MAMMALIAN SPECIES No. 733, pp. 1–5, 3 figs.

Eumops bonariensis.

By John L. Hunt, Lisa A. McWilliams, Troy L. Best, and Kevin G. Smith

Published 18 December 2003 by the American Society of Mammalogists

Eumops bonariensis (Peters, 1874)

Peters' Mastiff Bat

Promops bonariensis Peters, 1874:232. Type locality "Buenos-Aires," Argentina (Sanborn 1932:354).

Promops nanus Miller, 1900:470. Type locality "Bogava [= Bugaba—Carter and Dolan 1978:93], Chiriqui, Panama (alt. 250 m.)."

Eumops delticus Thomas, 1923:341. Type locality "Caldeirão, Marajo Island, Brazil." Restricted to "Ilha de Marajo at mouth of Rio Amazonas, Pará" (Carter and Dolan 1978:92).

Eumops patagonicus Thomas, 1924:234. Type locality "Chubut," Argentina (Sanborn 1932:355).

CONTEXT AND CONTENT. Order Chiroptera, suborder Microchiroptera, family Molossidae. The genus *Eumops* contains 8 species; *E. auripendulus*, *E. bonariensis*, *E. dabbenei*, *E. glaucinus*, *E. hansae*, *E. maurus*, *E. perotis*, and *E. underwoodi* (Freeman 1981; Koopman 1993, 1994). Four subspecies of *E. bonariensis* are recognized (Eger 1977; Koopman 1994):

E. b. beckeri Sanborn, 1932:354. Type locality "Trinidad, El Beni, Bolivia" (*patagonicus* Thomas is a synonym).

E. b. bonariensis (Peters, 1874:232), see above.

E. b. delticus Thomas, 1923:341, see above.

E. b. nanus (Miller, 1900:470), see above.

DIAGNOSIS. Compared with *E. glaucinus*, *E. bonariensis* has a skull with lambdoidal and sagittal crests that are less developed, and skull is relatively broader across rostrum. In *E. bonariensis*, M3 has a well-developed 3rd commissure, whereas that of *E. glaucinus* has only a slight indication of a 3rd commissure (Sanborn 1932). *E. bonariensis* has upper incisors with less divergent tips than those of *E. hansae*, larger upper canines that almost touch I1 and P4 and force P1 out of toothrow, wider P4s and bases of cusps bulge at cingulum, and shorter 3rd commissure of M3 than 2nd commissure. In addition, *E. bonariensis* has more crowded lower incisors; posterior border of palate is about at level of posterior edge of M3; mesopterygoid fossa narrows anteriorly and broadens posteriorly; lachrymal, sagittal, and lambdoidal crests are better developed; and braincase is deeper (Handley 1955).

GENERAL CHARACTERS. *Eumops bonariensis* (Fig. 1) is the smallest species of *Eumops* (Goodwin 1946; Redford and Eisenberg 1992; Sanborn 1932); length of forearm is 37–49 mm. The 3rd commissure on M3 of *E. bonariensis* is as long as the 2nd (Fig. 2; Eger 1977). Dorsal color is dark-chocolate to cinnamon brown; base of hairs are pale, generally white. Ventrum is paler than dorsum, with tips of some hairs white or gray (Barquez et al. 1991, 1993; Mares et al. 1989; Myers and Wetzel 1983; Redford and Eisenberg 1992; Sanborn 1932). Color varies geographically in Paraguay; bats from northwestern Chaco are paler than those from eastern Chaco and eastern Paraguay (Redford and Eisenberg 1992; Myers and Wetzel 1983).

Ears are broad and united by a small membrane. When laid forward, they extend beyond tip of snout. Inner keel of ear extends beyond posterior margin of antitragus (Barquez et al. 1991, 1993; Mares et al. 1989). Lips appear smooth (Barquez et al. 1993; Marinkelle 1970) and upper lip has many stiff, short hairs that project downward (Barquez et al. 1991; Mares et al. 1989). Snout is broad and upper incisors are hook-like (Barquez et al. 1993).

Average of external measurements (in mm) of 4 males and 7 females, respectively, from Venezuela are: total length, 89, 91; length of tail, 31, 31; length of foot, 9, 8; length of ear, 18, 19; and length of forearm, 37.7, 38.1 (measure of variation not provided—Eisenberg 1989). Average and range of external and cranial measurements (in mm) of 3 males and 8 females, respectively, from Argentina are: total length, 121 (117–128), 115 (105–129); length of tail, 41 (38–43), 38 (33–41); length of foot, 9.6 (8.3–10.3), 8.4 (7.0–10.2); length of ear, 22.0 (21.4–23.0), 22.7 (21.9–24.0); length of forearm, 47.9 (47.3–48.7), 48.0 (44.8–49.0); greatest length of cranium, 19.3 (19.1–19.5), 18.9 (18.3–19.2); condylobasal length, 18.3 (18.1–18.6), 18.0 (17.2–18.4); least interorbital length, 4.3 (4.2–4.3), 4.2 (4.0–4.3); zygomatic breadth, 11.8 (11.5–12.0), 11.5 (11.1–11.7); breadth of braincase, 9.6 (9.5–9.7), 9.3 (8.8–9.7); length of maxillary toothrow, 7.5 (7.3–7.6), 7.3 (7.1–7.5); length of palate, 7.3 (7.1–7.4), 7.6 (7.2–7.9); length of mandibular toothrow, 6.7 (6.6–6.9), 6.7 (6.5–7.3); and greatest length of mandible, 14.0 (13.8–14.1), 13.8 (13.6–14.0—Mares et al. 1996). Average and range of external and cranial measurements (in mm) of 3 males and 3 females, respectively, from Paraguay are: total length, 109 (103–114), 105 (102–110); length of tail, 37 (34–40), 38 (36–40); length of foot, 11 (10–11), 10 (9–10); length of ear, 22 (20–23), 19 (18–21); length of forearm, 46.1 (45.0–47.2), 45.4 (45.1–45.9); length of 3rd metacarpal, 48.2 (48.0–48.3), 47.3 (46.1–48.1); greatest length of cranium, 19.5 (19.2–19.7), 19.3 (18.8–19.7); condylobasal length, 18.4 (18.3–18.5), 18.1 (17.6–18.6); mastoidal breadth, 10.7 (10.4–10.9), 10.5 (10.3–10.8); zygomatic breadth, 11.3 (11.2–11.5), 11.2 (11.2–11.3); interorbital constriction, 4.1 (4.0–4.3), 4.1 (4.1–4.1); breadth across upper canines, 4.5 (4.3–4.6), 4.6 (4.4–4.7); breadth across upper molars, 8.0 (7.8–8.1), 7.9 (7.8–8.0); length of maxillary toothrow, 7.2 (7.1–7.5), 6.8 (6.8–6.9); and length of mandibular toothrow, 7.7 (7.4–8.0), 7.4 (7.4–7.5—Lopez-Gonzalez 1998). Average and range of external measurements (in mm) of 27 males and 40 females, respectively, from southern South America are: total length, 101 (92–114), 99 (92–110); length of tail, 35 (30–40), 34 (27–39); length of foot, 10 (8–11), 9 (7–10); length of ear, 20 (18–23), 19 (18–22); and length of forearm, 44.2 (41.9–46.2), 43.6 (40.2–45.7—Redford and Eisenberg 1992).

In Venezuela, mass averaged 7.4 g for 4 males and 7.0 g for 2 females (measure of variation not provided—Eisenberg 1989). In Bolivia, mass was 12–18 g (sample size not provided—Anderson et al. 1993). In Argentina, average and range of mass was 18.2 g (17.5–19.0) and 17.4 g (15.5–20.0) for 3 males and 8 females, respectively (Mares et al. 1996). In Paraguay, average and range of mass of 2 males and 2 females, respectively, were 14.5 g (13.9–15.0) and 13.7 g (12.0–15.1—Lopez-Gonzalez, 1998). In southern South America, mass of 10 individuals averaged 12.6 g (range, 11.0–19.0—Redford and Eisenberg 1992).

Peters' mastiff bat has significant geographic variation in size. *E. b. bonariensis* averages larger than *E. b. beckeri*, *E. b. delticus*,

FIG. 1. An adult *Eumops bonariensis* at Agua Dulce (about 170 km W Bahia Negra), Defensores del Chaco National Park in the northern Chaco, Paraguay. Photograph courtesy of P. Myers.

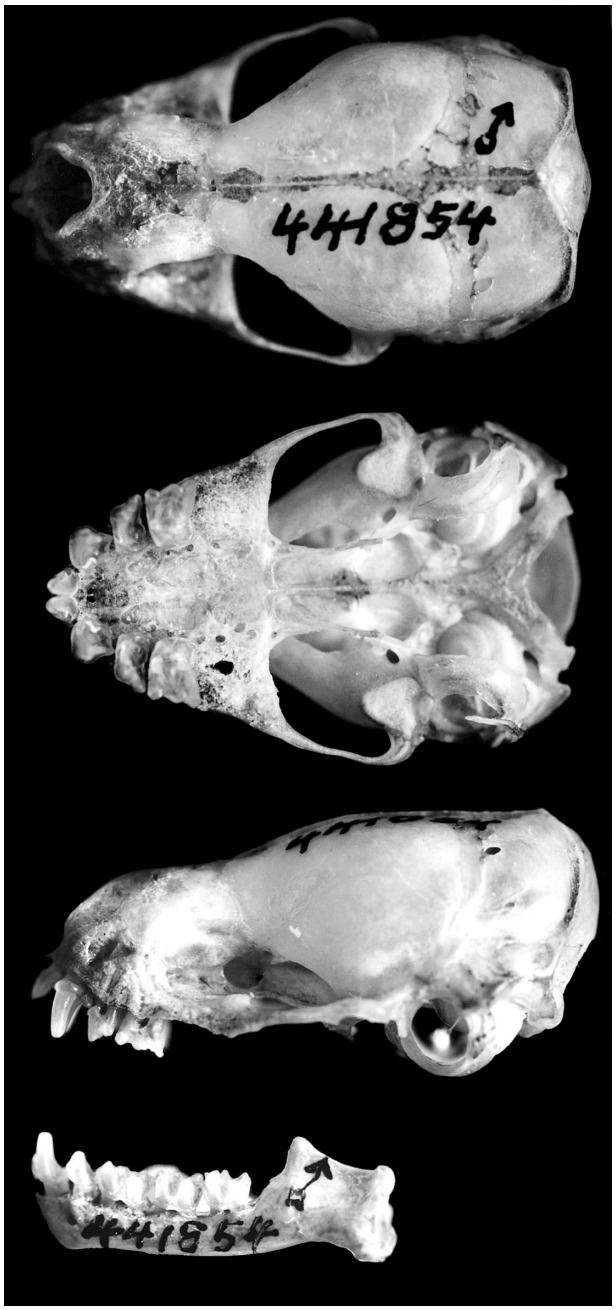

FIG. 2. Dorsal, ventral, and lateral views of cranium and lateral view of mandible of *Eumops bonariensis nanus* from 119 km N, 32 km W Maracaibo, Departamento Guajira, Colombia (male, United States National Museum of Natural History 441854). Greatest length of cranium is 16.5 mm. Photographs by T. L. Best.

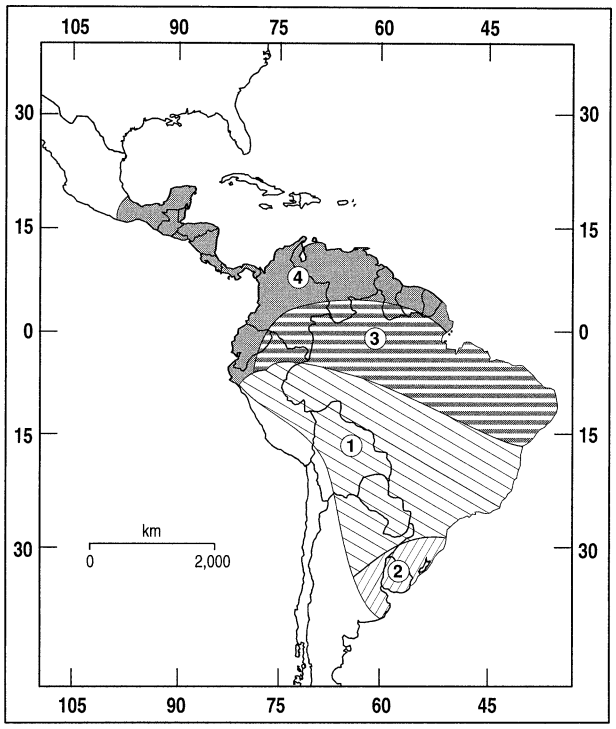

FIG. 3. Distribution of *Eumops bonariensis* in North and South America (Barquez et al. 1993, 1999; Eisenberg 1989; Eger 1977; Koopman 1982, 1993, 1994; Redford and Eisenberg 1992): 1, *E. b. beckeri*; 2, *E. b. bonariensis*; 3, *E. b. delticus*; and 4, *E. b. nanus*.

and *E. b. nanus* in all characters and is distinguished by length of forearm and condylobasal length. Average of external and cranial measurements (in mm) of up to 23 male and 50 female *E. b. beckeri* are: length of forearm, 44.2, 44.1; total length of cranium, 18.3, 17.9; condyloincisive length, 17.1, 16.5; zygomatic breadth, 10.8, 10.7; mastoidal width, 10.2, 10.1; height of braincase, 6.5, 6.4; length of upper maxillary toothrow, 6.9, 6.7; and postorbital constriction, 4.2, 4.1 (Eger 1977).

The same measurements (in mm) for 7 male and 7 female *E. b. bonariensis* are: length of forearm, 46.8, 46.7; total length of cranium, 20.4, 20.1; condyloincisive length, 19.2, 19.0; zygomatic breadth, 11.9, 11.9; mastoidal width, 11.3, 11.2; height of braincase, 7.3, 7.2; length of upper maxillary toothrow, 7.6, 7.6; and postorbital constriction, 4.4, 4.4 (Eger 1977).

Average of external and cranial measurements (in mm) of 3 male and 6 female *E. b. delticus* are 45.8, 46.3; total length of cranium, 18.6, 18.6; condyloincisive length, 17.5, 17.7; zygomatic breadth, 10.8, 10.8; mastoidal width, 9.9, 10.1; height of braincase, 6.6, 6.4; length of upper maxillary toothrow, 6.8, 6.9; and postorbital constriction, 3.8, 3.8 (Eger 1977).

The same measurements (in mm) for 12 male and 15 female *E. b. nanus* are: length of forearm, 39.1, 39.7; total length of cranium, 17.0, 16.7; condyloincisive length, 15.8, 15.6; zygomatic breadth, 10.0, 9.8; mastoidal width, 9.3, 9.1; height of braincase, 6.0, 5.9; length of upper maxillary toothrow, 6.3, 6.2; and postorbital constriction, 3.7, 3.6 (Eger 1977).

DISTRIBUTION. Peters' mastiff bat ranges from southern Mexico to central Argentina (Fig. 3; Cabrera 1958; Eger 1977; Eisenberg 1989; Koopman 1994; Myers and Wetzel 1983; Redford and Eisenberg 1992; Reid 1997; Sanborn 1932). *E. bonariensis* occurs at elevations of about 240 m in Panama (Miller 1900, 1912), sea level to 1,000 m in Colombia (Alberico et al. 2000; Marinkelle 1970), and 80 m in Venezuela (Ojasti and Linares 1971). No fossils are known.

FORM AND FUNCTION. Base of hairs on all parts of back are whitish (0.3 mm). Hairs of underparts are tricolored, white at base (0.5 mm), with broad brown band that becomes gradually darker distally. Tip of hairs may be yellow (Marinkelle 1970). Pelage on middle of back is ca. 5.5 mm in length (Miller 1900) and is somewhat shorter dorsally than ventrally. Dorsally, outer half of antebranchial membrane is covered with short woolly hairs. A band of similar hairs passes outward posterior to forearm, gradually becoming broad enough to cover ca. 50% of metacarpal bone of last digit (Dobson 1876, 1878).

Tips of wings are narrow. Average relative length of 2nd phalange is 6.6% of total length of 4th digit (Freeman 1981). Wing-membrane extends from ankles (Dobson 1876). Dorsally and ventrally, wing membrane is sparsely haired at distal and ulnar border of forearm and along 5th metacarpal. Hairs are similar in color to those of body, extending from flanks on membrane from about proximal 50% of upper arm to middle of femur. Propatagium is practically hairless. Membranes and auricles are black, leathery, and semitranslucent. Body pelage is thick and silky, ca. 6.5 mm long

in interscapular region and 4.5 mm long on chest (Marinkelle 1970).

Muzzle is obliquely truncated, and nose is almost twice as wide as base of antitragus. Lips have microscopic shallow wrinkles (Freeman 1981).

Ears are as broad as high (Dobson 1876, 1878). Antitragus is semicircular, and the minute tragus is subquadrate. Auricle extends 4 mm beyond snout when laid forward. Anterior margin of ear has minute conic outgrowths. Connecting membrane between ears and inner edge of keel is hairy. Other parts of auricle and face are practically hairless (Marinkelle 1970).

Mesopterygoid fossa is deep, broad posteriorly, and narrow anteriorly. Basisphenoid fossae are large, 0.8 mm deep, well defined, 5% larger than mandibular fossae, and divided by a narrow septum that remains parallel for >50% of length of basisphenoid fossae. Fossae expand only slightly posteriorly and mid-anteriorly above rims of apertures. Lachrymal ridges are slightly developed, but tubercles are moderately prominent. Sagittal crest is obsolescent and lambdoidal crests are moderate. Skull, in dorsal aspect, is relatively slender with rostrum narrower at base than at level of nares. A shallow interparietal depression occurs immediately anterior to fossa cerebellae. Supraoccipital area is visible in dorsal view and bulges posteriorly. Zygomatic arches are wider posteriorly than anteriorly and extend evenly onto rostrum without a distinct angle. In dorsal profile, middle of rostrum is slightly elevated, but does not reach level of interparietal depression (Marinkelle 1970).

Dental formula is i 1/2, c 1/1, p 2/2, m 3/3, total 30 (Eisenberg 1989; Mares et al. 1989). Upper incisors are in contact at base, but tips are divergent (1 mm apart). Cingula of incisor and canine are separated by 0.30 mm. A minute premolar extrudes 0.1 mm labially from axis of toothrow, touching P4 and canine. The P4 is large and has a protocone higher than in any other premolar or molar. Outline of cingulum does not have bulging cusp bases. The 3rd commissure of M3 is as long as 2nd commissure, and metacone is nearly as high as mesostyle. Lower incisors are arranged in 2 series forming a semicircle, but are slightly imbricated, definitely bilobed, and inner lobes are broader and higher than outer lobes. Inner lobe of i2 is slightly bilobed (Marinkelle 1970).

On the Yucatán Peninsula, most males (23 of 24) had enlarged or secreting throat glands May–June. In July, 6 of 7 males had small glands (Bowles et al. 1990).

Glans penis is 1.5–2.5 mm in length. Glans is oval at base and widens distally to form 3 prominent lobes; 2 lateral and 1 dorsal. The 2 lateral lobes join along ventral midline, creating a V-shaped furrow that terminates at urinary meatus at base of bacular mound. A bulbous bacular mound protrudes from ventral surface of dorsomedial lobe and forms dorsal rim of urinary meatus. The oval-shaped bacular mound extends slightly further distally than rim of dorsal lobe. Outer surface of glans penis is devoid of epithelial spines (Ryan 1991).

A large and curved os penis is at terminus of corpora cavernosa. Os penis tapers gently to end in a blunt tip, which lies within bacular mound distal to urinary meatus (Ryan 1991). Measurements (in mm) of os penis of 1 specimen from Paraguay were: greatest length, 0.53; greatest breadth at base, 0.11; and in lateral aspect, greatest distance from ventral surface to a line connecting lowermost basal and distal projections, 0.05. In dorsal view, os penis is swollen near base, tapers medially, and ends in a rod-like tip. The bone is bent to 1 side. In lateral aspect, the slender bone is bowed ventrally and tapers evenly from a broad, angular base to a narrow, rounded tip (Brown 1967).

ONTOGENY AND REPRODUCTION. In Yucatán, Mexico, an adult male had testes 5 mm in length on 28 March, and another had testes 4 mm in length on 12 May (Birney et al. 1974). Six adult males observed March–May had testes 3–5 mm in length, and testes of 2 in September–October were 4 mm in length (Bowles et al. 1990). In Argentina, 1 male had abdominal testes and another had scrotal testes in mid-July (Mares et al. 1995).

In Bolivia, 2 pregnant females with single embryos were present in November (Anderson 1997). In Yucatán, Mexico, 1 female had a fetus 8 mm in crown-rump length and another had a fetus 16 mm in crown-rump length on 28 March (Birney et al. 1974). Pregnant females were present from late March to late June, with parturition synchronous in mid- to late June. Lactating females were present over 7 weeks from early June to late July, indicating that lactation is 6–8 weeks. Pregnant females had single fetuses (crown-rump length in mm): 28 March (8); 30 March (9); 8 May (2); 15 May (2 and 16); and 16 June (15). Four subadults were present as follows: 12 July (2), 25 October (1), and 29 October (1—Bowles et al. 1990). In Argentina, 2 females had closed vaginas in mid-July, a female had well-developed mammae in November (Mares et al. 1995), and a pregnant female with a 3-g fetus was present in November (Mares et al. 1981). In Paraguay, pregnant females were present 17–21 October (Baud 1981).

ECOLOGY. In Mexico, roosts occupied by Peters' mastiff bat were in roofs of buildings (Bowles et al. 1990; Heideman et al. 1990; Lay 1962). In Yucatán, Mexico, ca. 20 individuals were in roof tiles of a building in summer and ca. 10 individuals were present in autumn. Sex ratio of adults was biased toward females at 2 sites (31:131 and 7:16) and biased toward males at another (13:5). Capture-recapture data (24 banded, 14 recaptured at least once) suggested some roost fidelity by both sexes. One male used the same tile, but with different pairs of females in 3 successive years. Another female that was observed exiting the same roost over a 2-year period was 20 tiles away on the same roof a year later after a banana tree had blocked the entrance of the 1st roost. While only 1 bat was observed exiting a given tile on numerous occasions, some aggregations occurred at individual roost tiles as follows: 1 male, 1 female; 1 male, 2 females; and 1 adult female, 1 subadult female (Bowles et al. 1990).

In Panama, where *E. bonariensis* is rare (Handley 1966), it is restricted primarily to xeric coastal lowlands. However, it does occur in association with man-made structures (Carter and Dolan 1978; Dolan and Carter 1979).

In South America, Peters' mastiff bat occurs in the Patagonian subregion, the eastern Brazilian highlands and coast, the Amazon Basin, the northern coast and islands, and the Pacific coast of Colombia and Ecuador (Koopman 1982). In Colombia, *E. bonariensis* occurs in rainforest along the Río Orteguaza (Marinkelle 1970). In northern Venezuela, it is strongly associated with dry, deciduous, tropical forest (Eisenberg 1989), and it occurs in arid borders of the Gulf of Venezuela. *E. bonariensis* was observed over a small pond in a thorn forest and a roost was in a hollow tree in the thorn forest (Handley 1976). In Brazil, it occupies all major biomes (da Fonseca et al. 1996). In Argentina, Peters' mastiff bat may be widely distributed (Barquez and Ojeda 1992; Barquez et al. 1993; Mares et al. 1995), but uncommon (Mares et al. 1981). Here it roosts in hollow trees and in human dwellings (Barquez et al. 1993) and occupies many habitats, from dense transitional forest to open environments (Barquez et al. 1991; Mares et al. 1996). In western Formosa Province, Argentina, Peters' mastiff bat was in Chacoan gallery forest (Mares et al. 1995). In Uruguay, *E. bonariensis* occurs in open thorn woodlands (Redford and Eisenberg 1992). In Paraguay, Peters' mastiff bat occurs in 6 of the country's 7 biomes (Willig et al. 2000). In the Paraguayan Chaco, it is a common house bat, roosting in roofs made of overlapping, split, palm logs; it is active over ponds (Myers and Wetzel 1983).

Peters' mastiff bat is an insectivore (Barquez et al. 1993; Mares et al. 1989). In Yucatán, Mexico, diet of 4 adult females was comprised of Lepidoptera (55% volume), Coleoptera (mostly Carabidae, 23.4%), Hemiptera (probably Lygaeidae, 15%), Scarabaeidae (3.8%), and unidentified insects (2.5%—Bowles et al. 1990).

In Tabasco, Mexico, *Myotis fortidens* occurred in the same roost site as *E. bonariensis* (Lay 1962). In Yucatán, Mexico, Peters' mastiff bat occurred in roof crevices with *Molossus ater* and *Molossus sinaloae* (Heideman et al. 1990). In Bolivia, *Desmodus rotundus*, *Eumops auripendulus*, *E. glaucinus*, *Myotis albescens*, *Myotis nigricans*, *Molossus molossus*, *Molossops temminckii*, *Nyctinomops aurispinosus*, *Nyctinomops laticaudatus*, *Nyctinomops macrotis*, and *Phyllostomus discolor* occurred with *E. bonariensis* over pools bordered by a thorn forest (Ibáñez and Ochoa G. 1989). In Paraguay, associated species include *M. albescens*, *M. nigricans*, and *M. temminckii* (Myers and Wetzel 1983). In Uruguay, associated species include *M. albescens* and *M. molossus* (Acosta y Lara 1950). In Argentina, associated species include *Artibeus lituratus*, *Cynomops abrasus*, *Eptesicus furinalis*, *Molossops temminckii*, *Molossus molossus*, *Myotis levis*, *Myotis riparius*, *Pygoderma bilobiatum*, and *Sturnira lilium* (Mares et al. 1995).

Peters' mastiff bat has been artificially infected with the protozoan *Schizotrypanum* (Dias and Romaña 1939; Romaña and Abalos 1950). The protozoan *Trypanosoma* also has been reported from *E. bonariensis* (Marinkelle 1968, 1976), but was not detected in

specimens from Colombia (Marinkelle 1982). Other parasites include the trematode *Czosnowia paraguayensis* (Boeger et al. 1985). No fleas occurred on a specimen from Panama (Tipton and Méndez 1966).

In Argentina, a sick Peters' mastiff bat was observed on the trunk of a tree; the bat was irritated, uncoordinated, and paralyzed. It tested positive for rabies (Amasino et al. 1986).

BEHAVIOR. *Eumops bonariensis* flies high and rapidly (Mares et al. 1989) and has been captured in mist nets (e.g., Dolan and Carter 1979; Marinkelle 1970). At rest and in flight, Peters' mastiff bat emits loud and distinctive high-pitched calls that are audible to humans (Acosta y Lara 1950; Redford and Eisenberg 1992).

GENETICS. Electrophoretic data from 24 genic loci indicate that relationships between *E. bonariensis* and other species of *Eumops* (Dolan and Honeycutt 1978) are similar to those suggested by morphological evidence (Eger 1977).

REMARKS. Several authors (Barquez and Ojeda 1992; Barquez et al. 1991, 1999; Mares et al. 1995, 1996; Willig et al. 2000) consider *E. bonariensis beckeri* to represent a species distinct from *E. bonariensis*; they referred to this taxon as *E. patagonicus*. In *E. patagonicus*, the internal keel of the ear barely reaches the anterior margin of the antitragus, and *E. bonariensis* is larger (Barquez et al. 1993). However, other authors consider *E. patagonicus* to be conspecific with *E. bonariensis* (Freeman 1981; Koopman 1993).

Eumops is from the Greek prefix *eu* meaning good or true and the Malayan *mops* meaning bat (Jaeger 1955). The specific epithet *bonariensis* refers to Buenos Aires, the type locality. Additional vernacular names include dwarf mastiff bat (Goldman 1920), moloso orejas anchas pardo (Barquez et al. 1993), moloso orejiancho (Mares et al. 1981; Redford and Eisenberg 1992), moloso orejón pardo (Barquez et al. 1991), murciélago mastín (Villa-R. 1967), pequeño moloso de Buenos Aires (Massoia 1970), and small mastiff bat (Mares et al. 1981).

We thank A. M. Krista, L. L. Thornton, and other personnel in the Interlibrary Loan Department at Auburn University R. B. Draughon Library for assistance in obtaining articles from other institutions; P. Myers for providing Fig. 1; W. B. Robinson for helping in preparation of Fig. 2; T. E. Rodriguez for preparing Fig. 3; J. C. Rainey for assistance in translating Spanish and Portuguese articles; and J. B. Armstrong, M. K. Causey, J. L. Eger, P. W. Freeman, C. Lopéz-González, and S. J. Presley for critically evaluating an early draft of the manuscript. This is journal article 15–985994 of the Alabama Agricultural Experiment Station.

LITERATURE CITED

Acosta y Lara, E. F. 1950. Quirópteros del Uruguay. Comunicaciones Zoologicas del Museo de Historia Natural de Montevideo 3(58):1–71.

Alberico, M., A. Cadena, J. Hernández Camacho, and Y. Muñoz-Saba. 2000. Mammals (Synapsida: Theria) of Colombia. Biota Colombiana 1:44–75.

Amasino, C. F., J. Avolio, F. Fava, R. Fernández, and D. Pereira. 1986. Rabia en murcielagos insectivoros: nuevos diagnosticos efectuados en el laboratorio central de salud publica de la PCIA, de Buenos Aires. Veterinaria Argentina 3: 735–739.

Anderson, S. 1997. Mammals of Bolivia, taxonomy and distribution. Bulletin of the American Museum of Natural History 231:1–652.

Anderson, S., B. R. Riddle, T. L. Yates, and J. A. Cook. 1993. Los mamíferos del Parque Nacional Amboró y la región de Santa Cruz de la Sierra, Bolivia. Special Publication, Museum of Southwestern Biology, University of New Mexico, Albuquerque 2:1–58.

Barquez, R. M., and R. A. Ojeda. 1992. The bats (Mammalia: Chiroptera) of the Argentine Chaco. Annals of Carnegie Museum 61:239–261.

Barquez, R. M., N. P. Giannini, and M. A. Mares. 1993. Guide to the bats of Argentina. Oklahoma Museum of Natural History, University of Oklahoma, Norman.

Barquez, R. M., M. A. Mares, and J. K. Braun. 1999. The bats of Argentina. Special Publications, Museum of Texas Tech University, Lubbock.

Barquez, R. M., M. A. Mares, and R. A. Ojeda. 1991. Mammals of Tucuman. Oklahoma Museum of Natural History, University of Oklahoma, Norman.

Baud, F. J. 1981. Expédition du Muséum de Genève au Paraguay: chiroptères. Revue Suisse de Zoologie 88:567–581.

Birney, E. C., J. B. Bowles, R. M. Timm, and S. L. Williams. 1974. Mammalian distributional records in Yucatán and Quintana Roo, with comments on reproduction, structure, and status of peninsular populations. Bell Museum of Natural History, University of Minnesota, Occasional Papers 13:1–25.

Boeger, W. A., V. E. Thatcher, and S. A. Marques. 1985. A validad de *Czosnowia* Zdzitowiecki, 1967, a redesçricao de *C. paraguayensis* (Fischthal e Martin, 1978), n. comb. (Trematoda: Lecithodendriidae) e aspectos de sua patologia no fígado do morcêgo, *Molossus ater* (Geoffrey), no Brasil. Studies on Neotropical Fauna and Environment 20:147–155.

Bowles, J. B., P. D. Heideman, and K. R. Erickson. 1990. Observations on six species of free-tailed bats (Molossidae) from Yucatán, Mexico. Southwestern Naturalist 35:151–157.

Brown, R. E. 1967. Bacula of some New World molossid bats. Mammalia 31:645–667.

Cabrera, A. 1958. Catalogo de los mamiferos de America del Sur. Revista del Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" 4:1–732.

Carter, D. C., and P. G. Dolan. 1978. Catalogue of type specimens of Neotropical bats in selected European museums. Special Publications, The Museum, Texas Tech University 15: 1–136.

da Fonseca, G. A. B., G. Herrmann, Y. L. R. Leite, R. A. Mittermeier, A. B. Rylands, and J. L. Patton. 1996. Lista anotada los mamíferos do Brasil. Occasional Papers in Conservation Biology (Conservation International) 4:1–38.

Dias, E., and C. Romaña. 1939. Algumas investigações sobre Schizotrypanum de quiropteros. Memorias do Instituto Oswaldo Cruz, Rio de Janerio, Brasil 34:619–625.

Dobson, G. E. 1876. A monograph of the group *Molossi*. Proceedings of the Zoological Society of London 1876:701–735.

Dobson, G. E. 1878. Catalogue of the Chiroptera in the collection of the British Museum. British Museum (Natural History), London, United Kingdom.

Dolan, P. G., and D. C. Carter. 1979. Distributional notes and records for Middle American Chiroptera. Journal of Mammalogy 60:644–649.

Dolan, P. G., and R. L. Honeycutt. 1978. Systematic and evolutionary implications of genic variation in the mastiff bat, Eumops (Chiroptera: Molossidae). Bat Research News 19(4): 72.

Eger, J. L. 1977. Systematics of the genus *Eumops* (Chiroptera: Molossidae). Life Sciences Contributions, Royal Ontario Museum 110:1–69.

Eisenberg, J. F. 1989. Mammals of the Neotropics. The northern Neotropics: Panama, Colombia, Venezuela, Guyana, Suriname, French Guiana. University of Chicago Press, Illinois 1:1–449.

Freeman, P. W. 1981. A multivariate study of the family Molossidae (Mammalia, Chiroptera): morphology, ecology, evolution. Fieldiana: Zoology, new series 7:1–173.

Goldman, E. A. 1920. Mammals of Panama. Smithsonian Miscellaneous Collections 69:1–309.

Goodwin, G. G. 1946. Mammals of Costa Rica. Bulletin of the American Museum of Natural History 87:271–474.

Handley, C. O., Jr. 1955. A new species of free-tailed bat (genus *Eumops*) from Brazil. Proceedings of the Biological Society of Washington 68:177–178.

Handley, C. O., Jr. 1966. Checklist of the mammals of Panama. Pp. 753–795 in Ectoparasites of Panama (R. L. Wenzel and V. J. Tipton, eds.). Field Museum of Natural History, Chicago, Illinois.

Handley, C. O., Jr. 1976. Mammals of the Smithsonian Venezuelan project. Brigham Young University Science Bulletin, Biological Series 20(5):1–89.

Heideman, P. D., K. R. Erickson, and J. B. Bowles. 1990. Notes on the breeding biology, gular gland and roost habits of *Molossus sinaloae* (Chiroptera, Molossidae). Zeitschrift für Säugetierkunde 55:303–307.

Ibáñez, C., and J. Ochoa G. 1989. New records of bats from Bolivia. Journal of Mammalogy 70:216–219.

Jaeger, E. C. 1955. A source-book of biological names and

terms. Third edition. Charles C Thomas Publisher, Springfield, Illinois.

KOOPMAN, K. F. 1982. Biogeography of the bats of South America. Pp. 273–302 in Mammalian biology in South America (M. A. Mares and H. H. Genoways, eds.). Pymatuning Symposia in Ecology, Special Publication Series, Pymatuning Laboratory of Ecology, University of Pittsburgh 6:1–539.

KOOPMAN, K. F. 1993. Order Chiroptera. Pp. 137–241 in Mammal species of the world: a taxonomic and geographic reference. Second edition (D. E. Wilson and D. M. Reeder, eds.). Smithsonian Institution Press, Washington, D.C.

KOOPMAN, K. F. 1994. Chiroptera: systematics. Handbook of zoology: a natural history of the phyla of the animal kingdom. VIII. Mammalia. Walter de Gruyter, New York.

LAY, D. M. 1962. Seis mamiferos nuevos para la fauna de Mexico. Anales del Instituto de Biología (Universidad de México) 33: 373–377.

LOPEZ-GONZALEZ, C. 1998. Systematics and zoogeography of the bats of Paraguay. Ph.D. dissertation, Texas Tech University, Lubbock, 395 pp.

MARES, M. A., R. M. BÁRQUEZ, AND J. K. BRAUN. 1995. Distribution and ecology of some Argentine bats (Mammalia). Annals of Carnegie Museum 64:219–237.

MARES, M. A., R. A. OJEDA, AND R. M. BARQUEZ. 1989. Guide to the mammals of Salta Province, Argentina. University of Oklahoma Press, Norman.

MARES, M. A., R. A. OJEDA, AND M. P. KOSCO. 1981. Observations on the distribution and ecology of the mammals of Salta Province, Argentina. Annals of Carnegie Museum 50:151–206.

MARES, M. A., R. M. BÁRQUEZ, J. K. BRAUN, AND R. A. OJEDA. 1996. Observations on the mammals of Tucumán Province, Argentina. I. Systematics, distribution, and ecology of the Didelphimorphia, Xenarthra, Chiroptera, Primates, Carnivora, Perissodactyla, Artiodactyla, and Lagomorpha. Annals of Carnegie Museum 65:89–152.

MARINKELLE, C. J. 1968. Importancia de los murcielagos del tropico americano en la salud publica. Pp. 142–168 in Medicina tropical (A. Anselmi, ed.). Talleres Gráficos de Editorial Fournier, México, Distrito Federal, México.

MARINKELLE, C. J. 1970. Redescription of *Eumops bonariensis delticus* Thomas, 1923 (Chiroptera, Molossidae). Revista Brasileira de Biologia 30:461–464.

MARINKELLE, C. J. 1976. Biology of the trypanosomes of bats. Pp. 175–216 in Biology of the Kinetoplastida (W. H. R. Lumsden and D. A. Evans, eds.). Academic Press, New York 1:1–563.

MARINKELLE, C. J. 1982. Prevalence of *Trypanosoma cruzi*-like infection of Colombian bats. Annals of Tropical Medicine and Parasitology 76:125–134.

MASSOIA, E. 1970. Contribución al conocimiento de los mamíferos de Formosa con noticias de los que habitan zonas vinaleras. Instituto Nacional de Tecnologia Agrupecuraria (Buenos Aires) 276:55–63.

MILLER, G. S., JR. 1900. A new free-tailed bat from Central America. Annals and Magazine of Natural History, Series 7, 6:470–471.

MILLER, G. S., JR. 1912. List of North American land mammals in the United States National Museum, 1911. Bulletin of the United States National Museum 79:1–455.

MYERS, P., AND R. M. WETZEL. 1983. Systematics and zoogeography of the bats of the Chaco Boreal. Miscellaneous Publications of the Museum of Zoology, University of Michigan 165: 1–59.

OJASTI, J., AND O. J. LINARES. 1971. Adiciones a la fauna de murcielagos de Venezuela con notas sobre las especies del genereo *Diclidurus* (Chiroptera). Acta Biologica Venezuela 7: 421–441.

PETERS, W. 1874. Hr. W. Peters las über eine neue Art von Flederthieren, *Promops bonariensis* und über *Lophuromys*, eine Nagergattung von Westafrika. Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin 1874: 232–234.

REDFORD, K. H., AND J. F. EISENBERG. 1992. Mammals of the Neotropics. The southern cone: Chile, Argentina, Uruguay, Paraguay. University of Chicago Press, Illinois 2:1–430.

REID, F. A. 1997. A field guide to the mammals of Central America and southeast Mexico. Oxford University Press, New York.

ROMAÑA, C., AND J. W. ABALOS. 1950. Lista de los quiropteros de la coleccion del Instituto de Medicina Regional, y sus parasitos. Anales del Instituto de Medicina Regional 3:111–117.

RYAN, J. M. 1991. Comparative morphology of the glans penis in *Molossus*, *Promops*, and *Eumops* (Chiroptera: Molossidae). Bulletin of the American Museum of Natural History 206:122–137.

SANBORN, C. C. 1932. The bats of the genus Eumops. Journal of Mammalogy 13:347–357.

THOMAS, O. 1923. Two new mammals from Marajó Island. Annals and Magazine of Natural History, Series 9, 12:341–342.

THOMAS, O. 1924. New South American small mammals. Annals and Magazine of Natural History, Series 9, 13:234–237.

TIPTON, V. J., AND E. MÉNDEZ. 1966. The fleas (Siphonaptera) of Panama. Pp. 289–338 in Ectoparasites of Panama (R. L. Wenzel and V. J. Tipton, eds.). Field Museum of Natural History, Chicago, Illinois.

VILLA-R., B. 1967. Los murcielegos de Mexico: su importancia en la economía y la salubridad—su clasificación sistemática. Universidad Nacional Autónoma de México, Instituto de Biologia, México.

WILLIG, M. R., S. J. PRESLEY, R. D. OWEN, AND C. LÓPEZ-GONZÁLEZ. 2000. Composition and structure of bat assemblages in Paraguay: a subtropical-temperate interface. Journal of Mammalogy 81:386–401.

Associate editors of this account were LESLIE N. CARRAWAY and LUI MARINELLI. Editor was VIRGINIA HAYSSEN.

J. L. HUNT, L. A. MCWILLIAMS, T. L. BEST, AND K. G. SMITH, DEPARTMENT OF BIOLOGICAL SCIENCES AND ALABAMA AGRICULTURAL EXPERIMENT STATION, 331 FUNCHESS HALL, AUBURN UNIVERSITY, ALABAMA 36849-5414, UNITED STATES.