

Myotis evotis. By Richard W. Manning and J. Knox Jones, Jr.

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Myotis evotis (H. Allen, 1864)

Long-eared Myotis

Vespertilio evotis H. Allen, 1864:48. Type locality, by subsequent restriction, Monterey, Monterey Co., California (see Dalquest, 1943).

Vespertilio chrysonotus J. A. Allen, 1896:240. Type locality "Kinney Ranch [Bitter Creek, Sweetwater Co.], Wyoming."

Myotis micronyx Nelson and Goldman, 1909:28. Type locality "Comondu, Lower [Baja] California, Mexico (altitude 700 feet)."

Myotis evotis: Miller, 1897:77. First use of current name combination.

CONTEXT AND CONTENT. Order Chiroptera, Suborder Microchiroptera, Family Vespertilionidae, Subfamily Vespertilioninae. The genus *Myotis* contains about 88 species (Koopman, 1984) and has one of the broadest distributions among mammalian genera, occurring in most of the temperate and tropical parts of the world. Two subspecies of *M. evotis* are recognized (Hall, 1981):

M. e. evotis (H. Allen, 1864), see above (*chrysonotus* J. A. Allen and *micronyx* Nelson and Goldman are synonyms).

M. e. pacificus Dalquest, 1943:2. Type locality "3½ mi. E and 5 mi. N Yacolt, 500 ft., Clark County, Washington."

DIAGNOSIS. Ears blackish, long (extending 5 mm or more beyond tip of nose when laid forward), averaging longer than those of any other American member of the subgenus *Myotis*; no conspicuous fringe of hairs on posterior border of uropatagium; among largest of bats in American long-eared myotis group, both externally and cranially; length of forearm 36 to 41 mm, usually 40 or less. Tooththrows relatively long, molars robust, and auditory bullae relatively large when compared with those of related long-eared species (Genoways and Jones, 1969; Hall, 1981; van Zyll de Jong, 1985).

From other members of the long-eared group of American myotis (*M. auriculus*, *M. keenii*, *M. milleri*, *M. septentrionalis*, and *M. thysanodes*), this species differs from all except *M. thysanodes* and a few *M. auriculus* in being larger, both externally and cranially. Except for Pacific coastal populations, it also differs from all except *M. t. pahasapensis* in having a distinctive contrast in color between the pelage and the dark brownish to blackish ears and membranes. The conspicuous fringe of stiff hairs on the posterior border of the uropatagium immediately distinguishes *M. thysanodes* from *M. evotis* (Genoways and Jones, 1969; Hall, 1981; van Zyll de Jong, 1985).

GENERAL CHARACTERS. Pelage dull or pale brownish to straw-colored overall (*M. e. pacificus* darker than *M. e. evotis*); pelage full, soft, glossy, about 10 mm long middorsally with individual hairs black at base. Ears and membranes blackish (Fig. 1); posterior border of uropatagium with inconspicuous fringe of minute hairs; tragus long, slender. Length of foot averaging slightly less than one-half that of tibia; calcar extending about one-half way from foot to tip of tail, not keeled or only slightly so (Genoways and Jones, 1969; Hall, 1981; Miller and Allen, 1928; van Zyll de Jong, 1985).

Ranges in external and cranial measurements (in mm) in a series of *M. e. evotis* (nine males, three females) from northwestern South Dakota (Jones and Genoways, 1967) are as follows: total length, 87 to 100; length of tail, 34 to 45; length of hind foot, 8 to 11; length of ear, 19 to 22; length of forearm, 36.9 to 39.3; greatest length of skull, 15.8 to 17.0; zygomatic breadth, 9.5-10.1; postorbital constriction, 3.5 to 4.0; breadth of braincase, 7.2 to 7.8; mastoid breadth, 7.5 to 8.4; length of maxillary tooththrow, 6.0 to 6.4; breadth across third upper molars, 6.0 to 6.5; breadth across upper canines, 3.6 to 3.9. According to Dalquest (1943:2), *M. e. pacificus* differs from *M. e. evotis* "only in darker coloration." External measurements (Maser et al., 1981) of *M. e. pacificus* are

(same order as above): 89 to 96; 37 to 43; 8 to 12; 20 to 23; 36 to 41. Weight of adults of both subspecies usually is between 5 and 8 g. For example, seven males from southeastern Montana averaged 6.8 g (5.7 to 7.6) and two nonpregnant females each had a weight of 7.4 g (Jones et al., 1973).

In profile (Fig. 2), the cranium rises gradually from rostrum to braincase; sagittal crest usually present, but never conspicuous; skull relatively narrow; braincase ovoid when viewed from above, bulging posteriorly beyond lambdoidal ridges. Molars relatively large, M3 with marked re-entrant angle between parastyle and mesostyle; first and second upper premolars not crowded and directly in line of tooththrow. Dental formula: i 2/3, c 1/1, p 3/3, m 3/3, total 38, as in most *Myotis* (Genoways and Jones, 1969; Hall, 1981; Miller and Allen, 1928; van Zyll de Jong, 1985).

DISTRIBUTION. *Myotis evotis* occurs in temperate western North America (Fig. 3). It is found from central British Columbia and southern Saskatchewan and Alberta southward along the Pacific Coast to Baja California, eastwardly through Montana and Idaho to the western Dakotas (Jones and Choate, 1978), and from Nevada, Utah, Wyoming, and Colorado to New Mexico and Arizona (modified from Hall, 1981). Known altitudinal range is from near sea level along the Pacific coast (Grinnell, 1933) to about 2,830 m in Wyoming (Long, 1965).

FOSSIL RECORD. Dalquest et al. (1969) reported remains of a large *Myotis* (cf. *evotis*) from Schulze Cave, Edwards Co., Texas. These Holocene-late Pleistocene deposits contained eight jaws in layer C1 (essentially a modern fauna, ca. 5,000 to 3,800 years B.P.), and one skull and 15 jaws in layer C2 (materials probably dating from ca. 11,000 to 8,000 years B.P.). *M. evotis* also has been reported from late Pleistocene deposits in Little Box Elder Cave, Converse Co., Wyoming (Anderson, 1968), Papago Springs Cave, Santa Cruz Co., Arizona (Skinner, 1942), and Klein Cave, Kerr Co., Texas (Roth, 1972).

FORM AND FUNCTION. These bats have been categorized (Findley 1987:44-45) as "hovering gleaners," that "usually feed by picking their prey from the surface of foliage, tree trunks, rocks, or even from the ground. A gleaning bat may fly slowly and deliberately around a shrub, searching for emerging moths, or perhaps even nonflying prey." Findley and Wilson (1982) noted that hovering gleaners have relatively larger brains than congeners that do not



FIG. 1. Long-eared myotis, *Myotis evotis*, from Carter County, Montana. Photograph by T. H. Kunz.



FIG. 2. Dorsal, ventral, and lateral views of skull, and lateral view of lower jaw, of adult female *Myotis evotis* (Texas Tech Univ. no. 38734) from Socorro County, New Mexico. Greatest length of skull is 16.7 mm.

feed in that way. They reported a more complex flight behavior for this species than for *M. volans*, for example. *Myotis evotis* (a substrate gleaner) has a more powerful bite than does *M. volans* (an aerial insectivore), but only as the dentary approaches closure. Also, *M. evotis* has the potential for a quicker jaw closure and the ability to produce a series of rapid nipping motions to a greater degree than does *M. volans* (Reduker, 1983).

Hill and Smith (1984:119) noted that "the use of multiple harmonics and the correlation with hunting situations is well illustrated in the genus *Myotis*. Species such as *Myotis volans* that hunt over open fields and in clearings use one prominent harmonic. On the other hand, *Myotis evotis* that hunt close to tangled vegetation use a narrow fundamental frequency and two harmonics."

In dorsal aspect, the baculum of *M. evotis* is a small (1.5 mm) and rather broad, hourglass-shaped structure with a forked, upturned (in lateral aspect), and flattened distal tip (0.5 mm at the broadest

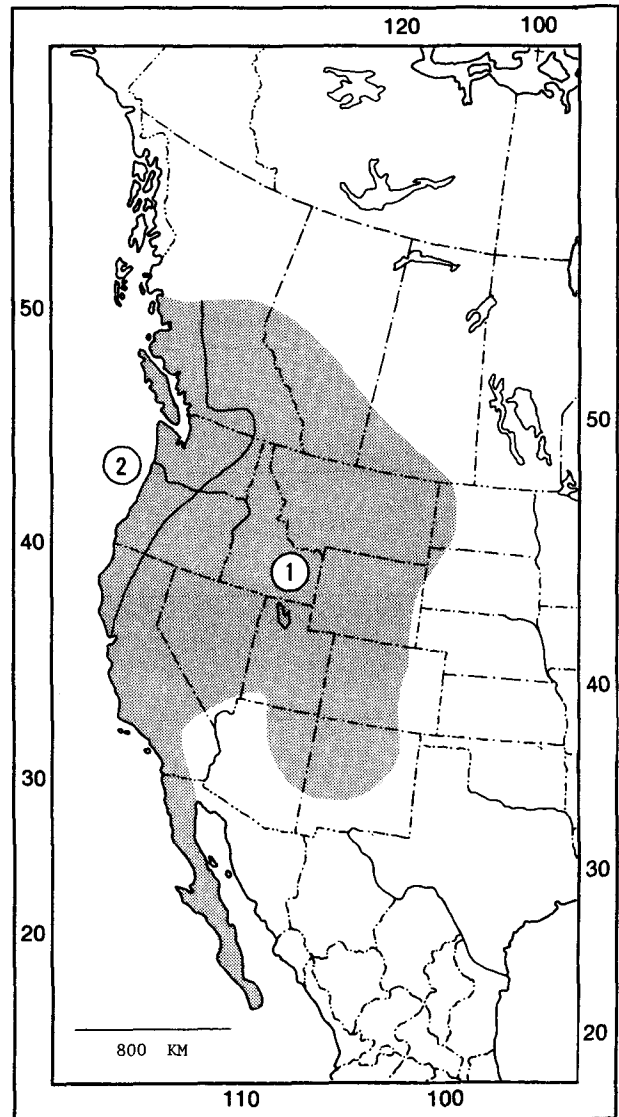


FIG. 3. Distribution of *Myotis evotis* in western North America. Subspecies are: 1, *M. e. evotis*; 2, *M. e. pacificus*.

part). The baculum is larger than that of *M. auriculatus*, more nearly resembling the baculum of *M. keenii* (Genoways and Jones, 1969).

Three of 11 specimens taken in August in Colorado were immature bats in gray pelage; the remaining individuals were pale yellowish brown (Cary, 1911). Two males netted on 30 June and 1 July in southeastern Montana (Jones et al., 1973) still were in old pelage, but 10 males taken later in July were molting as were two reproductively inactive females on 16 and 17 July. Seven adults (three females and two males) taken between 3 and 6 August in northwestern South Dakota were in fresh pelage ("molt nearly complete on the two remaining males"); one male taken in mid-July was in early stages of annual molt, with new pelage "pale yellowish brown" in contrast to the "golden brown pelage" of specimens taken in May and June (Andersen and Jones, 1971:370). Three of four males taken in mid-July in southeastern Montana were in the process of annual molt (Lampe et al., 1974).

Of 213 long-eared myotis captured and banded in Oregon, 185 were males and 28 were females (Maser et al., 1981). None of 15 adults taken in August had fat deposits; however, an adult male taken on 31 October had good fat accumulation (none was seen after that date).

ONTOGENY AND REPRODUCTION. All available reproductive data for *M. evotis* is anecdotal. The earliest reported date of pregnancy (a "minute" fetus) for this species is on 19 May at San Antonio Canyon, Los Angeles Co., California (about 900 m);

another female taken at the same place on 8 June carried a fetus that was 4 mm in length (Vaughan, 1954). Whitlow and Hall (1933) reported two females taken on 11 June, in a cabin in northern Idaho that carried one fetus each (crown-rump length, 7 and 8 mm), whereas Cowan and Guiguet (1960) reported two from British Columbia, each with one fetus, on 7 July. Hall (1946) noted two gravid females with one fetus each on 14 and 24 June at Mount Moriah, White Pine Co., Nevada.

The following information was reported by Maser et al. (1981) for *M. evotis* in western Washington: single young (naked, with sharp milk teeth) born on 15 July, four more were born on 16 July; neonates weighed from 1.08 to 1.36 g at birth, total length ranged from 40 to 47 mm, and the wingspan of the newborn bats was 103 mm as compared to adult wingspan of about 250 mm.

No pregnant females were reported from New Mexico by Findley et al. (1975), but lactating females were taken on 27 and 28 July; young-of-the-year, presumably volant, also were reported from 24, 27, 30, and 31 July. *M. evotis* is active in the Mogollon Mountains of New Mexico from May into September (Jones, 1965).

Four males taken in mid-July in southeastern Montana had testes that measured 3, 3, 4, and 5 mm in length; three of four July-taken females were lactating (Lampe et al., 1974). Two females from the same area (Jones et al., 1973), taken on 1 and 3 July, carried one fetus each (crown-rump lengths 15 and 25 mm, respectively). A male captured on 30 June and four males taken between 1 and 9 July had a mean testicular length of 4.5 mm (range, 3 to 6); whereas seven males collected in the last half of July had testes averaging 4.2 mm (range, 3 to 5) in length (Jones et al., 1973).

In northwestern South Dakota, females collected on 29 May and on 17 and 19 June carried single fetuses, measuring 3, 14, and 15 mm in crown-rump length, respectively. Male young-of-the-year were about adult size on 6 August. May-taken males had testes measuring between 2 and 4 mm, whereas males collected on 17 July and 3 August had testes 6.0 and 7.5 mm in length, respectively (Andersen and Jones, 1971; Jones and Genoways, 1967). Two males from southwestern North Dakota, taken on 26 June, had testes measuring 5 mm (Genoways and Jones, 1972).

ECOLOGY. *Myotis evotis* occurs in a wide variety of habitats over its range in North America, mostly forested areas. In British Columbia, for example, the species occurs from dry forest to sub-alpine forest, especially where broken rock outcroppings prevail (Cowan and Guiguet, 1960). Where suitable roosting sites are available, however, this species also is found in semiarid shrublands, sage, chaparral, and even agricultural areas (Armstrong, 1972; Bailey, 1936; Larrison and Johnson, 1981; Rust, 1946; Vaughan, 1954). Elsewhere, *M. evotis* has been taken in areas with juniper (*Juniperus*) and a few pine (*Pinus*) at lower elevations up to pine and spruce-fir (*Picea-Abies*) forests (Bailey, 1932; Clark and Stromberg, 1987; Davis, 1939; Hoffmeister, 1986; Jones, 1965; Larrison and Johnson, 1981; Maser et al., 1981). Hoffmann and Pattie (1968:15) considered this long-eared bat as "a widespread but relatively uncommon species in Montana, usually found singly or in small groups. Perhaps it is more common in coniferous forests in western Montana than elsewhere."

In Oregon, specimens were collected along the edge of forests or over open meadows near tall timber, and along a creek fringed with willow (*Salix*) with cliffs about 1 km distant (Bailey, 1936). In Nevada, too, individuals were shot at dusk or later in the evening over mountain streams fringed with deciduous trees (Hall, 1946). In the pine-clad (*Pinus ponderosa*) hills of the three-corners region of Montana, North Dakota, and South Dakota, individuals of *M. evotis* were shot or netted as they foraged among deciduous trees along water courses or over man-made reservoirs in short-grass prairie near hills and ridges that supported pine (Andersen and Jones, 1971; Genoways and Jones, 1972; Jones et al., 1973; Lampe et al., 1974). Bats were collected over a brush-lined ravine in southeastern Montana in company with *Myotis ciliolabrum*, *M. lucifugus*, *M. volans*, *Lasiorycteris noctivagans*, *Eptesicus fuscus*, and *Lasiurus cinereus* (Jones et al., 1973).

Females form small maternity colonies in summer, whereas males and perhaps some barren females live singly or in small groups, occasionally occupying the same site as a maternity colony but roosting apart from it. Groups of 12 to 30 individuals have been found in British Columbia (Cowan and Guiguet, 1960). Miller and Allen (1928) reported a group of adults and young, probably a

maternity colony, occupying a deserted ranch house in Colorado. Day-time roost sites frequently are in buildings, often deserted, but these bats also have been found roosting in hollow trees, behind loose slabs of bark, among timbers of an unused railroad trestle, in caves and mines, in fissures of cliffs, and in sink holes (Armstrong, 1972, 1982; Cary, 1911; Cowan and Guiguet, 1960; Genoways and Jones, 1972; Grinnell et al., 1930; Jones et al., 1973; Maser et al., 1981). A specimen from Canyonlands National Park, Utah, was taken in a portable latrine, which evidently served as a day roost (Armstrong, 1982). Caves are known resting sites at night in the warm months; Albright (1959) recorded individuals as entering a cave at Oregon Caves National Monument between 10 p.m. and 2 a.m. in August. These bats probably migrate short distances between summer haunts and winter retreats, although the winter range of *M. evotis* is unreported. Nothing is known about hibernacula (Maser et al., 1981), but this species probably seeks winter retreats primarily in caves and abandoned mines.

Ectoparasites of *M. evotis* include a chigger, *Leptotrombidium myotis*, found on the ears (Andersen and Jones, 1971), and two mites, *Macronyssus crosbyi* (Macronyssidae) and *Spinturnix americanus* (Spinturnicidae; Whitaker and Wilson, 1974). We know of no endoparasites reported from this species.

Warner (1985) reported insects of the following orders were eaten by *M. evotis* in a montane grassland area, elevation 840 m, in northern Arizona: Lepidoptera, Coleoptera, Diptera, Neuroptera, Hymenoptera, Hemiptera, and Homoptera. He concluded that temporal opportunism appears to be the rule in insectivorous bats as predicted by Fenton and Morris (1976).

Whitaker et al. (1977:50) reported 11 types of food of *M. evotis*, but noted that the "major food was Lepidoptera." Jones et al. (1973:3) recorded the following items from stomachs of three individuals taken in southeastern Montana: "One contained a cicadellid, a chironomid, a small moth (Lepidoptera), and a scarab beetle; another a small moth and a dragon fly (*Agriion* sp.); and the third a small moth, scarab beetle, and a large, black bristly muscoid fly, probably family Calliphoridae (Diptera)."

In areas where *M. evotis* and *M. auriculatus* are sympatric, some evidence indicates that the two species have slightly different diets (Black, 1974; Findley, 1987). *M. evotis* eats beetles whereas *M. auriculatus* eats moths. In areas of allopatry, *M. evotis* and *M. auriculatus* exhibit sexual differences in foods eaten, indicating intraspecific niche partitioning or behavioral character displacement (Husar, 1976). In both species, males eat significantly more moths than do females. Ingles (1949) mentioned culicid species and other aquatic insects as food items of *M. evotis*.

The yellow-bellied racer (*Coluber constrictor mormon*) has been reported as a predator of these bats in British Columbia (McIntosh and Gregory, 1976). *M. evotis* also is known to carry rabies (Maser et al., 1981). Record longevity for this species is 22 years for a male (Tuttle and Stevenson, 1982).

BEHAVIOR. Dalquest (1948:152) considered *M. evotis* to be a relatively late forager—often after midnight; one hit by a car near Baker Lake, Washington, was "hovering in the road like a large moth" others "flew slowly in rather straight courses, 20 to 25 feet from the ground." Armstrong (1975:36) also reported that this bat "emerges late in the evening to feed." Hoffmeister (1986), however, reported two specimens taken at 7:50 p.m. on 9 August in Arizona in company with *Pipistrellus hesperus*, and Vaughan (1954) reported foraging time as beginning about 0.5 h after sunset and continuing for a little more than 2 h. Whitaker et al. (1977) noted that in August in Oregon these bats emerged to forage 10 to 40 min after full darkness.

Myotis evotis demonstrated a preference for activity at relatively low temperatures in the Mogollon Mountains of southwestern New Mexico and adjacent Arizona. Peak nettings of this species occurred when air temperature averaged 12°C (range, 6 to 12°C). Bats were captured later in the evening on the average (mean activity period about 2 h after sunset) than some other species of *Myotis* (Jones, 1965).

Ingles (1949) noted *M. evotis* foraging in red fir-lodgepole pine (*Abies-Pinus*) forest (Canadian life zone, California, elevation 2,400 m) in early September flew in a nearly straight course and caught insects about 12 m above the ground; as the air cooled, however, bats hunted nearer the ground. He thought the best hunting time for this bat was the hour following dusk, just before rapidly cooling temperatures stilled insects in the upper strata of the forest.

Dalquest (1947:23) reported "a dormant female *Myotis evotis* with a new-born young . . . near the end of a 75-foot long [mine] tunnel" in California on 24 June.

Davis (1939:114) found dozens of these bats in company with *Plecotus townsendii* on 9 and 10 July at Crater of the Moon National Monument, Idaho, in an "old lava tube about 100 yards long and 30 feet in diameter with a large vent near one end." He reported that bats emerged just before dark from dry crevices and fluttered in and out of the cavern; melting ice in cracks and crevices continuously dripped, supplying the only water within a radius of several km.

GENETICS. Karyotypically, *M. evotis* has a diploid number of 44 chromosomes and a fundamental number of 52. The Y chromosome is large as in other bats of the New World long-eared *Myotis* group, except *M. septentrionalis* (Bickham, 1979). Genically, *M. evotis* most closely resembles *M. milleri*; morphologically it closely resembles *M. auricolus*, a condition that may indicate shared primitive characters and ecological similarity (Reduker et al., 1983).

REMARKS. The generic name *Myotis* means "mouse-eared." The specific name *evotis* is derived from the Greek *ev*, meaning "good," and the Greek *otus*, meaning "ear."

Variation in *Myotis evotis* has not been studied since Miller and Allen's (1928) revision of the genus. A thorough morphometric analysis of the species throughout its known range is overdue.

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