

Fringed myotis, *Myotis thysanodes*
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Description: *Myotis thysanodes* is one of the larger *Myotis* species, with a forearm length of 40-47 mm, and an adult weight of 5.3-7.6 g. It can be distinguished from all other California bat species by a well-developed fringe of hair on the posterior edge of the tail membrane. It has relatively large ears, and can most readily be confused with the long-eared myotis, *Myotis evotis*. *M. evotis* is smaller (forearm = 36-41 mm), with longer ears (22-25 mm in *M. evotis* vs. 16-20 mm in *M. thysanodes*). Although *M. evotis* sometimes has a scant fringe of hairs on its tail membrane, it is never as distinct as that in *M. thysanodes*. *M. thysanodes* varies in color from yellowish brown to a cinnamon brown, with more northern populations tending to have darker coloration.

Taxonomic Remarks: *M. thysanodes* is in the Family Vespertilionidae. The type locality for *M. thysanodes* is Old Fort Tejon (at Tejon Pass) in the Tehachapi Mountains, Kern County, California (Miller 1897). Four subspecies are recognized (Hall 1981, Manning and Jones 1988), *M. t. aztecus*, *M. t. thysanodes*, *M. t. pahasapensis*, and *M. t. vespertinus*. Most *M. thysanodes* in California are referable to *M. t. thysanodes*; populations in the northwestern part of the state (Humboldt, Siskiyou and Shasta counties) have recently been placed in the new subspecies, *M. t. vespertinus* (Manning and Jones 1988), although relatively few specimens have been examined and the boundary between subspecies has not been clearly delineated. Recent investigation of evolutionary affinities among long-eared *Myotis* of the southwestern U.S. (Reduker et al. 1983) suggest they form a monophyletic clade, and that *M. thysanodes* shared a common ancestor with *M. evotis*, after the divergence of *Myotis auriculus* (a species not currently known from California).

Distribution: *M. thysanodes* is widely distributed across the western third of the United States, is found in most of Mexico, and reaches into southern British Columbia. Three subspecies have very limited distributions, *M. t. pahasapensis* in western South Dakota, western Nebraska and eastern Wyoming, *M. t. aztecus* in southern Mexico (Hall 1981), and *M. t. vespertinus* in southwestern Washington, western Oregon, and northwestern California (Manning and Jones 1988). *M. t. thysanodes*, the primary subspecies found in California, ranges from 51°54' N. lat. in southern British Columbia (Rasheed et al. 1995) to Michoacán in southern Mexico (Hall 1981).

In California, the species is found the length of the state, from the coast (including Santa Cruz Island) to >1,800 m in the Sierra Nevada. Records exist for the high desert and east of the Sierra Nevada (e.g., lactating females were captured in 1997 by P. Brown near Coleville on the eastern slope of the Sierra Nevada). However, the majority of known localities are on the west side of the Sierra Nevada.

Life History: *M. thysanodes* is a colonial species. Although Barbour and Davis (1969) state that nursery colonies of several hundred are not uncommon, and the colony studied by O'Farrell and Studier (1975) contained 1,000-2,000 individuals, colonies observed in California in recent years more typically contain 10-20 adults (E. Pierson and W. Rainey unpubl. data), although one colony of > 200 was known from the San Bernardino Mountains (P. Brown pers. comm.).

The reproductive cycle in *M. thysanodes* has been most thoroughly investigated at a colony in northeastern New Mexico by O'Farrell and Studier (1973). Like other North American vespertilionids, *M. thysanodes* appears to mate in the fall after the maternity colony has disbanded. Ovulation, fertilization and implantation occur in the spring and are followed by a pregnancy of 50-60 days. Females give birth to a single young per year. In the New Mexico colony, parturition occurred between 25 June and 7 July. Available evidence suggests that births take place much earlier

in California. In Napa County, females in late stage pregnancy have been observed in early May, and young 10-14 days old by the third week in May (Pierson and Rainey unpubl. data). Farther north, in Shasta County, females in late pregnancy or with newly born young were observed in late May and early June for three consecutive years from 1992-1994 (Rainey and Pierson unpubl. data).

Prenatal and postnatal growth has been described by O'Farrell and Studier (1973). Young are born unfurred, with their eyes open, at about 22% adult weight. They are capable of limited flight by 16.5 days of age, and full flight at 20.5 days.

Only limited information is available on diet in *M. thysanodes*. In a study conducted in New Mexico, Black (1974) concluded the species appeared to be a beetle strategist. In western Oregon (Whitaker et al. 1977), the dominant prey item in the diet of three out of four animals examined was lepidopterans (moths). The diet also included phalangids (harvestmen), gryllids (crickets), tipulids (crane flies), and araneids (spiders). The feces of one individual captured on the upper Sacramento River in California contained predominantly coleopterans (beetles) and hemipterans (bugs) (Rainey and Pierson 1996). Relatively heavy tooth wear on animals examined in a five year study on the Sacramento River would suggest that in this area the species feeds primarily on heavy bodied insects, such as coleopterans and hemipterans. The presence of non-flying taxa in the diet of the Oregon animals suggests a foraging style which relies at least partially on gleaning.

Winter behavior is even more poorly understood than summer behavior. Scattered winter records suggest, however, that the species is not migratory, and like many species in the more temperate parts of California, may be intermittently active throughout the winter. The species has been found hibernating in buildings and mine tunnels along the coast in the San Francisco Bay area and in the coast range north of San Francisco.

Habitat: *M. thysanodes* occurs in a wide range of habitats, from desert scrub to high elevation conifer forest (O'Farrell and Studier 1980). Barbour and Davis (1969) found it to be one of the more common species in oak forest at 1,500-1,800 m elevation in the Chiricahua Mountains. In a study in the Mogollon Mountains of New Mexico and Arizona, Jones (1965) found *M. thysanodes* occurred almost exclusively in evergreen forest (>2,000 m elevation), and was the fourth most common species in this habitat. In a long-term study in western New Mexico (Jones and Suttkus 1972), *M. thysanodes* was found predominantly at the highest elevation sampled (2,600 m), and was the ninth most common bat species in this habitat.

A paucity of records makes it difficult to assess habitat preferences for this species in California. The earliest records for the state (Grinnell 1933) are all between 360 and 900 m elevation. Orr (1956) in reviewing specimens held at the California Academy of Sciences, notes two localities from the coastal region (Carmel in Monterey County and Woodside in San Mateo County). P. Brown (pers. comm.) reports finding a colony in 1991 at Big Bear in the San Bernardino Mountains. More recently, records have accumulated from the upper Sacramento River (Rainey and Pierson 1996), and the Sierra Nevada (Pierson and Rainey unpubl. data). Although nowhere common, the species occurs as one of the rarer taxa in netting records from the central coast to at least 1,950 m in the Sierra Nevada. It has been found in mixed deciduous/coniferous forest and in both redwood and giant sequoia habitat (Pierson and Rainey unpubl. data).

Most known roosts for *M. thysanodes* are in caves, buildings, or mines (O'Farrell and Studier 1980). Although outside of California maternity colonies have been found in caves (e.g. Baker 1962, Easterla 1966, Judd 1967), the only cave in California for which there are multiple records is Clough Cave in Sequoia National Park. The majority of roost sites documented in California have been

found in buildings (e.g., Orr 1956), including the type locality at Old Fort Tejon (Miller 1897). Although mines are mentioned as roost sites by several authors (Cahalane 1939, Cockrum and Musgrove 1964, Barbour and Davis 1969), there are no published records of maternity roosts in mines. Since 1987, we have located two small maternity roosts in mines (ca. 10 adult females each) in the coast range north of San Francisco. P. Brown (pers. comm.) in 1992 also located a maternity colony of ca. 50 in a mine in the southern Sierra foothills, and in 1991 captured lactating females entering a mine in the Castle Mountains, in the eastern Mojave Desert. Five roosts in the Laguna Mountains, San Diego County, located by radiotelemetry in the summer of 1996, were in rock crevices on cliff faces (Miner et al. 1996). Research within the past few years in Oregon and Arizona has also documented that *M. thysanodes* roosts in tree hollows, particularly in large conifer snags (Cross and Clayton 1995, Chung-MacCoubrey 1996). In California, a small colony was also located in a hollow redwood tree in the Carmel Valley (Pierson and Rainey unpubl. obs.). Tree-roosting behavior is consistent with an observed association between *M. thysanodes* and heavily forested environments in the northern part of its range (M. Brigham pers. comm., Cross et al. 1976, E. Pierson and W. Rainey pers. obs.).

One issue needing further investigation for this species is its preferred roost temperature. Work by Studier and O'Farrell (1972) on a colony in New Mexico suggested that *M. thysanodes* could fly at lower ambient temperature than many species, and sought cooler roosting conditions than did *M. lucifugus* with which it shared an attic roost. The two mine roosts which were identified recently in California were both relatively cool and damp (one mine had standing water). In contrast, a mine used as a nursery roost in the southern Sierra Nevada is dry and moderately warm (P. Brown pers. comm.).

Barbour and Davis (1969) noted that this species was readily captured at the entrances to night roosts in buildings, mines and caves. In a five year study on the upper Sacramento River, we observed that *M. thysanodes*, though one of the least commonly encountered bats, was more readily detected at bridge night roosts than in netting surveys conducted over water (Pierson et al. 1996).

Status: Class II. The status of this species has not been systematically investigated. Museum records suggest that while *M. thysanodes* is widely distributed in California, it is everywhere rare. Our personal experience is that although this species occurs in netting and night roost surveys in a number of localities, it is always one of the rarest taxa (Pierson et al. 1996).

Available museum records offer documentation for only six maternity sites: two in Kern County (including the type locality at Old Fort Tejon), and one each in Marin, Napa, Tuolumne, and Tulare counties. Investigation of four of these sites since 1990 has shown that while the roosts are still available this species is no longer present at any of these sites.

The limited data available suggest serious population declines. Maternity colonies identified between 1891 (Old Fort Tejon) and the early 1970s (Point Reyes National Seashore, Marin County) were likely considerably larger than any colonies known today. Forty-two animals were collected at the Fort Tejon site (five different collections between 1891 and 1945), 58 at Point Reyes National Seashore between 1973 and 1974, 40 in one year from a site in Napa County, 20 from a Tuolumne County site, and 14 from a Kern County site. Although, in the context of surveys not targeting this species, we have identified six new maternity sites in northern California, none of these contains more than 10-30 females. One site in Napa County was described by Dalquest (1947) as having about 50 animals in July 1945. Forty animals were collected at that time. In June 1987 the site contained 10-15 animals, and in August 1988, none. The grounds around this building had been considerably modified in 1988 for a new winery installation, and the building which housed the bats

was experiencing more human activity and scheduled for renovation. P. Brown (pers. comm.) observed two somewhat larger colonies (40-50 animals) in southern California, although one was in a house from which it has since been excluded. This species appears to be extremely sensitive to disturbance at roost sites and to human handling. While some species of *Myotis*, like *Myotis yumanensis*, seem tolerant of human incursions into their roosting space, *M. thysanodes* is not.

A cave in Sequoia National Park was documented in 1951 as being a *M. thysanodes* maternity site. Sixteen animals were collected at that time. Additionally, this cave has experienced very heavy recreational use for many years. Repeated attempts by the Park Service to gate the cave have been thwarted by vandalism. Although *M. thysanodes* has been mist-netted in the vicinity of this cave, it has not apparently been observed roosting there recently.

A comparison of historic and current records indicates limited recolonization at sites from which it has been extirpated. What may have been the largest documented colony in California occupied a barn at Point Reyes National Seashore. Fifty-eight animals were collected from this site in 1973 and 1974. Monitoring of this site since 1979 showed annual reoccupation by a *Myotis yumanensis* maternity colony, but *M. thysanodes* was not detected until 1996. The site has been protected by the Park Service for at least ten years, with no known human incursions into the roosting space. This suggests that the distribution of *M. thysanodes* is patchy and its dispersal capabilities limited.

Closure of old mines for hazard abatement and renewed mining in historic districts both pose considerable risks to this and other cavern dwelling bat species (Belwood and Waugh 1991, Brown and Berry 1991, Altenbach and Pierson 1995, Riddle 1995). One of the two *M. thysanodes* mine nursery sites we (E. Pierson and W. Rainey) have found since 1987 was destroyed by renewed mining. The colony persists by default, now occupying the lower level of a mine gated as a mitigation site for *Corynorhinus townsendii* (Pierson et al. 1991).

Restoration of historic buildings may also pose a threat to this species. One historic roost site (Old Fort Tejon) and two current roost sites are located in historic buildings owned by the California Department of Parks and Recreation. Another is located in a utility building on a State wildlife refuge. The tendency for bats to occupy historic buildings creates potential conflicts between the goals of historic preservation, access for public education, and wildlife protection. Although these conflicts are generally resolvable, and bat populations can almost always be accommodated in buildings without damaging historic values, this is frequently not appreciated.

In some forested settings, *M. thysanodes* appears to rely heavily on tree cavities as roost sites, and may be threatened by current timber harvest practices. For example, Chung-MacCoubrey (1996) in Arizona found that this species prefers large diameter (45-65 cm DBH) conifer snags, the size tree which is preferentially harvested under "shelterwood removal" regimes.

Although the species is protected from over-collection under current Department permitting practices, there is no doubt that scientific collection contributed to or accounted for the extirpation of the colony at Point Reyes National Seashore, and possibly the colony at Old Fort Tejon. While these museum records are invaluable in providing the only historic data we have, historic collecting practices appear to have harmed some populations.

Management Recommendations: Distributional surveys are needed, particularly in the Sierra Nevada and Coast Range. These mountain ranges offer the opportunity to evaluate distribution in relationship to latitude, altitude, and habitat type. It is particularly important to investigate the association between this species and late successional forest. This can be accomplished partly by

netting and night roost (e.g., mine, building, and bridge) surveys. Identification of tree roosts would, however, require radiotracking. Given the apparent sensitivity of this species to disturbance, radiotracking studies should be undertaken with the greatest caution. Until the tolerance of the species for radiotracking can be evaluated, studies should be limited to males and post-lactating females. Also, studies should be conducted in a setting which offers the opportunity to recapture the animals to assess transmitter impacts and remove the transmitter package. To minimize disturbance of day roosting sites, and maximize chances of recapture, animals selected for radiotracking should be captured only at night roosting sites.

Although extensive mine surveys have been conducted by P. Brown and others in the desert regions of southern California in the past 20 years, only limited surveys have been conducted in the Sierra Nevada foothills and other areas of central and northern California. Since mine use by bats appears to vary regionally, more extensive mine surveys need to be conducted in northern and eastern California.

Two of the currently known roost sites occupy historic buildings in state parks. Park personnel in these two parks have been very responsive to protecting the bats, and have been able to accommodate them within the historic structures. Although there is no inherent conflict between wildlife protection and historic preservation, local management is not consistently supportive of wildlife protection goals. Thus, policies need to be changed within appropriate agencies at both the Federal and State level to recognize the potential importance of anthropogenic features to bats and other wildlife.

The extent to which *M. thysanodes* uses caves is not well documented in California. Since it is known to use caves quite extensively elsewhere in its range, and has been considered a cave-dwelling bat (Barbour and Davis 1969), it should be considered along with other bat species in cave management plans. The reluctance of land management agencies to manage caves for wildlife rather than for human recreation poses one of the most significant threats to bat populations in California. Revised management practices which restrict human access to bat caves would make a significant difference for a number of bat species, likely including *M. thysanodes*.

FRINGED MYOTIS

Myotis thysanodes



Locations verified by authors
(captures, observations, museum records)

- Post - 1978
- 1978 and before

No CNDDDB Data