



# *Myotis riparius* (Chiroptera: Vespertilionidae)

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**Abstract:** *Myotis riparius* is a vespertilionid bat commonly called the riparian myotis. It is a medium-sized bat, with woolly fur; color of dorsal fur varies geographically from a reddish to blackish tinge. *M. riparius* is widely distributed in the Neotropics, occurring from Honduras southward into South America to Paraguay, northern Argentina, and Uruguay. It occurs in rainforests, savannas, and open habitats, at elevations from sea level to about 2,000 m. It is listed as “Least Concern” by the International Union for Conservation of Nature and Natural Resources.

**Key words:** bat, insectivorous bat, Myotinae, riparian myotis, South America, vespertilionid

Synonymy completed 21 January 2017

DOI:10.1093/mspecies/sex011

Version of Record, first published online July 12, 2017, with fixed content and layout in compliance with Art. 8.1.3.2 ICZN.

Nomenclatural statement.—A life science identifier (LSID) number was obtained for this publication: urn:lsid:zoobank.org:pub:EE2E9E1C-08E3-4326-950B-C91CD10121C9

## *Myotis riparius* Handley, 1960

### Riparian Myotis

*Myotis simus riparius* Handley, 1960:466. Type locality “Tarcuna Village, 3,200 ft., Río Pucro, Darién, Panama.”

*Myotis riparius*: LaVal, 1973:32. First use of the current name combination.

[*Myotis*] *riparia* Woodman, 1993:545. Unjustified emendation of *Myotis riparius* Handley, 1960.

*Myotis (Leuconoe) riparius*: Koopman, 1993:214. Name combination.

CONTEXT AND CONTENT. Order Chiroptera, suborder Yangochiroptera, family Vespertilionidae, subfamily Myotinae, genus *Myotis*. *M. riparius* is monotypic (LaVal 1973; Koopman 1994; Simmons 2005; Wilson 2008). It was originally described as a subspecies of *Myotis simus* by Handley (1960). Subsequently, LaVal (1973) raised *riparius* to the species level. Included in the cosmopolitan subgenus *Leuconoe* by Koopman (1993), which was subsequently determined to be polyphyletic (Ruedi and Mayer 2001; Hofer and Van Den Bussche 2003; Stadelmann et al. 2007). Currently, *M. riparius* is included in an unnamed New World subgenus (Stadelmann et al. 2007).



**Fig. 1.**—An adult male of *Myotis riparius* from Rio Jí-Paraná, Rondônia, Brazil. Photograph by Roberto Leonan Morim Novaes.

## DIAGNOSIS

*Myotis riparius* is morphologically similar to its Neotropical congeners. In general, *M. riparius* can be distinguished from other *Myotis* by the following set of traits: long, woolly fur; dorsal hairs unicolored; plagiopatagium broadly attached to the foot at the level of the base of the toes; fringe of hairs along the trailing edge of uropatagium absent; sagittal and lambdoidal crests present, varying from low to high; occipital region flattened posteriorly. Specimens from Paraguay, northern Argentina, southeastern Brazil, and Uruguay are generally brownish or blackish pelage in the dorsal region, with low sagittal and lambdoidal crests. Specimens from the Amazon basin northward into Panama generally have reddish, reddish-brown or cinnamon dorsal pelage, and medium-to-high sagittal and lambdoidal crests.

## GENERAL CHARACTERS

*Myotis riparius* (Fig. 1) is a medium-sized species compared to other South American *Myotis* (see external and skull measurements below). Ears are comparatively short, extending forward halfway from eye to nostril. The antitragal notch is barely evident. The tragus is pointed, slightly curving outward above and convex below, with a small triangular lobule at the outer base. Membranes are Mummy Brown (following Ridgway 1912); and the plagiopatagium is broadly attached to foot at the level of the base of the toes. The fringe of hairs along the trailing edge of uropatagium is absent; and the upper and lower surfaces of the uropatagium are barely covered with hairs. *M. riparius* has long woolly fur. Ventral hairs are bicolored, with dark-brown bases and yellowish tips, with a strong contrast between bases and tips. Dorsal hairs are unicolored, without contrast between bases and tips (López-González et al. 2001; Moratelli et al. 2013). Pelage color varies geographically (Moratelli 2008).

In *M. riparius*, the skull is moderate in size; the parietal is inclined forward; the occipital region is generally flattened posteriorly; the sagittal crest is generally present, ranging from low to high; lambdoidal crests are always present, ranging from low to median; P3 is generally aligned with P2 and P4, and is visible in profile view, but may be displaced to the lingual side, being visible or not (Fig. 2). As with pelage color, height of skull crests varies geographically (Moratelli 2008).

External and skull measurements (mm or g; parenthetical *n*) for adult males and females combined were: total length 73–91 (107); tail length 28–48 (104); foot length 6–10 (98); ear length 7–15 (96); tragus length 4–11 (35); forearm length 32.3–39.8 (172); length of 3rd metacarpal 29.2–36.5 (161); length of dorsal fur 5–9 (101); length of ventral fur 4–8 mm (97); body mass 4–7 (89); greatest length of skull 13.2–15.2 (159); condylocanine length 11.3–13.4 (160); condylobasal length 11.8–14.0 (160); condyloincisive length 12.1–14.3 (160); basal length 10.8–12.8 (158); zygomatic breadth 8.2–10.0 (73); mastoid breadth 6.7–7.9 (154); braincase breadth 6.0–7.0 (160); interorbital breadth 4.2–5.3 (162); postorbital breadth 3.1–3.9 (161); breadth across



**Fig. 2.**—Dorsal, ventral, and lateral views of the skull and lateral view of the mandible of the holotype of *Myotis riparius*. The holotype is an adult female (National Museum of Natural History [USNM] 310255) from Río Pucro, Darién, Panama. Length of skull 13.9 mm. The picture of the lateral view of the mandible was inverted to allow alignment with remaining skull pictures in the plate (scale bar = 5 mm).

canines 3.4–4.3 (158); breadth across molars 5.2–6.2 (160); length of maxillary tooththrow 4.7–5.7 (162); length of molari-form tooththrow 2.7–3.2 (160); mandibular length 9.3–11.0 (140); and length of mandibular tooththrow 5.1–6.1 (156). The bacula is narrow and shallow with a pointed shaft, but widening suddenly near the proximal end. Bacular measurements and means (mm; parenthetical ranges) were: length 0.77 (0.65–0.86), depth 0.28 (0.22–0.29), and width 0.38 (0.36–0.50—LaVal 1973).

Generally, specimens from Central America and Amazon basin have reddish-brown or cinnamon-brown dorsal fur, with a few individuals showing a brownish or blackish dorsal fur coloration (LaVal 1973). On the other hand, most individuals from southeastern Brazil, Paraguay, and Argentina have brownish or blackish dorsal fur (Barquez et al. 1999; López-González et al. 2001; Dias and Peracchi 2007, 2008), with a few reddish-brown or cinnamon-brown individuals (e.g., Universidade Federal Rural do Rio de Janeiro [ALP] 6623). The few individuals we examined from the Brazilian Caatinga and Cerrado are reddish-brown. Most individuals from Central America, Amazon basin, and Guiana Shield have medium-to-high sagittal and lambdoidal crests, and the occipital region is flattened posteriorly (Handley 1960; LaVal 1973; Simmons and Voss 1998; Moratelli et al. 2013). In contrast, populations from southeastern Brazil, Paraguay, and Argentina tend to have low-to-medium sagittal and lambdoidal crests, and the occipital region is slightly rounded (Barquez et al. 1999; López-González et al. 2001;

Dias and Peracchi 2007, 2008; Moratelli 2008). Similarly, P3 either crowded to the lingual side or positioned in toothrow, but not visible in labial view, is more frequent in individuals from northern localities. In individuals from southeastern Brazil, P3 is generally in toothrow and visible in labial view. Although these populations from northern South America and Central America and from southern Brazil, Paraguay, and Argentina show different trends for fur color and skull traits, morphometric analyses did not reveal any discontinuity among populations (Moratelli 2008). Results suggest that these populations may represent distinct subspecies, but molecular analyses are necessary for a more accurate understanding of population structure of *M. riparius*.

## DISTRIBUTION

*Myotis riparius* is widely distributed in the Neotropics, occurring from southern Honduras southward into all South

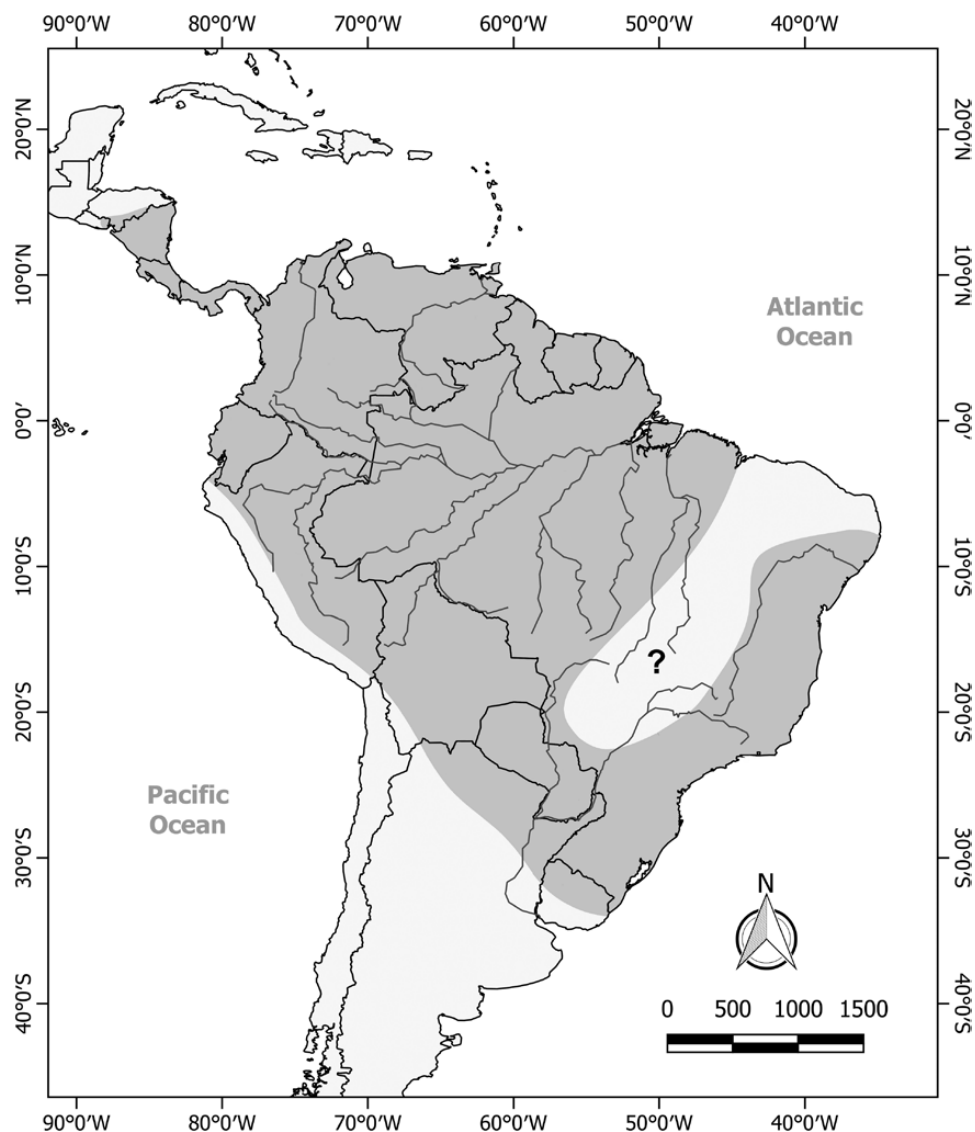


Fig. 3.—Geographic distribution of *Myotis riparius*.



American countries, except Chile (Simmons 2005; Wilson 2008; Fig. 3). It occurs from sea level (Mocambo, Pará, Brazil—Wilson 2008) to about 2,000 m of elevation (Fila La Maquina, San José, Costa Rica—LaVal 1973), with most records in lowland localities (LaVal 1973; Anderson 1997).

*Myotis riparius* has been found in lowland and upland tropical rainforests, deciduous forests, savannas, xerophytic caatinga, pampa grasslands, and anthropic environments, such as agricultural fields and pastures (LaVal 1973; Muñoz-Arango 2001; Aguirre 2007; Novaes et al. 2015). Moreover, the species is not known for the Alto Chaco (Wilson 2008). Based on its range of elevational and latitudinal distribution, and diversity of habitats where it has been recorded, we assume that *M. riparius* has large plasticity for temperature and habitat.

## FORM AND FUNCTION

Like other species of *Myotis*, the dental formula of *M. riparius* is  $i\ 2/3$ ,  $c\ 1/1$ ,  $p\ 3/3$ ,  $m\ 3/3$ , total 38 (Miller and Allen 1928). The deciduous dental formula is  $di\ 2/3$ ,  $dc\ 1/1$ ,  $dp\ 2/2$ , total 22, which is identical to that of most *Myotis* (Webster 1981). *M. riparius* has myotodonte dentition, similar to other New World myotine bats. P3 is either crowded to the lingual side or positioned in toothrow.

## ONTOGENY AND REPRODUCTION

In Costa Rica, the reproductive pattern of *Myotis riparius* was classified as seasonal monoestry, with a high prevalence of pregnant females in April, May, and June (LaVal and Fitch 1977; LaVal and Rodríguez 2002). Pregnant females were observed in August in Peru (Graham 1987), and the birth of a single young in November was observed in Uruguay (González 2001). One pregnant female, with 1 embryo of 7 mm (crown–rump), was collected in February in Panama (Handley 1960).

## ECOLOGY

*Myotis riparius* occurs in a broad variety of habitats and uses different roosts, which suggests the species has significant plasticity for habitat and roost usage. It occurs along a wide elevational range (from sea level to 2,000 m), and different habitats such as tropical rainforests, savannas, and xerophytic formations, as well as environments with different levels of human disturbance (LaVal 1973; Muñoz-Arango 2001; Aguirre 2007; Novaes et al. 2015). In French Guiana, *M. riparius* showed a strong association with primary forests, with a preference for preserved habitats (Simmons and Voss 1998). In Argentina, colonies of *M. riparius* were found roosting under tree bark (*Schinopsis* [Anacardiaceae]), and in a house roof in a rural area (Barquez and Ojeda 1992). In the latter, it was cohabiting with *Myotis nigricans* (black myotis), *M. albescens* (silver-tipped myotis), and *Molossus molossus* (Pallas's mastiff bat; see Barquez et al.

1999). In Brazil, *M. riparius* was found in caves (Guimarães and Ferreira 2014), among other roosts. This species can form gregarious groups of up to 50 individuals (Barquez and Ojeda 1992).

Based on short capture distances obtained in Costa Rica, LaVal and Fitch (1977) suggested small activity ranges for *M. riparius*. This species shows a tendency to use lower forest strata, although it may also explore the forest canopy (Simmons and Voss 1998; Bernard 2001; Kalko and Handley 2001; Sampaio et al. 2003). *M. riparius* is an insectivore that forages over water (Findley 1993; Kalko et al. 1996). Its diet includes a large variety of insects, particularly those in the orders Coleoptera, Diptera, Lepidoptera, and Orthoptera, all caught in flight (LaVal and Rodríguez 2002).

Ectoparasites include the Nycteribiidae dipterans *Basilia anceps* in Brazil, Panama, and Venezuela (Guimarães 1966; Guerrero 1996; Graciolli et al. 2008); *B. carteri* in Argentina and Paraguay (Autino et al. 1999; Graciolli et al. 2006); *B. ferrisi* in Venezuela (Guimarães 1972); *B. hughscotti* in Brazil (Graciolli et al. 2008); *B. juquiensis* in Brazil, Paraguay, and Venezuela (Guimarães 1972; Graciolli et al. 2006; Graciolli et al. 2008); *B. lindolphi* in Brazil (Graciolli et al. 2002); *B. manu* in Peru (Guerrero 1996); and *B. ortizi* in Venezuela (Guimarães 1972). There is also a record of a mite of the genus *Steatonyssus* (Mesostigmata, Macronyssidae) from Brazil (Graciolli et al. 2008). A positive record for rabies disease was reported for an individual of *M. riparius* from São Paulo, southeastern Brazil (Rosa et al. 2011).

## GENETICS

Two specimens from Letícia, Department of Amazonas, Colombia, had a diploid number (2n) of 44 chromosomes, and a fundamental autosomal number (FN) of 50 (Baker and Jordan 1970). Autosomes include 3 large and 1 small metacentric pairs, and 17 acrocentric pairs ranging in size from small to medium (Moratelli and Morielle-Versute 2007). The X chromosome is a medium submetacentric, and the Y chromosome is a small acrocentric (Baker and Jordan 1970).

Molecular phylogenies using mitochondrial cytochrome-*b* and nuclear Rag-2 genes clustered *Myotis riparius* and its Neotropical and Nearctic congeners in a consistent clade (Stadelmann et al. 2007). These analyses revealed a close relationship of *M. riparius* with *M. elegans* (elegant myotis), *M. ruber* (red myotis), and *M. simus* (velvety myotis; see Stadelmann et al. 2007).

## CONSERVATION

*Myotis riparius* is classified as “Least Concern” in the International Union for Conservation of Nature and Natural Resources *Red List of Threatened Species* because of its wide distribution, apparent large populations (no decline), and occurrence in several protected areas (Barquez et al. 2008).

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