Nyctinomops femorosaccus.

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Nyctinomops Miller, 1902

Nyctinomops Miller, 1902:393. Type species Nyctinomus femorosaccus Merriam, 1889, by original designation.

CONTEXT AND CONTENT. Order Chiroptera, Suborder Microchiroptera, Family Molossidae. The genus Nyctinomops, restricted to the warmer parts of the New World, contains four species, a key to which follows:

1. Greatest length of skull >22.0 mm; length of maxillary toothrow usually >8.5 mm; length of forearm >54 mm (usually 58-64) N. macrotis
   Greatest length of skull <22.0 mm; length of maxillary toothrow usually <8.5 mm; length of forearm <54 mm

2. Length of maxillary toothrow ≥7.9 mm; greatest length of skull usually ≥20.0 mm; length of forearm ≥47 mm (usually 48-53) N. aurispinus
   Length of maxillary toothrow ≤7.5 mm; greatest length of skull usually <20.0 mm; length of forearm ≤49 mm

3. Length of forearm usually 45–49 mm; length of maxillary toothrow >7.0 mm; length of ear, 22–24 mm; occurring in southwestern United States and adjacent Mexico southward to Guerrero N. femorosaccus
   Length of forearm usually 41–45 mm; length of maxillary toothrow <7.0 mm; length of ear 19–21 mm; occurring from Tamaulipas and Jalisco, Mexico, southeastward into South America N. latcaudatus

DIAGNOSIS. Free-tailed bats with large, rugose ears that are joined anteriorly, at their bases, over the nose; second phalanx of fourth digit noticeably shortened; rostrum narrow and more or less tubelike (Fig. 1). The palatal emargination is relatively narrow; premaxillae separated anteriorly by a narrow space; mandible thin and delicate; sagittal crest poorly to moderately developed; coronoid processes low; basioccipital pits deep. There are two pair of lower incisors; upper incisors more or less parallel; P3 relatively large; M3 with complete posterior commissure (Freeman, 1981; Miller, 1902). In the characters assessed by Freeman (1991:107), Nyctinomops . . . averages closer to the Old World Tedarida than to any other genus.

Nyctinomops femorosaccus
(Merriam, 1889)

Pocketed Free-tailed Bat


Nyctinomops femorosaccus: Miller, 1902:393. First use of current name combination.

CONTEXT AND CONTENT. Context as given above for the genus Nyctinomops. N. femorosaccus is a monotypic species.

DIAGNOSIS. Nyctinomops femorosaccus (Fig. 2) is a small to medium-sized member of the genus, somewhat larger than N. latcaudatus, but smaller than N. aurispinus and especially N. macrotis; the four species form a graduated size series beginning with N. latcaudatus (Freeman, 1981). Ears reaching beyond tip of nose when laid forward and joined basally at midline on head; rostrum elongate and slender; wing tip narrow (as in other species of the genus). Length of forearm usually from 45 to 49 mm; membranous sac, frequently difficult to locate, situated “from inner third of femur to middle of tibia, forming a deep pocket between it and the intermembranous membrane” (Merriam, 1889:23), present to varying degrees in other Nyctinomops as well; basioccipital drumstick-shaped in dorsal aspect (Brown, 1967); crown of M1 nearly square as opposed to broader posteriorly than anteriorly (Hall, 1981; Hoffmeister, 1986).

Compared to the closely related and mostly allopatric N. latcaudatus, aside from being larger, N. femorosaccus differs in

![Fig. 1. Skulls of four species of Nyctinomops showing size relationships (bottom to top): N. macrotis (greatest length, 23.6 mm), N. aurispinus, N. femorosaccus, N. latcaudatus. Photographs by N. L. Olson.](image-url)
having a shorter thumb, fewer and finer hairs on the membranes, especially the uropatagium, thicker, more rugose ears, and also in cranial and dental details (Benson, 1940). From the larger N. aura-
sinus, with which it is partly sympatric, N. femorosaccus also
differs in having a noticeably less inflated braincase, posterior margin
of palate terminating posterior to M3, posteroendontal cingula of m1
and m2 quadrangular in shape, and in having decidedly smaller
teeth (Gardner, 1963; Jones et al., 1972).

GENERAL CHARACTERS. Dorsum brownish to grayish
brown (occasionally reddish, possibly the result of bleaching prior to
annual molt), basal half of hairs whitish, ventral slightly paler, some-
times with buffy wash. Anterior border of ear with bony excrences;
second phalanx of fourth finger usually <5 mm. Skull (Fig. 3)
elongate in appearance; rostrum not much broader anteriorly than
at point of least interorbital constriction; sagittal crest moderately
well developed; bony palate terminating slightly posterior to third
upper molar; upper incisors simple, well developed, parallel in frontal
view, separated by evident gap from canines; lower incisors bifid,
forming complete arcade between canines; canines well developed
and with distinct cingula. Dental formula, as in related species, is i
1/2, c 1/1, p 2/2, m 3/3, total 30 (Barbour and Davis, 1969;
Hall, 1981; Hoffmeister, 1986; Miller, 1907).

Ranges in external measurements (in mm) of 11 males, followed
by measurements of one female, from Santa (Jones et al., 1972)
are: total length, 100–110; 108; length of tail, 34–44, 41; length
of hind foot, 10–12, 11; length of ear, 22–24, 23; length of forearm,
45.5–47.8, 48.7; weight (in g), 11.3–18.0, 14.5. Ranges in cranial
dimensions of nine males, followed by those of a female, from the
same source are: greatest length of skull, 19.3–19.8, 19.2; ry-
gomatic breadth, 10.4–10.9, 10.3; postorbital constriction, 3.4–3.7,
3.4; breadth of braincase, 8.8–9.3, 8.8; mastoid breadth, 10.1–
10.5, 10.3; length of maxillary toothrow, 7.3–7.5, 7.3. Females
average slightly smaller than males, at least cranially.

DISTRIBUTION. The pocketed free-tailed bat occurs in
western North America (Fig. 4), from southern California, central
Arizona, southern New Mexico, and western Texas southwest to
central Nuevo Leon and hence to Jalisco, Michoacan, and Guerrero
in western Mexico; the distribution also includes Baja California
(Hall, 1981; Jones et al., 1988). The distribution of N. femorosaccus
is sympatric in part with that of N. aurispinosus and N. macrotis,
but evidently is mostly allopatric with respect to the range of
the closely related N. latiscudatus, which occurs as far north in western
Mexico as Jalisco. The altitudinal distribution of N. femorosaccus is
from sea level to about 2,250 m based on known localities of
occurrence.

No fossils of this bat are known. N. constantinii, an extinct
Pliocene species from New Cave, Carlsbad Caverns National Park,
New Mexico, is larger and has a flatter skull and broader rostrum
than N. femorosaccus (Kurtén and Anderson, 1980).

FORM AND FUNCTION. Krutzsch (1944b), based on
observations of a colony of 50 to 60 N. femorosaccus, described
the flight of these bats as they left their daytime roost as having a
rapid and complete wing beat, unlike the fluttering of Myotis and
Plecotus. When flight-tested along with other bats in a simulated
tunnel (Hayward and Davis, 1964), pocketed free-tailed bats oriented
poorly, crashing into ceiling and walls within 15 m of the point of
release, whereas bats of other species oriented well and flew swiftly
in a straight line. The individuals N. femorosaccus evidently were not
echolocating at the time, hence the numerous accidents. The fact
that these pocketed free-tailed bats normally roost in rock crevices,
from which they drop and immediately gain elevation with no need
for echolocation to assist them in orientation, may explain why they
performed poorly in the experimental tunnel, which was found much
more suited to cave-dwelling bats.

While wire-trapping N. femorosaccus over a pool of water,
Benson (1940:28) observed that bats that hit the wire and fell into
the water started swimming rapidly toward shore, producing a "quick
pattering or splashing sound." Swiming was accompanied with a
distinct bobbing motion, high in the water, using quick simultaneous
strokes of the partly extended wings.

Functional capabilities of the jaws of Nyctinomops probably
are much the same as those of Chaerephon and Otomops (Freeman,
1981), because their jaws are similarly structured. Nyctinomops
probably consumes mostly soft-bodied prey. "In the New World
species, brasiliensis, femorosaccus, and macrotis ... a large per-
centage of [the] diet consists of moths" (Freeman, 1981:69).
ONTogeny and Reproduction. Female mollusks characteristically give birth to one young annually (Cockrum, 1955). Insemination evidently occurs just before ovulation in spring. The offspring is born in late June or July and lactation may continue until September (Jameson and Peters, 1988). All available information on *N. femorosaccus* corroborates the above reproductive data (Benson, 1940; Cockrum and Musgrove, 1965; Easterla, 1968, 1973a, 1973b; Hoffmeister, 1986; Jones et al., 1972). Testes of males measured from 2 by 1 to 2 by 1.5 mm from mid-July to early August in Big Bend National Park (Easterla, 1973a); lactating females were taken between 7 July and 8 August and flying young-of-the-year were captured as early as 7 August. A pregnant female from Arizona carried "a nearly full-term (30 mm) fetus on 15 July (Hoffmeister, 1986:119), and one from New Mexico had a fetus 24 mm in crown-rump length on 4 July (Easterla, 1973b)."

**ECOLOGY AND BEHAVIOR.** *Nyctinomops femorosarcus* is colonial and roosts primarily in crevices in rugged cliffs, slopes, and high rocky outcrops (Barbour and Davis, 1969; Cockrum, 1956; Easterla, 1973a; Kutsch, 1944, 1945; Neil, 1940); individuals normally leave their roosts well after dark (Benson, 1940; Gould, 1959; From June through December, free of emergence of bats leaving a colony in a building in Arizona was never before solar radiation reached zero, and the average emergence time was 45 min after the zero point (Gould, 1961). These free-tailed bats were found sharing the recesses of a vertical crevice in a large granite boulder with *Eumops perotis* in San Diego County, California (Kutsch, 1945). *N. femorosaccus* was captured at the narrow upper end of the crevice, whereas *E. perotis* occupied the lower, wider end; there was a distinct separation between the two coexisting species, which Kutsch considered indicative of an antagonistic relationship. Pocketed free-tailed bats also may roost in crevices in shallow caves (Jones et al., 1972; Loumis and Webb, 1969), in buildings, and under roofing tiles (Barbour and Davis, 1969; Hoffman, 1986; Jones et al., 1972).

Cockrum (1956) attributed the relative rarity of *N. femorosaccus* in museum collections to the tendency of bat collectors to visit accessible daytime roosts and also to collect bats by shooting at twilight when most leave their roosts (not well after dark). Cockrum and Musgrove (1965) collected 11 specimens of *N. femorosaccus* in mist nets between midnight and 0445 h in 2 nights in Mohave County, Arizona; *Macrotus californicus*, M. rufomannisia, *Pipistrellus hesperus*, *Eptesicus fuscus*, *Antrozous pallidus*, *Tadarida brasiliensis*, and *Eumops perotis* were taken at the same place.

Baker and Christiano (1966:310–311) netted *N. femorosaccus* on 11 November on a dry water hole in the Rio Alamos, Sonora, at a place "surrounded by mixed tropical deciduous and thorn forest." Pocked free-tailed bats were captured almost continuously (0.5–5 h intervals) from 1000 to 2230 h, but most were taken later than *T. brasiliensis* and other species of bats netted there.

Easterla (1968) netted *N. femorosaccus* in the Big Bend of Texas over a dirt water tank in a low, dry, hot valley near rolling hills with small rocky ledges, about 1,000 m elevation, among Chihuahuan Desert dominants such as creosote bush (Larrea divaricata), sotol (Dasylirion lepidophyllum), candellaria (Euphorbia antisahuliana), and giant daisy yuca (Yucca canariensis). *Mormoops megalophylla*, *Myotis californicus*, M. velifer, P. hesperus, E. fuscus, A. pallidus, T. brasiliensis, and *N. macrotis* were also taken there. Across the Rio Grande, in adjacent Coahuila, Easterla (1970) captured *N. femorosaccus* in Chihuahuan Desert habitat at a place bordering on one side by a limestone cliff, from 0500 to 0900 h, with high cliffs of the Sierra de del Caminos about 6 km distant. Cockrum and Musgrove (1965) netted these mollusks in a floodplain in Arizona that was heavily vegetated with sycamore (Platanus) and mesquite (Prosopis), and in an area bounded by large cliffs and mountains that rose some 1,000 m above the valley. Of five major plant associations in which bats were netted in Big Bend National Park (Easterla, 1973a), this free-tailed species was taken in two, desert shrub and river floodplain arroyo. In January, Findley and Jones (1965) netted pocketed free-tailed bats over pools in the bed of the Rio Yaqui, in central Sonora, along with *M. californicus*, *Glossophaga soricina*, *Myotis occultus* (= *Lucifugus*), P. hesperus, Lasiurus borealis (= *blossumii*), and *T. brasiliensis*.

A nonpregnant female of this free-tailed species was shot in February in Jalisco as it foraged with other bats in pine–oak (Pinus–Quercus) forest at an elevation of about 2,100 m (Watkins et al., 1972). Another female was trapped in a mist net in tropical deciduous forest along the Rio Juchipila in Zacatecas at about 1,130 m in company with *G. soricina* and *Chiroderma salenis* (Matson et al., 1978). A mummified individual was found hanging from the ceiling of a building in Zacatecas (Matson and Baker, 1986).

Pocketed free-tailed bats squeak or chatter much of the time in day roosts and also squeak when placed in holding bags after capture; they produce shrill, sharp, high-pitched chattering calls when first taking flight (Kutsch, 1944b). Benson (1940:28) observed these bats arriving at a watering pool about an hour after sunset, flying "swiftly about the pool, making distinctly audible whistling and fluttering sounds with their wings" and occasionally squeaking and chattering shrilly. They also drink while in rapid flight, hitting the surface of the water with a smacking sound (Benson, 1940). Those that hit a wiretrap over the pool were unable to take flight while swimming and were defenseless when handled while in water; however, on reaching solid ground, they were observed to turn and bite and to protest shrilly when seized.

According to Ross (1967), *N. femorosaccus* eats macrolepideropods (100% in one stomach), but also eats microlepideropods and coleopterans (85 and 15%, respectively, in another stomach). Easterla and Whitaker (1972) reported that large moths made up 36.9% of the volume in 69.2% of the stomachs in 13 *N. femorosaccus*. They also found that many other flying insects (Formicidae and other Hymenoptera, Hemiptera, Diptera, and Coleoptera) made up a lesser percentage of the volume and frequency, and that prey included such unlikely groups as Gryllidae, Tettigoniidae, Cercopidae, Cicadellidae (all terrestrial insects that may have been captured at roost sites). Eleven *N. femorosaccus* examined by Benson (1940), captured shortly after they had left their roosts, already had full stomachs. Only the bodies of large insects are eaten, but in the case of small prey species, such as flying ants and leafhoppers, the entire insect is consumed (Easterla, 1973a). This species evidently is nonmigratory, the distribution being limited by temperature (Easterla, 1973a).

Remains of *N. femorosaccus* were found in owl pellets collected in a cave in Sinaloa (Jones et al., 1972). A California lyme snake, *Trimorphodon vandenburghi*, which recently had fed on *N. femorosaccus*, was captured in a roost crevice used as a roosting site by pocketed free-tailed bats (Kutsch, 1944a). Easterla (1973a) banded 44 individuals at Big Bend National Park, Texas, but none was recaptured.

*Nyctinomops femorosaccus* is the type host of a wing mite (Loomis and Tanigoshi, 1968), *Trombicula spathii* (Acarina: *Trombiculidae*). The intraspecific *Oligomenus microlepideropodarius* (Acarina: *Trombiculidae*, found primarily in *Tadarida brasiliensis mexicana*, also has been recorded from one *N. femorosaccus* (Davis and Loomis, 1971). Loomis and Lipovsky (1954) noted that *N. femo-
rosaccus harbored large numbers of chiggers and opined that the prevalence of these external parasites possibly adversely affected the population of information chiggers in this species. Loomis and Webb (1969) reported Speloculus tadoridae, also a trombiculid, as an external parasite of Sinaloan N. femorosaccus. A macrorysis cecacidaceae, Chiroptorynus venezuelanus, is a common ectoparasite of the pocketed free-tailed bat according to Whitaker and Easterla (1975), who also reported one C. microhippathopus and a N. femorosaccus from the Big Bend of Texas. A cecacidaceae, Eumera tadoridae, has been described from a specimen of N. femorosaccus from Sonora, México (Duszynski et al., 1988).

GENETICS. The karyotype of N. femorosaccus has a diploid number of 48 and a fundamental number of 58. Autosomes were described (Warner et al., 1974) as consisting of one pair of large metacentrics, three pairs of medium-sized submetacentrics, one pair of medium-sized subtelocentrics, one pair of small subtelocentrics, and 17 pair of acrocentrics; one of the pair of medium-sized acrocentrics sometimes appears to be subtelocentric. The X chromosome is a medium-sized submetacentric; the Y is a medium-small submetacentric instead of a small acrocentric as in Tadarida brasiliana.

REMARKS. In a multivariate study of the bat family Molossidae, Freeman (1981) used the size-out distance matrix to generate a phenomenon showing a distinct cluster of the four New World species (N. aurispinus, N. femorosaccus, N. laticaudatus, and N. macrotis) forming the genus Nyctinomops, referred to by Shamel (1931) as the Tadarida macrotis group. Freeman (1981) recommended that Miller’s (1902) name Nyctinomops be accorded generic status for the four species because of the way they clustered in her analysis and we follow Freeman here. Miller (1907) and others used the generic name Nyctinomus É. Geoffrey St-Hilaire for these and some other free-tailed bats, and until Freeman’s (1981) study they were placed for many years in the genus Tadarida (as femorosaccus, aurispinus, laticaudatus), but in Nyctinomops the endings revert to masculine because, according to the International Code of Zoological Nomenclature (ICZN, 1985:59), “A genus-group name ending in -ops is to be treated as masculine, regardless of its derivation or of its treatment by its author.”

In some earlier literature, particularly that dealing with eastern México, N. femorosaccus was confused with N. laticaudatus, leading to the incorrect use of one name or the other in some instances. The generic name Nyctinomops literally means “resembling a night feeder.” The specific name alludes to the location of the characteristic interfemoral sac.

LITERATURE CITED


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