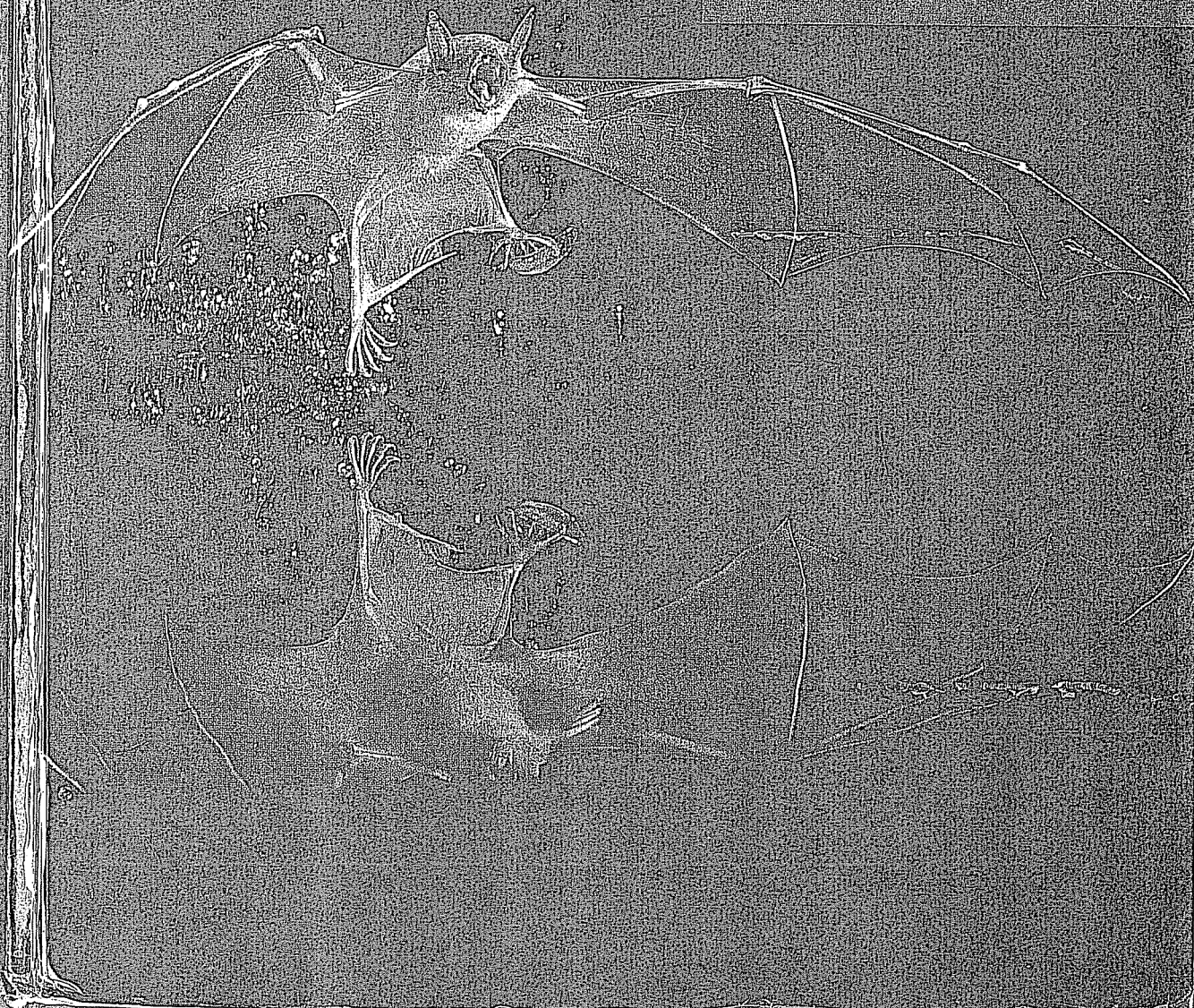


Walker's
BATS
of the World

Ronald M. Nowak

Introduction by Thomas H. Kunz
and Elizabeth D. Pearson



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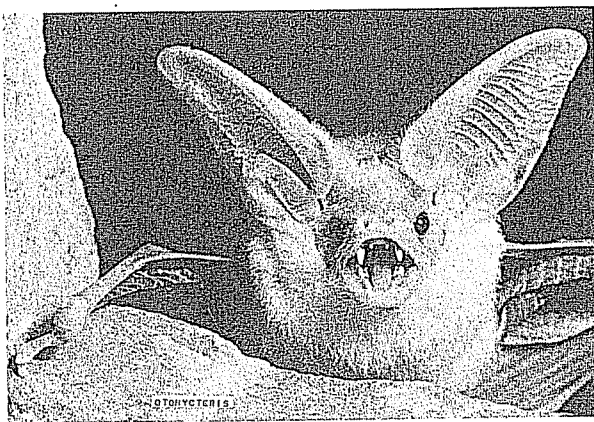
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Hemprich's long-eared bat (*Otonycteris hemprichi*), photos by Erwin Kulzer. The skin of the wings and feet of bats is so thin and tender that cages for newly captured bats should be lined with coarse mesh cloth, as in these pictures.

CHIROPTERA; VESPERTILIONIDAE; Genus
OTONYCTERIS
Peters, 1859

Desert Long-eared Bat

The single species, *O. hemprichi*, occurs in the desert zone from Morocco and northern Niger through Egypt and the northern Arabian Peninsula to Kazakh S.S.R. and Pakistan (Aulagnier and Mein 1985; Corbet 1978; Fairon 1980; Roberts 1977; Shaimardanov 1982).

Head and body length is about 73–81 mm, tail length is about 47–70 mm, and forearm length is 57–67 mm. Gaisler, Madkour, and Pelikan (1972) gave the weight of two adult males as 18 and 20 grams. The coloration above is pale sandy to dark brown; the underparts are usually whitish.

The large ears, about 40 mm in length, are directed nearly horizontally and are connected across the forehead by a low band of skin. Five female specimens revealed two pairs of pectoral mammae, a unique condition in mammals. It is not known whether both pairs are functional. The skull and teeth resemble those of *Eptesicus*.

Harrison (1964) stated that this bat is capable of inhabiting extremely barren and arid regions. In the Negev Desert a pair was found roosting in a rocky crevice on a hill. This bat has also been found in buildings and reportedly has a slow, floppy flight. Based on an analysis of its body mass, low aspect ratio, and low relative wing loading, Norberg and Fenton (1988) predicted that *Otonycteris* will be found to be carnivorous in diet. Three pregnant females, each with two embryos, were found in a deserted hut in Jordan on 2 May (Atallah 1977). Another female with two fetuses was taken in Soviet Central Asia on 12 June (Roberts 1977).

CHIROPTERA; VESPERTILIONIDAE; Genus
LASIURUS
Gray, 1831

Hairy-tailed Bats

There are 13 species (Baker et al. 1988; Cabrera 1957; Dinerstein 1985; Genoways and Baker 1988; Hall 1981; Koopman and Gudmundsson 1966; Krzanowski 1977; Webster, Jones, and Baker 1980; Wilkins 1987):

- L. intermedius*, Atlantic and Gulf coasts of United States, western and eastern coasts of Mexico, southern Mexico to Honduras, Cuba and nearby Isle of Pines;
- L. egregius*, eastern Panama to southern Brazil;
- L. ega* (yellow bat), southern Texas and eastern Mexico to northeastern Argentina;
- L. xanthinus*, southwestern United States, central and western Mexico, Baja California;
- L. cinereus* (hoary bat), north-central and southern Canada, conterminous United States, Mexico, Guatemala, Colombia and Venezuela to Chile and Argentina, Bermuda, Hawaii, Iceland, Orkney Island north of Scotland;
- L. brachyotis*, Galapagos Islands;
- L. castaneus*, Costa Rica, eastern Panama;
- L. seminolus*, Pennsylvania, southeastern United States, possibly northeastern Mexico, occasionally Bermuda;
- L. pfeifferi*, Cuba;
- L. degelidus*, Jamaica;
- L. minor*, Bahamas, Hispaniola, Puerto Rico;
- L. borealis* (red bat), Alberta and Nova Scotia to Chihuahua (northern Mexico) and Florida;
- L. blossevillii*, southern British Columbia through Utah and Mexico to Chile and Argentina.

Hall (1981) used the name *Nycteris* Borkhausen, 1797, for this genus. Hall and most other American authors have not continued to recognize *Dasypterus* Peters, 1871, as a separate genus for the yellow bats, *L. intermedius*, *L. egregius*, and *L. ega*. Some authorities, including Buden (1985), Corbet and Hill (1986), and Honacki, Kinman, and Koepl (1982), have included *L. pfeifferi*, *L. degelidus*, and *L. minor* within *L. borealis*, but Bickham (1987) disagreed on the basis of electrophoretic data. Chromosomal data led Baker et al. (1988) to recognize *L. degelidus* as a full species and to suggest that it, *pfeifferi*, and *minor* might actually be subspecies of *L. seminolus*. Corbet and Hill (1986) also listed *L. insularis* of Cuba as a species distinct from *L. intermedius*.

Head and body length is 50–90 mm, tail length is 40–75 mm, and forearm length is 37–58 mm. Adults weigh from 6 to 30 grams. The red bats are brick red to rusty red, usually washed with white; the hoary bats receive their common name from the silver frosting on the yellowish brown to mahogany brown hairs of the upper parts; and the yellow bats are whitish buff, yellowish, or orange, usually with a blackish wash. Male red bats tend to be more brightly colored than the females. The tail membrane is well furred above.



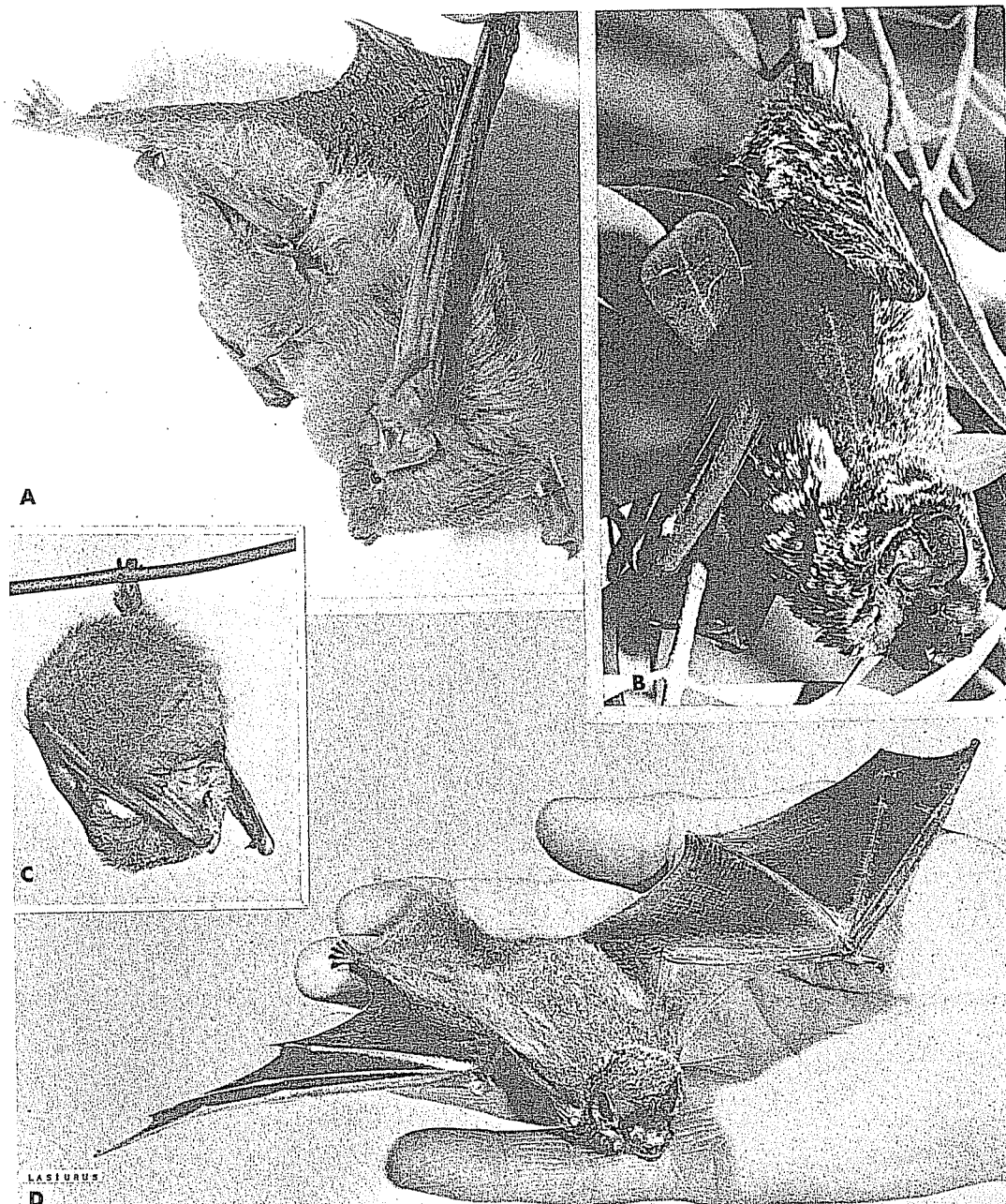
Red bats (*Lasiurus borealis*), mother with nursing baby, photo by Ernest P. Walker.

These bats generally occur in wooded areas and roost in foliage, or occasionally in tree holes and buildings. The distribution of *L. seminolus* nearly coincides with that of Spanish moss, within clumps of which it roosts for most of the year. Hairy-tailed bats usually appear early in the evening. Feeding flights are usually 6–15 meters above the ground. Most insects are captured in flight, but *L. borealis* will alight on vegetation to pick off insects.

Populations of *L. seminolus* may shift southward in the fall, and this species is known to become torpid in cold weather (Barbour and Davis 1969; Lowery 1974). Both *L. borealis* and *L. cinereus* are highly migratory, sometimes moving south many hundreds of kilometers during the fall and occasionally landing on ships at sea or on oceanic islands, especially Bermuda. Migratory movements of these species are not well documented, but it appears likely that from September to November populations in Canada and the northern United States move south to the central and southern United States. Winter populations of *L. borealis* build up in Missouri and Kentucky but may not increase substantially farther to the

south. During the winter limited hibernation may take place, but the bats awake and forage on warmer days. Northward migration begins as early as March or April and reaches Canada by late May (Banfield 1974; Barbour and Davis 1969, 1974; Lowery 1974; Schwartz and Schwartz 1959). The population density of *L. borealis* was estimated at 1 per 0.4 ha. in part of Iowa and 1 per ha. in Indiana (Mumford 1973).

Available evidence suggests that these bats are generally solitary but that the females of some species form small nursery colonies and that flocks of up to several hundred individuals form for migration. During the summer the sexes of *L. cinereus* apparently segregate, with males concentrated in the western United States and females and young in the east. Barbour and Davis (1969) gave the following information on *L. intermedius*. At least 50 females with their young were once found in less than 0.4 ha. of live oaks; during the summer female aggregations are formed, but males are rare therein; and during the winter males apparently congregate. In populations of *Lasiurus* in temperate regions, mating takes place in the late summer or fall, sperm is stored over the



A. Hairy-tailed bat (*Lasiurus intermedius*), with nursing young clinging to its mother, photo by David K. Caldwell. B. Hoary bat (*L. cinereus*), photo by Bruce Hayward. Red bat (*L. borealis*): C. In sleeping position; D. Resting on hand, photos by Ernest P. Walker.

winter in the uterus, ovulation and fertilization occur in the spring, and births take place from late May to early July. Barbour and Davis (1969) gave the estimated gestation period of *L. borealis* as 80–90 days. Greer (1965) collected female *L. borealis*, each with 2 young, in Chile in December and January.

Lasiurus is the only genus of bats in which there are commonly more than two young per birth. *L. cinereus*, *L. intermedius*, and *L. seminolus* are known to produce litters of up to four young (Banfield 1974; Barbour and Davis 1969; Low-

ery 1974), while there are two records of female *L. borealis* being found with five clinging young (Hamilton and Stalling 1972). The normal litter size in all species apparently is two or three, but single young have been reported for *L. ega*, *L. intermedius*, and *L. cinereus* (Birney et al. 1974; Bogan 1972). Old observations suggested that females initially carried their litters during foraging, but R. Davis (1970) found no evidence for the transportation of young by *Lasiurus* or any other North American bat, except in cases of disturbance.

The Hawaiian hoary bat (*L. cinereus semotus*) is desig-

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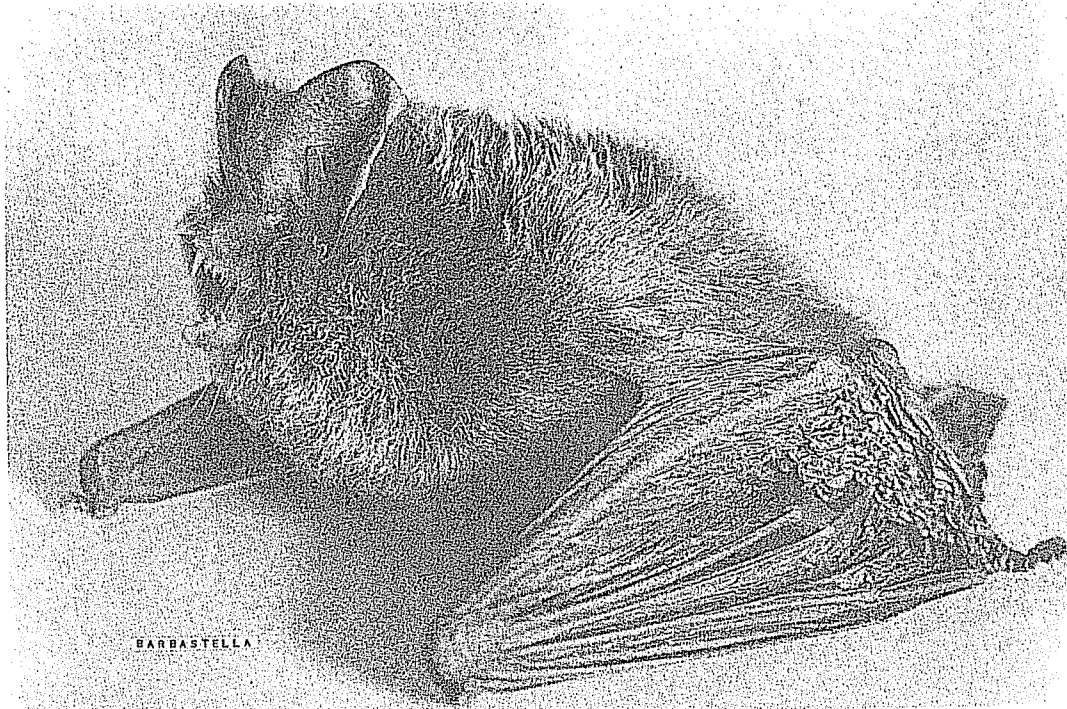
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Barbastelle (*Barbastella barbastellus*), photo by Erwin Kulzer.

nated as endangered by the USDI and as indeterminate by the IUCN. Comparatively little is known about this subspecies, but it is thought to have declined because of loss of its forest habitat. A few thousand individuals may still survive. The species *L. brachyotis*, one of the few mammals native to the Galapagos Islands, was observed regularly in the late nineteenth century (Allen 1942) but was listed as extinct by Goodwin and Goodwin (1973).

CHIROPTERA; VESPERTILIONIDAE; Genus
BARBASTELLA
Gray, 1821

Barbastelles

There are two species (Corbet 1978; Ibáñez and Fernandez 1985a):

- B. barbastellus*, Europe and the larger Mediterranean islands, Morocco, Canary Islands;
- B. leucomelas*, from the Caucasus, through Iran and Central Asia, to Japan and Indochina.

Corbet (1978) also mentioned old records from Sinai, Senegal, and Eritrea in Ethiopia, each of which is dubious or, if valid, might apply to either species. Qumsiyeh (1985), however, considered *leucomelas* to be only a subspecies of *B. barbastellus* and accepted the presence of this subspecies in Sinai and southern Israel.

Head and body length is 43–60 mm, tail length is 40–55 mm, and forearm length is 35–45 mm. Adults usually weigh 6–10 grams. The pelage is soft and long. In *B. barbastellus* the coloration is blackish, the tips of the hairs being whitish or

yellowish to impart a “silvered” or “frosted” appearance, and the underparts are somewhat paler. *B. leucomelas* is uniformly dark brown above and below, the tips of the hairs being gray to buffy on the upper parts and whitish on the underparts.

The fur extends onto the tail membrane and the wings. The nostrils of *Barbastella* open upward and outward behind a median pad. The ears, conspicuously notched on their external margins, are short, broad, and united by a low band across the forehead. This genus resembles *Plecotus* and *Euderma* in most skull features and in dental characters but lacks the extreme auditory specializations of those genera.

The flight is described as relatively slow and flapping. Barbastelles often fly near the ground but sometimes feed at fairly high altitudes, particularly during good weather. *B. barbastellus* is reported to appear early, not later than sunset, and *B. leucomelas* is said to emerge rather late in the evening. There is some indication that these bats wander considerably, and they sometimes emerge from hibernation and fly around during the winter. They hibernate in caves, usually in drier regions, from late September to early April. They have been found in caves with *Myotis*, *Pipistrellus*, and *Plecotus*. The common roosts in summer are trees, generally on and under bark, and buildings. From one to about half a dozen individuals are usually found in a given roost, but during the breeding season barbastelles apparently congregate in fairly large numbers. Breeding habits are not known. One captive barbastelle picked houseflies off a ceiling and also fed on mealworms, and another individual readily accepted small pieces of meat.

Stebbins and Griffith (1986) designated *B. barbastellus* as vulnerable worldwide and as possibly endangered in western Europe. One of the rarest bats in Europe, it appears to be declining through habitat disturbance, pollution, and loss of hollow trees.

this species appear to remain together throughout the year.

Vizotto and Taddei (1976) reported *M. temminckii* and *M. planirostris* in Brazil to roost mainly in hollow fence posts in groups of up to 8 individuals; pregnant females were found there from September to January, and lactating females in February. Taddei, Vizotto, and Martins (1976) collected pregnant female *M. abrasus* from October to December in southeastern Brazil. Pregnant or lactating females of *M. greenhalli* have been taken in May, June, and July (Gardner, LaVal, and Wilson 1970; Valdez and LaVal 1971).

CHIROPTERA; MOLOSSIDAE; Genus
NEOPLATYMOPS
Peterson, 1965

South American Flat-headed Bat

The single species, *N. mattogrossensis*, is known from five localities in southern Venezuela, southern Guyana, the Matto Grosso region of Brazil, and east-central Brazil, but it probably has a wide distribution in the Amazon Basin and the eastern Brazilian highlands (Willig 1985a). Although Peterson (1965a) originally described *Neoplatymops* as a full genus, it was regarded only as a subgenus of *Molossops* by both Freeman (1981) and Legendre (1984). Honacki, Kinman, and Koeppl (1982) agreed, but not Corbet and Hill (1986). Except as noted, the information for the remainder of this account was taken from Willig (1985a) and Willig and Jones (1985), who also considered *Neoplatymops* generically distinct, on the basis of morphological and karyological data.

Neoplatymops is one of the smallest molossids. Average measurements for males, followed by those for females, are: head and body length, 52.6 mm and 51.1 mm; tail length, 25.5 mm and 25.7 mm; forearm length, 30.1 mm and 30.2 mm; and weight, 6.1 grams and 5.4 grams. The pelage is short and sparse. The upper parts are generally pale brownish, the ears and membranes are dark brown, and the underparts are whitish to grayish. The ears are widely separated, there is a gular gland on the throat, the skull is conspicuously flattened, and there is no sagittal crest.

Neoplatymops has some resemblance to *Molossops* but

has two (rather than one) well-developed upper premolar teeth, a flatter skull, and a series of small, wartlike granular structures on the dorsal surface of the forearm. These forearm granulations, which are not found in any other New World molossid, may function to provide anchorage on the porous surfaces of the rocks on which *Neoplatymops* roosts, thereby reducing the likelihood of being pulled off by a predator.

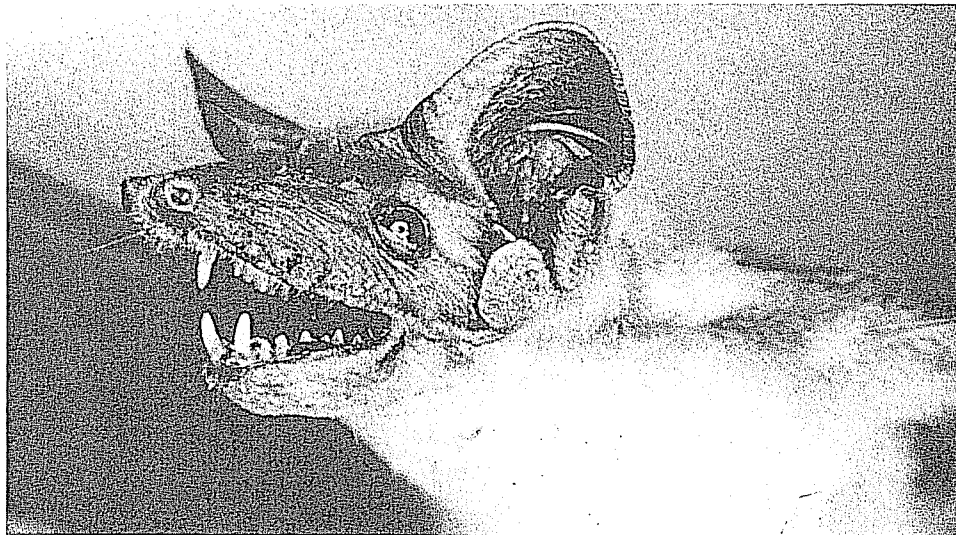
The local distribution of *Neoplatymops* is restricted to areas containing rocky outcrops, where it roosts, close to the ground, in narrow horizontal crevices beneath granitic exfoliations. In this regard, it is convergent with the Old World *Platymops* and *Sauromys*. Its morphology suggests that it is capable of maneuverable flight and the utilization of both soft and hard-bodied prey. Stomach contents of specimens show a wide variety of small insects, with beetles being most common.

Three or four individuals sometimes roost under the same granitic exfoliation. Females are monotocous and seasonally monestrous. In eastern Brazil pregnancies have been found initially in August, during the middle of the dry season. Synchronized births occur there in November and December, during the transition from the dry to the wet season, and lactation persists through the wet season from December to April.

CHIROPTERA; MOLOSSIDAE; Genus **CABRERAMOPS**
Ibáñez, 1980

Ibáñez (1980) erected this genus for the species originally described as *Molossops aequatorianus*, known only by four specimens collected in 1864 at Babahoyo in west-central Ecuador.

In two specimens, head and body length was 50 and 52 mm, tail length was 29 and 31 mm, and forearm length was 37.6 and 35.9 mm. From *Molossops*, *Cabreramops* differs in having the anterior bases of the ears near together on the forehead, a wrinkled upper lip (though more weakly than in *Tadarida*), and well-developed basisphenoid pits. There is no anterior palatal emargination in the skull, the sagittal crest is absent, and there are only two lower incisors and a single upper premolar on each side.



South American flat-headed bat (*Neoplatymops mattogrossensis*), photo by Merlin D. Tuttle.

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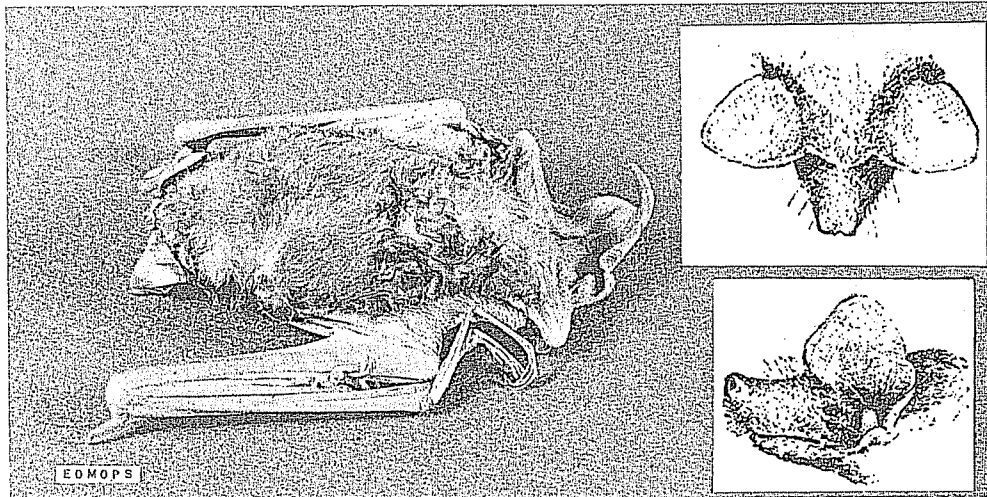
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Myotis whitleyi, photo by P. F. Wright of specimen in U.S. National Museum of Natural History. Inset photos from *Ann. & Mag. Nat. Hist.*

CHIROPTERA; MOLOSSIDAE; Genus **MYOPTERUS**
E. Geoffroy St.-Hilaire, 1818

Three species were listed by Hayman and Hill (*in* Meester and Setzer 1977):

M. whitleyi, Ghana, Nigeria, Cameroon, Zaire, Uganda;
M. albatius, Ivory Coast, northeastern Zaire;
M. daubentonii, Senegal.

The validity of the last species is questionable; it may be conspecific with *M. albatius*. The name *Eomops* Thomas, 1905, has sometimes been used in place of *Myotis*.

Head and body length is about 56–66 mm, tail length is about 25–33 mm, and forearm length is about 33–37 mm. The upper parts are dark brown and the underparts are light reddish yellow to white. This genus resembles some of the other molossid bats in external features, but it differs from them in cranial and dental characters. Some external features of *Myotis* are as follows: the ears are shorter than the head; the ears and the short tragus are rounded above; the muzzle projects beyond the jaws; the end of the nose is separate from the upper lip; and the nostrils open almost laterally.

According to Happold (1987), *M. whitleyi* lives only in the rainforest zone. It seems to be solitary; individuals have been found clinging to the bark of a tree, among the leaves of plantains, and in the roof of a shed. At night it flies in the forest, into gardens, and around houses. Freeman (1981) speculated that *Myotis* is probably more maneuverable in flight than are most molossids, that *M. whitleyi* takes small, soft-bodied prey, and that *M. albatius* is able to consume large, hard-bodied prey.

CHIROPTERA; MOLOSSIDAE; Genus **TADARIDA**
Rafinesque, 1814

Free-tailed Bats

There are 2 subgenera and 8 species (Aggundey and Schlitter 1984; Ansell 1986; Ansell and Dowsett 1988; Cabrera 1957;

Corbet 1978; Ellerman and Morrison-Scott 1966; Freeman 1981; Hall 1981; Harrison 1975b; Harrison and Bates 1984; Hayman and Hill, *in* Meester and Setzer 1977; Hill 1961b, 1982a, 1983a; Hill and Morris 1971; Kock 1975; Koopman 1975, 1982a, 1984a; Largen, Kock, and Yalden 1974; Laurie and Hill 1954; Legendre 1984; Lekagul and McNeely 1977; McKean and Calaby 1968; Medway 1977, 1978; Peterson 1971c, 1974a; Pienaar 1972; Rautenbach, Fenton, and Braack 1985; Ride 1970; Schlitter et al. 1986):

subgenus *Tadarida* Rafinesque, 1814

- T. teniotis*, Mediterranean zone of Europe and northern Africa to Japan and Taiwan;
- T. lobata*, Kenya, Zimbabwe;
- T. fulminans*, eastern Zaire, Rwanda, Kenya, Tanzania, Zambia, Malawi, Zimbabwe, Madagascar;
- T. ventralis*, southern Sudan, Ethiopia, eastern Zaire, Kenya, Malawi, Zambia, Transvaal;
- T. aegyptiaca*, Algeria, Egypt, Nigeria and Sudan to South Africa, southern Arabian Peninsula, Iran, Pakistan, India, Sri Lanka;
- T. australis*, Western Australia to southern Queensland and Victoria;
- T. kuboriensis*, Kubor Range in central Papua New Guinea;

subgenus *Rhizomops* Legendre, 1984

- T. brasiliensis*, southern United States to Chile and Argentina, West Indies.

Tadarida often is considered to include as subgenera what are here regarded as the separate genera *Mormopterus*, *Chaerephon*, *Mops*, and *Nyctinomops* (see accounts thereof). *Rhizomops*, described as a full genus by Legendre (1984), was not accepted as such by Corbet and Hill (1986) or Jones, Arroyo-Cabral, and Owen (1988). Koopman (1982a, 1984a) considered *T. kuboriensis* a subspecies of *T. australis*, but Freeman (1981) and Legendre (1984) regarded the two as distinct species. The name *T. africana* often is used in place of *T. ventralis*.

In *T. australis*, one of the largest species, head and body length is 85–100 mm, tail length is 40–55 mm, forearm length is 57–63 mm, and weight is 25–40 grams (Richards, *in*

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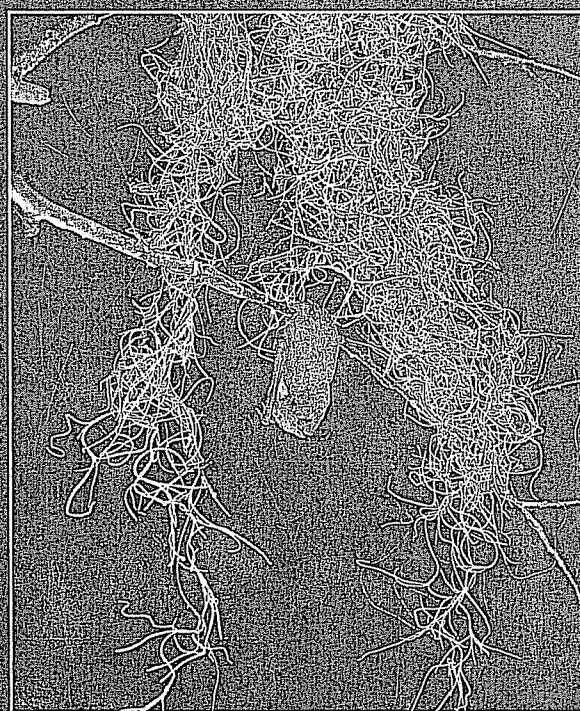
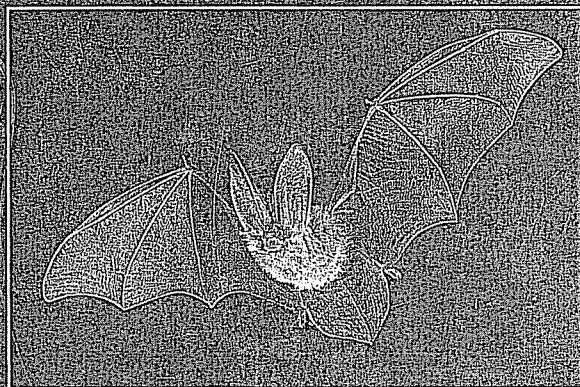
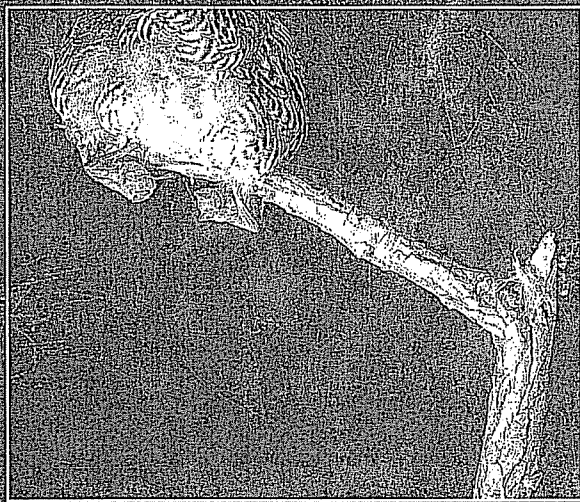
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Ernest P. Walker (1891-1969) began work on *Mammals of the World* in the early 1930s, when he became assistant director of the National Zoo in Washington. **Ronald M. Nowak** is the author of the fourth and fifth editions of *Walker's Mammals of the World*. His other works on mammalogy include *North American Quaternary Carnivores*.

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