *Myotis* are among the specimens thus obtained, and we here summarize pertinent ecologic, taxonomic, and distributional data relative to these taxa. Also provided is a key to members of the genus on the mainland of western México, which it is hoped will prove useful for field recognition of the included species.

In addition to our own field work, J. R. Alcorn, R. H. Baker and students who accompanied him, P. L. Clifton, W. L. Cutter, R. F. Johnston and students, and M. R. Lee obtained specimens used in this report. Field work has been sponsored by the Museum of Natural History and Department of Zoology at Kansas, the Kansas University Endowment Association, the University's Committee on Systematic and Evolutionary Biology (NSF grant GB-4446X1), and through a contract (DA-49-193-MD-2215) with the Medical Research and Development Command of the U. S. Army.

In the following accounts, all catalogue numbers refer to the collections of the Museum of Natural History of The University of Kansas. All measurements are given in millimeters and all weights are in grams. External measurements are listed in the following sequence: total length; length of tail; length of hind foot; length of ear; and length of forearm.

***Myotis auriculus apache* Hoffmeister and Krutzsch, 1955**

Specimens examined.—JALISCO: 4 km. E Venustiano Carranza, 2160 meters, 10 mi. NNE Pihuamo, 3500 ft., 1.

Only three specimens of this bat are known from Jalisco—one from Los Masos (Findley, 1960:20) and the two herein reported.

A male from 4 km. E Venustiano Carranza was taken at 10:37 PM from a net stretched across a dry stream bed under a large, overhanging tree. Coniferous forest grew on a hillside in one direction from the stream bed and a large, heavily grazed field was adjacent on the other. Several *Myotis velifer* had been taken earlier in the same net and the *auriculus* evidently was attracted to the net by the squeaking of a hand-held *M. velifer*. A female from 10 mi. NNE Pihuamo was netted over a small stream, which was lined with trees that formed a complete canopy over it.

External measurements of our two specimens (male first) are: 87, 88; 38, 39.5; 10, 10.5; 19, 20; 39.5, 39.7. The male weighed 6.2 (testes, 4.0) and is somewhat darker in color of pelage and membranes than the female. Genoways and Jones (1969) recently have discussed reasons for use of the specific name *auriculus* for this bat, formerly regarded (Findley, 1960) as a representative of *Myotis keenii*.

***Myotis californicus mexicanus* (Saussure, 1860)**

Specimens examined.—SINALOA: 5 mi. E Plomosas, 5500 ft., 2; 3 mi. SE Plomosas, 4000 ft., 1. JALISCO: 10 mi. N Guadalajara, 3350 ft., 1; 2 mi. SE Mascota, 5200 ft., 1; Sierra de Cuale, 7300 ft., 1; 5 mi. W Atenquique, 7700 ft., 1; Volcán de Fuego, 9800 ft., 1.

This dark-colored subspecies of *M. californicus* inhabits mountainous areas of south-central México, from Tamaulipas and Veracruz

westward to Sinaloa and Guerrero. All of our specimens are from elevations of 3350 feet or higher. *M. c. mexicanus* has been reported previously from Jalisco by Miller and Allen (1928:160) from Los Masos, Santa Rosalia, and Sierra Nevada de Colima, and Genoways and Jones (1967:477-478) mentioned in passing two of the Jaliscan specimens here listed. The three bats from the vicinity of Plomosas, in southeastern Sinaloa, netted or shot in pine-oak forest, are the first to be reported from that state. Most of our Jaliscan specimens were netted or shot in pine-oak forest or pine-oak mixed with fir. The one from north of Guadalajara was shot from a night roost in a culvert in the barranca of the Río Grande de Santiago in an area where the vegetation was predominantly tropical in nature.

A Sinaloan female (30 April 1965) carried a single embryo that measured 10 (crown-rump). A male from Sierra de Cuale (26 October 1962) had testes that measured 3.5 in length.

External measurements of two females from Sinaloa, followed by those of a female and two males from Jalisco, are, respectively: 81, 78, 77, 75, 87; 35, 34, 36, 35, 37; 7, 7, 7, 7, 8; 14, 14.5, 14, 14, 13; 34.4, 33.1, 32.8, 32.0, 33.2. The Sinaloan females both weighed 4.6.

***Myotis fortidens fortidens* Miller and Allen, 1928**

Specimens examined.—SINALOA: Cosalá, 1300 ft., 1; 6 km. E Cosalá, 1500 ft., 3; Isla Palmito de la Virgen, 15 ft., 3. JALISCO: El Tabaco, 200 ft., 6.

Aside from the specimens here listed, *M. f. fortidens* is known from Sinaloa only from Escuinapa (Hall and Dalquest, 1950:587), and our series from Jalisco represents the first record of the species for that state. Findley and Jones (1967:442) have recorded *fortidens* from several localities in western México. The material at hand confirms their conclusion that the subspecies *fortidens* is smaller and more brightly colored than is *sonoriensis*, and that *fortidens* occurs at least as far north as central Sinaloa.

Specimens from the vicinity of Cosalá, Sinaloa, all were taken in mist nets set over streams; those from the barrier island of Palmito de la Virgen were netted over a freshwater pond approximately 50 yards in diameter along with *Noctilio leporinus* and *Rhogeessa parvula*. The Jaliscan series, all males, was netted along pathways cut through a dense, old banana grove. Many phyllostomatids, *Pteronotus parnellii*, and *Lasiurus ega* were taken in the same nets. Four of five June-taken females from Sinaloa were pregnant; embryos measured 4, 7, 10, and 12 in crown-rump length.

External measurements of three females and a male, respectively, from the vicinity of Cosalá, Sinaloa, followed by the average and extreme

Table 1. Cranial measurements of eight species of *Myotis* from western México.

Number averaged or catalogue number, and sex	Greatest length of skull	Zygomatic breadth	Interorbital constriction	Breadth of braincase	Mastoid breadth	Length of maxillary toothrow	Breadth across upper molars
<i>Myotis auriculus apache</i> , Jalisco							
KU 120509, ♂	16.5	9.8	3.7	7.7	8.4	6.6	6.4
KU 108607, ♀	17.0	10.3	3.8	7.9	8.6	6.6	6.5
<i>Myotis californicus mexicanus</i> , 5 mi. E Plomosas, Sinaloa							
KU 97051, ♀	14.3	8.1	3.0	6.1	6.9	5.5	5.5
KU 97052, ♀	13.6	8.4	3.3	6.4	...	5.3	5.5
Jalisco							
KU 92945, ♂	13.8	8.3	3.2	6.3	6.9	5.1	5.4
KU 107485, ♂	14.2	8.6	3.1	6.5	7.1	5.3	5.2
KU 103651, ♀	13.6	8.3	...	6.4	6.9	5.1	5.3
<i>Myotis fortidens fortidens</i> , 6 km. E Cosalá, Sinaloa							
KU 90734, ♀	15.1	...	4.0	7.3	7.8	5.7	6.2
KU 90735, ♀	14.8	9.2	3.7	6.9	7.5	5.6	6.0
El Tabaco, Jalisco							
Average 6 (♂)	15.0	9.7	3.9	7.2	7.8	5.7	6.3
Minimum	14.4	9.5	3.8	6.9	7.5	5.5	6.1
Maximum	15.7	10.1	4.1	7.4	8.1	5.9	6.6
<i>Myotis fortidens sonoriensis</i> , Río Fuerte, Sinaloa							
KU 67491, ♂	16.0	10.5	3.8	7.5	8.2	6.0	6.6
<i>Myotis nigricans extremus</i> , Jalisco							
Average 6 (3♂, 3♀)	13.8	8.3	3.4	6.5	7.0	5.3	5.5
Minimum	13.7	8.2	3.3	6.5	6.7	5.1	5.4
Maximum	14.0	8.5	3.5	6.7	7.2	5.5	5.7
<i>Myotis thysanodes thysanodes</i> , 10 mi. SE Talpa de Allende, Jalisco							
KU 97063, ♀	16.4	10.4	4.1	7.8	8.3	6.3	6.4
KU 97064, ♀	16.9	10.9	4.2	8.3	8.5	6.2	6.7
<i>Myotis velifer velifer</i> , vicinity Santa Lucía, Sinaloa							
Average 20 (♀)	16.7	10.6	3.9	7.5	8.5	6.7	7.0
Minimum	16.2	10.2	3.7	7.3	8.2	6.3	6.7
Maximum	17.2	11.0	4.1	7.7	8.7	7.0	7.4
vicinity Guadalajara, Jalisco							
Average 20 (11♂, 9♀)	16.6	10.7	3.9	7.6	8.5	6.6	7.0
Minimum	16.1	10.3	3.6	7.4	8.2	6.3	6.7
Maximum	17.2	11.2	4.2	7.9	8.8	6.8	7.2
<i>Myotis volans amotus</i> , 15 mi. S and 9 mi. E Talpa de Allende, Jalisco							
KU 97066, ♀	14.1	8.4	3.6	7.1	7.5	5.4	5.5

Table 1. Continued.

Number averaged or catalogue number, and sex	Greatest length of skull	Zygomatic breadth	Interorbital constriction	Breadth of braincase	Mastoid breadth	Length of maxillary toothrow	Breadth across upper molars
<i>Myotis yumanensis lutosus</i> , northern Sinaloa							
KU 95174, ♂	13.0	...	3.6	6.7	7.0	5.0	5.0
KU 95876, ♂	13.4	8.1	3.6	6.6	7.0	4.9	5.1
KU 95877, ♂	13.2	...	3.6	6.6	6.8	4.8	5.0
El Salto, Jalisco							
Average 6 (1 ♂, 5 ♀)	13.2	8.1	3.6	6.7	7.0	4.9	5.1
Minimum	12.9	7.8	3.3	6.3	6.7	4.8	5.0
Maximum	13.6	8.5	3.8	6.9	7.3	5.0	5.2

measurements of the six Jaliscoan males, are: 89, 84, 90, 80, 83.3 (80–86); 35, 32, 37, 31, 34.1 (32.5–35); 9, 9, 10, 9, 8.9 (8–9.5); 14.5, 14.5, 15, 14, 13.5 (12–15); 36.1, 35.2, 37.5, 37.6, 36.0 (34.7–38.8). Four Sinaloan specimens, two pregnant females, a nonpregnant female, and a male, weighed 6.0, 7.5, 7.0, and 5.7, respectively.

***Myotis fortidens sonoriensis* Findley and Jones, 1967**

A male from the Río Fuerte, 1 mi. N and 1/2 mi. E San Miguel, in northern Sinaloa, is the only bat of this subspecies in our collections. Findley and Jones (1967:442) and Jones *et al.* (1962:154, as *M. occultus*) previously have reported on this same individual. External measurements of the specimen are 101, 44, 10, 13, 38.7, weight 8.0.

***Myotis nigricans extremus* Miller and Allen, 1928**

Specimens examined.—JALISCO: 14 mi. WSW Ameca, 5000 ft., 1; 2 mi. S La Cuesta, 1500 ft., 1; Contla, 1320 meters, 1; 11 mi. SW Autlán, 710 meters, 1; ca. 30 km. N, 10 km. E Santiago (Colima), 1; 15 km. NW Cihuatlán, 5.

This Neotropical species has been reported previously from Jalisco by Davis and Carter (1962:72), from 16 mi. NE Tamazula, and by Jones (1964:513) on the basis of several of the specimens here listed. *M. nigricans* is known from as far north in western México as the vicinity of San Blas, Nayarit (Gardner, 1962:103). All of our specimens were netted over ponds or streams. The one from the highest elevation (5000 feet) was the only bat taken in two nets stretched over a stream in a tropically-vegetated canyon situated between oak-covered hills. None of the females examined (April- and May-taken) was reproductively active.

Average and extreme external measurements of nine adults (four males, five females) are as follows: 78.2 (74–83); 34.2 (31–40); 7.9 (7–9); 12.1 (11–13.5); 34.7 (33.0–36.9); seven specimens averaged 3.9 (3.5–5.0) in weight.

***Myotis thysanodes thysanodes* Miller, 1897**

Specimens examined.—JALISCO: 10 mi. SE Talpa de Allende, 5350 ft., 2.

Our two specimens were netted by Percy L. Clifton on 14 May 1964 between midnight and dawn over a pool in a mountain stream. Tall deciduous trees grew along the stream, whereas pine-oak forest clothed the surrounding hillsides. Other species netted along with *M. thysanodes* included *Pteronotus parnellii*, *Glossophaga soricina*, *Enchistenes hartii*, and *Eptesicus fuscus*. The fringed myotis has been reported previously from La Laguna and Los Masos, Jalisco, by Miller and Allen (1928:127); a specimen listed in the original description of the species (Miller, 1897:83) from Sierra Nevado de Colima is unaccounted for in subsequent publications.

Both bats were pregnant, each with a single embryo; the embryos measured 18 and 15 in crown-rump length. External measurements of the two females, which are darker in color than typical members of the subspecies, are: 92, 89; 37, 32; 11, 11; 18.5, 19; 43.7, 42.5; weight 8.6, 9.7.

***Myotis velifer velifer* (J. A. Allen, 1890)**

Specimens examined.—SINALOA: ½ mi. SE Vaca, 650 ft., 1; El Fuerte, 1500 meters, 2; Río Fuerte, 1 mi. N, ½ mi. E San Miguel, 1; 10 mi. NNW Los Mochis, 1; La Cruz, 30 ft., 1; 1 km. NE Santa Lucía, 3700 ft., 16; Santa Lucía, 3600 ft., 4; 1 mi. E Santa Lucía, 5650 (=ca. 3650) ft., 52; 1 km. NE Pánuco, 2700 ft., 1; 7 mi. ENE Plomosas, 6000 ft., 2; 3 mi. SE Plomosas, 4000 ft., 3.

JALISCO: 12 mi. W Encarnación de Díaz, 5600 ft., 5; 14 mi. SE Lagos de Moreno, 6700 ft., 1; 2 mi. NW Magdalena, 4500 ft., 1; 1 mi. NE Tala, 4400 ft., 1; 2 mi. SE Mascota, 5200 ft., 11; Atenguillo, 1; 13 mi. S, 15 mi. W Guadalajara, 21; 21 mi. SW Guadalajara, 11; Hda. San Martín, 5000 ft., 18 mi. W Chapala, 3; 15 mi. S, 9 mi. E Talpa de Allende, 6900 ft., 5; 4 mi. E Atemajac de Brizuela, 8000 ft., 1; 6 mi. E Limón, 2700 ft., 7; 5 mi. S Grullo, 3100 ft., 1; 6 mi. S Mazamitla, 6200 ft., 17; 3 km. E Venustiano Carranza, 2130 meters, 1; 4 km. E Venustiano Carranza, 2160 meters, 10; 4 km. W Tuxpan, 1380 meters, 1.

The cave myotis is the commonest and most widespread member of the genus in western México, where it occurs in a variety of habitats from sea level in Sinaloa up to at least 8000 feet in Jalisco. We have seen no bats of this species from the coastal areas of the latter state. Many of our specimens were taken in mist nets, but other were shot in flight or captured in abandoned buildings. *M. v. velifer* has been reported previously from Sinaloa by Jones *et al.* (1962:154) and in passing by Hayward (1970:24). The subspecies originally was described from Jalisco (J. A. Allen, 1890:177) and has been recorded since by several

authors—see especially Miller and Allen (1928:91) and Villa-R (1967:367).

Among the females at hand, in which all months from February through October are represented, only individuals obtained in May, June, and July evinced reproductive activity. A Jalisco female carried an embryo (crown-rump length, 13.5) on 20 May. Of 27 June-taken females from Sinaloa that were autopsied, 19 were pregnant and five were lactating; lactating females were obtained as late as 23 July when flying young of the year also were captured. Thirteen embryos examined in late June from the vicinity of Santa Lucía averaged 20.2 (14–30) in crown-rump length. Two August-taken males from Jalisco and one obtained on 10 December in Sinaloa had testes that measured 5, 8, and 4, respectively.

Average and extreme external measurements for a series of 20 adult females from the vicinity of Santa Lucía, Sinaloa, followed by those for 20 adults (11 males, nine females) from southwest of Guadalajara, Jalisco, are as follows: 96.3 (92–101), 98.2 (89–105); 44.2 (41–49), 41.9 (40–45); 10.0 (9–11), 10.8 (10–11); 15.8 (15–17), 16.2 (15–18); 43.7 (41.6–45.3), 43.4 (40.7–46.1). Eleven nonpregnant Sinaloan females had an average weight of 8.9 (8.2–9.6). Specimens obtained in late spring and early summer are noticeably paler than those in fresh pelage taken later in the summer. Annual molt evidently takes place in late June and early July.

***Myotis volans amotus* Miller, 1914**

Specimens examined.—JALISCO: 15 mi. S, 9 mi. E Talpa de Allende, 6900 ft., 3.

This relatively rare southern subspecies of *M. volans* is reported in the literature only from the type locality in Veracruz and from two localities in southern Jalisco—Los Masos (Miller and Allen, 1928:145) and 8 mi. W Atenquique, at 9100 feet on the southeast slope of El Nevado de Colima (Baker and Phillips, 1965:691–692). Our specimens, the first from the mountains of northwestern Jalisco, were netted on 20 May 1964 over pools in a small stream that flowed through a valley cleared for grazing but surrounded by hills covered with pine and fir. Other species, all vespertilionids, taken in the same nets included *Myotis velifer*, *Eptesicus fuscus*, *Lasiurus borealis*, *L. cinereus*, and *L. intermedius*. Two of our three specimens are females and each carried an embryo (16, 18 in crown-rump length).

Among western Mexican members of the genus, *M. v. amotus* can be recognized easily by a combination of its relatively short and rounded ears, medium size (length of forearm, 38.8 to 39.5 in our three speci-

ments), fur on the underside of the wing to the level of the elbow, ochraceous-tawny color, and high, rounded braincase. Baker and Phillips (*loc. cit.*) gave external and cranial measurements for a series from El Nevado de Colima.

***Myotis yumanensis lutosus* Miller and Allen, 1928**

Specimens examined.—SINALOA: $\frac{1}{2}$ mi. SE Vaca, 650 ft., 3; 6 km. NE El Fuerte, 150 meters, 1; 2 mi. E Aguacaliente, 800 ft., 1; Cosalá, 1300 ft., 1. JALISCO: Cuarenta, 6300 ft., 10; El Salto, 24 mi. W Guadalajara, 1280 meters, 7; 2 mi. S La Cuesta, 1500 ft., 1.

The Yuma myotis evidently is widespread, albeit relatively rare or perhaps common only locally, in western México. Our specimens are the first of the species to be reported from Sinaloa and *yumanensis* was known previously from Jalisco only by two individuals of unknown provenience (Miller and Allen, 1928:72). Sinaloan specimens were netted or shot over streams bordered by deciduous trees, whereas those from Cuarenta, Jalisco, were shot from a night roost under a small bridge. Bats from El Salto, Jalisco, were netted, along with more than a dozen other species of chiropterans, over a wide, shallow stream bordered by dense trees that formed a canopy over it; relatively open grazed and farmed areas were adjacent to the stream.

We note a slight trend toward paler color northwardly, but no differences in size, in the specimens at hand. Along with a female from Vado Cuchijaqui, 9 mi. ESE Alamos, Sonora (KU 87126), all seem referable to a single subspecies, *M. y. lutosus*. Burt (1938:21) assigned specimens from eastern Sonora to the subspecies *sociabilis* because they were noticeably darker in color than *M. y. yumanensis* of adjacent regions to the north and the Mexican Plateau to the east. In so doing, he created a disjunct range for *sociabilis* (see Hall and Kelson, 1959:163) in that the Sonoran records were separated from the main range of the subspecies by a broad segment of the range of the pale race *yumanensis*. Burt did not consider the then poorly known *lutosus* in assigning his Sonoran material to *sociabilis*. We suspect that these specimens, like ours, are best assigned to *lutosus*, which evidently occupies west-central México and occurs also northward in the Sierra Madre Occidental and adjacent foothills to Sonora. Our material from northern Sinaloa and the one specimen from Sonora are intermediate in color between typical *lutosus* and Californian specimens of *sociabilis*, but nearer the former.

A female from Cosalá, Sinaloa (15 June 1962), carried an embryo that measured 14 in crown-rump length; two of four females taken on 14 August 1969 at El Salto, Jalisco, were lactating. Testes of males measured 3, 2, and 2 on 15 June, 14 August, and 24 November, respectively.

External measurements of three males from northern Sinaloa, followed by the mean and extremes of those for six specimens (a male and five females) from El Salto, Jalisco, are: 74, 76, 78, 77.5 (75–82); 36, 30, 30, 35.0 (30–39); 8, 9, 9.5, 9.0 (8–10); 14, 14, 13.5, 13.6 (13–14); 32.6, 32.5, 32.7, 32.8 (31.5–34.2); weight 3.7, 4.6, 4.0, 3.7 (2.6–4.6, 5 specimens only).

Key to Western Mexican *Myotis*

The following key is based on specimens examined by us and on measurements and descriptions in the literature. It is devised to be as useful as possible in identifying specimens in the field. In addition to the characters used, the reader is directed to external measurements listed in the several accounts and to cranial measurements in Table 1.

1. Ear more than 15; forearm usually more than 39; greatest length of skull 16.0 or more; maxillary tooththrow 6.2 or more.....2
- 1'. Ear 15 or (usually) less; forearm usually less than 39 (excepting *M. volans*); greatest length of skull 16.0 or less; maxillary tooththrow 6.0 or less.....4
2. Ear large, 18–20; color pale, ochraceous or tawny; breadth across upper molars 6.7 or less.....3
- 2'. Ear medium, 15–18 (usually 16–17); color dark, grayish brown; breadth across upper molars 6.7 or (usually) more.....*Myotis velifer*
3. Uropatagium with conspicuous fringe of hairs on posterior margin; forearm more than 42; membranes dark, contrasting with dorsum; length of maxillary tooththrow less than breadth across upper molars.....*Myotis thysanodes*
- 3'. Uropatagium lacking conspicuous fringe of hairs on posterior margin; forearm less than 41; membranes pale, contrasting little with dorsum; length of maxillary tooththrow greater than breadth across upper molars.....*Myotis auriculus*
4. Dorsum pale reddish or yellowish red; premolars 2/2; greatest length of skull 14.4 or more.....*Myotis fortidens*
- 4'. Dorsum not pale reddish or yellowish red; premolars 3/3; greatest length of skull 14.3 or less.....5
5. Forearm more than 37; fur on underside of wing to level of elbow; breadth of braincase 7.0 or more.....*Myotis volans*
- 5'. Forearm less than 37; fur on underside of wing not extending to level of elbow; breadth of braincase 6.9 or less.....6
6. Dorsum rich, dark brown to mahogany; ears and membranes blackish, ears opaque; hind foot small (usually 6–7), less than 50 per cent length of tibia measured dry; interorbital breadth 3.3 or (usually) less.....*Myotis californicus*
- 6'. Dorsum brownish; ears and membranes relatively pale, not contrasting noticeably with dorsum, ears translucent; hind foot medium (usually 8–9), more than 50 per cent length of tibia measured dry; interorbital breadth 3.3 or more.....7

7. Venter grayish to whitish, occasionally with pale buffy wash; dorsum paler, brownish in fresh pelage, tips of hairs not noticeably burnished, bases dark grayish; breadth across upper molars 5.3 or less; length of maxillary tooththrow 5.1 or less (averaging 4.9).....*Myotis yumanensis*
- 7'. Venter dark brown with distinctive buffy wash; dorsum darker, blackish brown in fresh pelage, tips of hairs burnished, bases dark brown to blackish; breadth across upper molars 5.4 or more; maxillary tooththrow 5.1 or more (averaging 5.3).....*Myotis nigricans*

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