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Myotis nigricans.

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Myotis nigricans (Schinz, 1821)

Vespertilio nigricans Schinz, 1821:179. Type locality Fazenda do Agá, near Rio Iritibi, Espírito Santo, Brazil.
Myotis nigricans: Miller, 1897:74. First use of current name combination.
Vestpertilio parvulus Temminck, 1837:246. Type locality Brazil.
Vespertilio concinnus H. Allen, 1866:280. Type locality San Salvador, El Salvador.
Myotis chiriquensis J. A. Allen, 1904:77. Type locality Boqueron, Chiriquí, Panamá.
Myotis punensis J. A. Allen, 1914:383. Type locality Puna Island, Ecuador.
Myotis bondae J. A. Allen, 1914:384. Type locality Bonda, Santa Marta, Columbia.
Myotis maripensis J. A. Allen, 1914:385. Type locality Maripa, Venezuela.
Myotis esmeraldae J. A. Allen, 1914:385. Type locality Esmeraldas, Ecuador.
Myotis caucensis J. A. Allen, 1914:386. Type locality Río Frio, Cauca River, Colombia.

CONTEXT AND CONTENT. Order Chiroptera, Family Vespertilionidae, Subfamily Vespertilioninae. The genus *Myotis* includes approximately 80 species. Four subspecies of *M. nigricans* are recognized (LaVal, 1973). Some names in addition to those cited above have been listed in the synonymy of *Myotis nigricans* by some authors, but these names either belong with species separable from *M. nigricans* or their relationships are unclear at this time.

M. n. nigricans (Schinz, 1821:179), see above (*parvulus* Temminck, *concinnus* H. Allen, *chiriquensis* J. A. Allen, *bondae* J. A. Allen, *maripensis* J. A. Allen, *extremus* Miller and G. M. Allen, and *dalquesti* Hall and Alvarez are synonyms).
M. n. punensis J. A. Allen 1914:383, see above (*esmeraldae* J. A. Allen is a synonym).
M. n. caucensis J. A. Allen, 1914:386, see above.
M. n. carteri LaVal, 1973:13. Type locality 16 mi. NE Tamazula, Jalisco, México.

DIAGNOSIS. Forearm 2 to 5 mm longer than third metacarpal; tibia/forearm ratio between 0.38 and 0.42; fur on back somewhat silky, not woolly, usually between 4.0 and 4.5 mm in length; tips of dorsal hairs normally contrast slightly with bases; fur on dorsum of uropatagium does not extend distally as far as knees; supraoccipital region of braincase not raised above level of roof of braincase; small upper premolars in toothrow, rarely crowded; sagittal crest lacking (LaVal, 1973).

GENERAL CHARACTERS. General appearance much like that of other small New World species of the genus. Length of head and body 38 to 49 mm; tail 33 to 44; third metacarpal 29 to 36; greatest length of skull 12.8 to 15.0; weight 3.0 to 5.5 g; color both geographically and individually variable, bone brown to cinnamon above, and white to dark brown below; little if any sexual dimorphism in size or color; bacula variable in shape but usually diagnostic (figures 3A-3C in LaVal, 1973). More detailed descriptions may be found in Miller and Allen (1928) and LaVal (1973). Figure 1 shows general features of the skull, jaws, and dentition.

DISTRIBUTION. The known range of this species and its subspecies is shown in Figure 2. In general, the distribution corresponds to the entire Neotropical region, from the southern edge of the Mexican plateau to just below the Tropic of Capricorn. Occurrence of the species in the Amazon Basin and extreme eastern Brazil is questionable. Known elevational range is from sea level to 3150 m. The species occurs in virtually every tropical and subtropical forest association shown on the vegetation map (LaVal, 1973:fig. 2), as well as in areas of savanna and scrub. There is no fossil record.

FORM. Valdivieso and Tamsitt (1971) listed hematological data for *M. nigricans*. Wilson and Findley (1970) and Wilson (1971) discussed certain aspects of the reproductive system. Other systems have not been studied. External, cranial, and dental characteristics have been described by Wied (1826), Miller and Allen (1928), and LaVal (1973). General form of this species probably differs little from that of other species in the genus, notably *M. lucifugus*, which is well represented in the literature.

FUNCTION. Studier and Ewing (1971) reported on diurnal changes in weight and blood composition in *M. nigricans*. Body weight and percentage body water of naturally roosting *M. nigricans* does not change significantly during roosting hours, although erythrocytes increase significantly from 53.7 to 56.3 percent of blood volume. Relative spleen weight increases significantly during the middle of the roosting period, but then returns to nearly its original value by sunset. Relative kidney weight does not change significantly. Serum sodium levels increase significantly from 126 to 172 m-equiv./l.

Studier (1970) studied evaporative water loss in *M. nigricans*, and found no significant difference among males (46.6 mg/hr), females (54.5 mg/hr), and pregnant females (48.0 mg/hr).

Studies on thermoregulation in *M. nigricans* (Studier and Wilson, 1970) revealed that body temperatures vary directly with ambient temperatures from 2.8 to 28.3°C, with the body temperatures 0.9 to 5.3° above ambient temperature. They exhibit torpor when cooled and recover upon warming. Pregnant females show no evidence of homeothermy.

ONTOGENY AND REPRODUCTION. *Myotis nigricans* has a unique reproductive cycle (Wilson and Findley, 1970). On Barro Colorado Island in the Panama Canal Zone fertilization and implantation occur in late December and early January. The gestation period is approximately 60 days and the first parturition peak occurs in February. This is followed by post-partum estrus and repetitions of the cycle resulting in birth peaks in April-May and August. The third peak is followed by a period of declining reproductive activity until late December when a new annual cycle begins. This cycle seems to be correlated with a seasonal food supply (insects), such that no young bats are weaned during the dry season (January through March) when insects are relatively scarce. The first birth peak results in a maximum number of young bats being weaned in April, coinciding with the onset of the rainy season and the concomitant insect bloom. Copulation ceases in September and resumes in December.

Males undergo a spermatogenic cycle that is similar to the female cycle outlined above. Spermatogenesis slows or stops during September, October, and November, and no sperm storage occurs. However, *M. nigricans* from Mexico more closely resemble temperate zone bats in their reproductive condition at certain times of the year (Wilson and Findley, 1971).

Mares and Wilson (1971) reported on two females, neither of which was pregnant or lactating, from Costa Rica during February and March. A. L. Gardner (personal communication) has collected both pregnant and lactating females from Costa Rica during the dry season.

Young remain attached to their mothers for the first two or three days, then are left behind in large groups when the mothers leave to feed at night. Mothers seek out their own young, either by olfaction or audition, upon returning to the roost. Mortality rates are high for young bats due to predation, diseases, and parasitism. Adult weight is reached by week 2 after birth and flight begins in week 3, although young are not proficient flyers until week 4 or 5. Adult proportions and measurements are gained by week 5 or 6; molt to adult pelage and fusion of epiphyses of the long bones to the diaphyses occur between weeks 8 and 13, rendering the young externally undistinguishable from adults. Weaning occurs at about week 5 or 6 and dispersal from the roost at any time thereafter (Wilson, 1971).

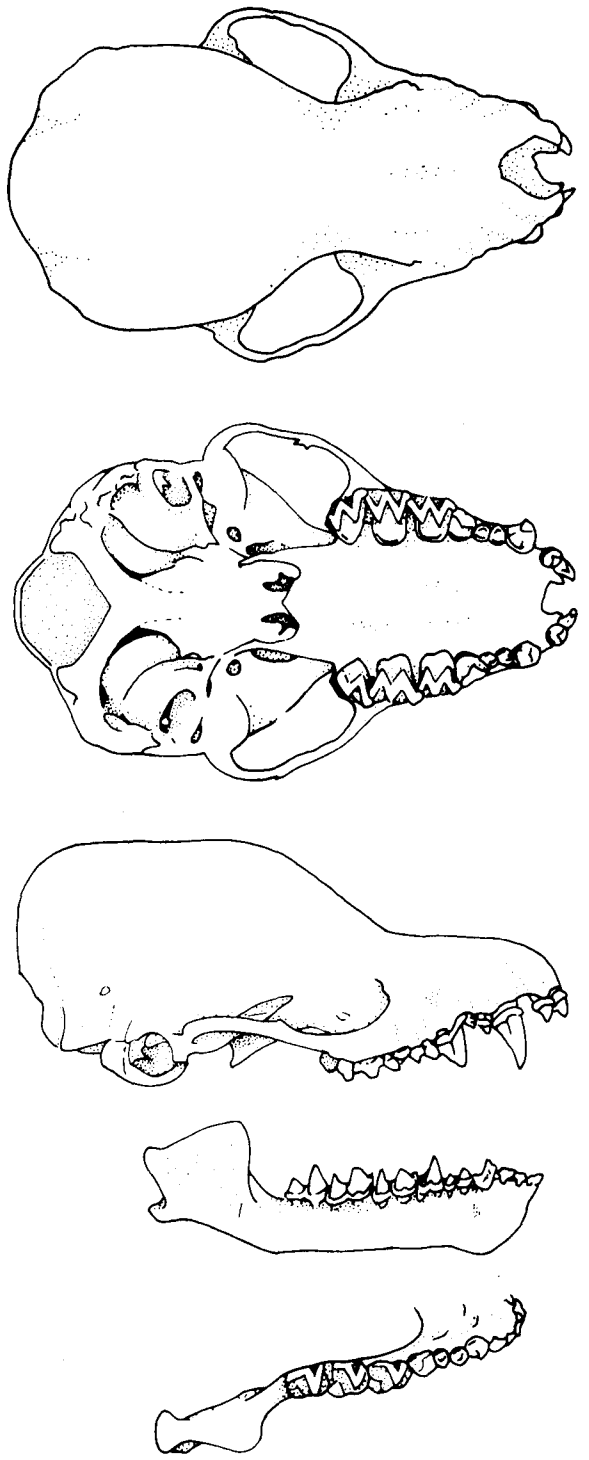

FIGURE 1. Views of skull of *Myotis nigricans* (USNM 373933). From top to bottom, dorsal, ventral, and lateral views of cranium, and lateral and occlusal view of mandible. Illustration by Wilma Martin.

Wilson and Findley (1971) sectioned testes from known-age individuals to determine age at puberty. Their data indicate that males become reproductively active at weeks 15 to 17.

Some individuals of *Myotis nigricans* are known to live for at least 7 years in the wild (Wilson and Tyson, 1970). Wilson (1971) recovered 1.5% (nine individuals) of an original banded population of 600 individuals after 7 years.

ECOLOGY. The ecology of *M. nigricans* was reviewed by Wilson (1971). In a colony of 1000 individuals living in an attic on Barro Colorado Island, age ratios were constantly changing due to reproduction throughout most of the year.

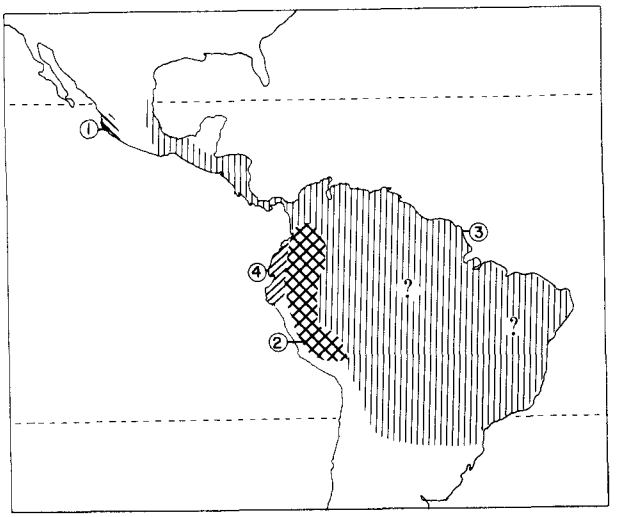

FIGURE 2. Map of Neotropical America showing known distribution of *Myotis nigricans*. Numbers indicate subspecies, as follows: 1, *M. n. carteri*; 2, *M. n. caucensis*; 3, *M. n. nigricans*; 4, *M. n. punensis*. Dotted lines represent Tropic of Cancer (top) and Tropic of Capricorn (bottom). Map redrawn from U. S. Geological Survey World Political-Physical: 1970 Map; approximate scale 1:62,000,000 at Equator.

Sex ratios varied with age, but the newborn ratio is 54% females to 46% males. Adult females outnumber adult males by two to one, possibly due to differential dispersal. Numerous outlying roosts of subadult males suggested territoriality of a sort, with new roosts formed by males, who in turn attract females.

Predators may include a variety of mammals (opossums, cats, other bats), snakes (*Psuestes*, *Boa*) and arthropods (cockroaches, spiders). Competition for food and roosting sites may occur with *Molossus molossus*, and other insectivorous species of bats.

Ectoparasites of *M. nigricans* were reviewed by Wenzel and Tipton (1966). They include mites, bat mites, soft ticks, hard ticks, chigger mites, fleas, and two families of batflies. Caballero y Caballero (1964) found three species of trematodes in the intestine of a single specimen from the Panama Canal Zone.

Homing studies (Wilson and Findley, 1972) demonstrated that some *M. nigricans* were capable of returning to the roost from 50 km within 2 days. The results suggested that they were familiar with an area with a radius of about 13 km.

Goodwin and Greenhall (1961) stated that *M. nigricans* eats insects and Hal Black (personal communication) has found lepidoptera scales in fecal samples. Alberto Cadena (personal communication) found plant remains in the stomach of a specimen from Costa Rica.

Myotis nigricans is known to carry rabies in the Canal Zone and is considered a pest because of its propensity to roost in buildings. Both the Canal Zone government and various U. S. military installations carry out active programs of eradication and control of these bats (Wilson, 1971).

BEHAVIOR. Some aspects of behavior were studied by Wilson (1971). On Barro Colorado Island, the bats became active at sunset and all were out of the roost by an hour after sunset, except during heavy rains. Bats returned to the roost during the hour before sunrise and fought over the preferred roosting sites under metal roof corrugations. Individual bats return to the same general area, but not the exact site in the roost from day to day. They remain lethargic until midmorning when the roost begins to warm.

The bats respond to the 50°C temperatures in the upper parts of the roost by behavioral thermoregulation. They move down the walls to the floor and the tight clusters are broken up into small groups and solitary individuals. They cannot survive temperatures above 42°C for more than 2 hours.

Although *M. nigricans* roosts in association with other bats, notably *Molossus molossus*, no interspecific behavioral interactions have been noted. Wilson has seen *M. nigricans* roosting in the same attic with *Phyllostomus hastatus*, an omnivorous bat that readily eats *M. nigricans* in captivity.

Myotis nigricans tends to roost in large clusters composed of females and young, with the males separate and solitary.

The presence of a few adult males in the clusters suggests a social heirarchy of some sort such as harem formation.

Adults remain out of the roost all night, but probably do not feed continuously during this time. Night feeding roosts were observed in Costa Rica by Andy Starrett (personal communication). Wilson (1971) observed individuals flying set patterns on several successive nights.

Mating behavior was observed frequently between January and August. Copulation normally occurs in late afternoon when the bats have congregated on the floor of the roost and the solitary males mix in with the open aggregations of females.

The male mounts the female dorsally and maneuvers his hindquarters under her uropatagium. Terminal swellings on the penis help hold the pair together during the infrequent pelvic thrusting, which occurs only when the female attempts to move. The sequence, lasting for as long as 45 minutes, normally ends when the female escapes the grasp of the male.

Bats tend to remain lethargic and unresponsive at lower temperatures early in the morning, but become more alert as the temperature rises. Torpor was never observed, but daytime roost temperatures seldom fall below 30°C.

GENETICS. The diploid chromosome number in *M. nigricans* is 44, and the fundamental number of chromosomal arms is 50. There are three large pairs and one small pair of metacentrics and 17 pairs of medium to minute acrocentrics. The X-chromosome is a medium submetacentric, and the Y is a small submetacentric (Baker and Patton, 1967). This karyotype is identical to that of 14 other New World species of *Myotis* (Baker, 1970).

REMARKS. The name *nigricans* alludes to the normal blackish color of individuals of this species, especially those from the region of the type locality. The names *punensis* and *caucensis* are derived from the names of their respective type localities, and *carteri* is named after Dilford C. Carter, probably the first to collect specimens of that subspecies.

Because the holotype is lost, because the original description lacks diagnostic characters, and because another species of small, blackish *Myotis* occurs at the type locality, a neotype was selected (LaVal, 1973) to preclude future confusion over allocation of the name *nigricans* to the species described in this account.

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