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DESCRIPTIONS OF NEW BATS FROM PANAMA

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In its studies of tropical diseases, the Gorgas Memorial Laboratory of Panama is conducting a mammal survey of the Republic. The work in 1959 centered on the headwaters of the Río Pucro, near Cerro Tacarcuna, Province of Darién, eastern Panama.

Among the mammals collected on the Río Pucro were 43 species of bats, all caught in mist nets. Many of these species had not been taken previously in Central America. Three species and one subspecies herein described are new. Either there is a surprising amount of endemism in this region, which is continuous with the Choco of Colombia, or else there are a surprising number of undescribed widespread species of bats in the Neotropical fauna.

The Malaria Control and Survey Branch of the Office of the Chief Surgeon, U.S. Army Caribbean, has also been collecting bats in Panama. Included in its collections are several species not previously taken in the Republic and one of the new subspecies here described.

I am indebted to the personnel of the Gorgas Memorial Laboratory, particularly Carl Johnson, Pedro Galindo, and Rudolpho Hinds for their support and cooperation. Likewise, I thank Robert Altman, Marvin Keenan, and Vernon Tipton of the Malaria Control and Survey Branch for their assistance and for the opportunity to study their collections. I am also grateful to the authorities of the American

Museum of Natural History (AMNH), Academy of Natural Sciences of Philadelphia (ANSP), Chicago Natural History Museum (CNHM), and Harvard University Museum of Comparative Zoology (MCZ) for allowing me to study specimens under their care.

Capitalized color terms in the following descriptions are from Ridgway (Color Standards and Color Nomenclature, 1912). All measurements are in millimeters and are explained in Handley (1959, pp.98-99).

*Mimon crenulatum keenani*, new subspecies

HOLOTYPE: USNM 311951, adult male, skin and skull, collected August 25, 1959, by C. M. Keenan, Fort Gulick, Panama Canal Zone, original number 4127.

DISTRIBUTION: Central Panama to northwestern Venezuela and western Ecuador. The Panamanian specimen was found in the daytime hanging on the outside of a decayed hollow stump in a sparsely wooded area. The Ecuadorean specimens likewise were taken in a hollow rotted tree stump in a wooded area (Tate, 1931, p. 250).

DESCRIPTION: Dorsum bright mahogany brown (between Carob Brown and Black); individual hairs monocolored from base to tip; prominent yellowish-white median stripe from forehead to base of tail; large prominent yellow-orange spots at posterior bases of ears. Underparts orangish, individual hairs fuscous at base. Membranes and ears blackish. Noseleaf hairy, slightly crenulated at base; wing membranes attached to metatarsus; calcar long. Rostrum relatively long, shallow, and dorsally flattened; sagittal crest relatively low; posterior extension of palate relatively long and broad; molariform teeth broad and massive.

MEASUREMENTS: See table 1.

COMPARISONS: Brighter and more ornate than the contiguous races *crenulatum* and *longifolium*. Rostrum longer and slightly deeper, posterior palatal elongation longer and broader, teeth larger, and calcar longer than in *crenulatum*. Rostrum shallower and dorsally flatter than in *longifolium*.

REMARKS: The nominal genera *Anthorhina* and *Mimon* are not distinguishable even as subgenera. The bats of *Anthorhina* differ from those of *Mimon* principally in having a smaller anterior upper premolar ( $P^1$ ); shorter lower incisor; larger auditory bulla; stouter zygomatic arch; shorter, less woolly fur; smaller ears; and hairy noseleaf.

It is doubtful that either of the nominal genera contains more than a single species. Dalquest (1957, p. 45) cleared up some of the confusion surrounding the supposed species *M. bennettii* and *cozumelae*, presently known only by a few specimens from Brazil and Mexico, respectively. Dalquest failed, however, to note that his only specimen of *bennettii* was a juvenile, and that he distinguished it from his

TABLE 1.—Measurements of *Mimon crenulatum*.

Species and locality	Sex	Specimens	Total length	Tail vertebrae	Hind foot	Forearm	Tibia	Calcus	Greatest length	Zygomatic breadth	Interorbital breadth	Brachase breadth	Brachase depth	Maxillary tooth row length	Postpalatal length	Palatal breadth outside of M5	Rostral breadth behind canine
<i>M. crenulatum</i> , Santarém, Brazil	♂	MCZ 30285	79	24	13	48.2	-----	22.0	21.5	12.2	4.2	8.7	7.3	7.7	8.0	8.4	5.3
<i>M. crenulatum</i> , Santarém, Brazil	♀	MCZ 30284	85	23	12	49.1	-----	24.0	21.6	12.1	4.1	8.6	7.5	7.8	7.6	8.4	5.1
<i>M. crenulatum</i> , Port-of-Spain, Trinidad	♀	AMNH 175586	-----	-----	12	50.1	19.7	20.4	20.9	11.7	4.4	8.2	7.4	7.8	7.4	8.0	5.4
<i>M. keenani</i> , Río Tocuyo, Venezuela	♂	AMNH 130687	82	24	12	49.9	-----	18.6	21.8	12.5	4.0	8.4	7.4	7.7	7.5	8.2	5.2
<i>M. keenani</i> , Río Tocuyo, Venezuela	♀	AMNH 130688	78	24	11	50.3	-----	20.3	21.1	11.9	4.3	8.3	7.7	7.5	6.9	8.1	5.1
<i>M. keenani</i> , (holotype) Fort Gulick, Panama Canal Zone.	♂	USNM 311951	-----	-----	12	51.9	20.9	25.3	21.9	12.5	4.3	8.6	7.6	8.3	7.4	9.0	5.3
<i>M. keenani</i> , Bahía de Caráquez, Ecuador	♂	AMNH 64541	82	23	12	50.8	21.2	21.8	22.2	12.0	4.1	8.5	7.5	7.9	7.5	8.3	5.3
<i>M. longifolium</i> , Santo Antonio, Brazil	♂	AMNH 92223	80	22	13	50.1	-----	24.7	21.4	12.2	4.3	8.4	7.7	7.9	7.8	8.7	5.2
<i>M. longifolium</i> , Santo Antonio, Brazil	♀	AMNH 92224	82	24	12	48.9	-----	23.0	21.3	12.1	4.0	8.1	7.4	8.0	7.3	8.4	5.3

adult *cozumelae* on the basis of its juvenile characters—smaller size; darker, less ornate coloration; and bulging braincase. Apparently *bennettii* and *cozumelae* are very similar, but until adult specimens of each are compared, their true relationship cannot be determined.

Four species have been named in *Anthorhina*, but all seem to have been based on distortions of preservation or individual, seasonal, or geographic variations of a single species. Crenulation and hairiness of the noseleaf are individually variable throughout. The wings apparently are always inserted on the distal portion of the metatarsus, but this feature may be obscured by labels tied to the ankle. The calcar varies individually and geographically, and often is difficult to measure accurately in preserved specimens. Coloration varies with age and season, as well as geographically. Coloration of the fresh adult pelage approximates black and white, but with age these colors became progressively obscured with yellow, orange, and reddish. Juveniles are duller, blacker, and have less prominent markings than adults. Crowding of the maxillary tooth row is individually variable. Size of the ears in dried specimens depends to some extent on the conditions of drying.

The genus *Mimon* includes the following:

*Mimon bennettii* Gray: Type locality Ipanema, São Paulo, Brazil; and *Mimon cozumelae* Goldman: Type locality Cozumel Island, Quintana Roo, Mexico. DIAGNOSIS: Body size large (forearm averages 55 mm.); coloration pale brownish, unmarked except for whitish postauricular patches; fur long and woolly; ears very large; noseleaf plain, naked; anterior upper premolar ( $P^1$ ) about equal to inner upper incisor ( $I^1$ ) in size; lower incisor longer than wide; auditory bullae small; zygomata fragile. SPECIMENS EXAMINED: *M. bennettii*: Brazil: Ipanema, São Paulo, 1, USNM. *M. cozumelae*: Mexico: Cozumel Island, Quintana Roo, 1, MCZ, 2 including type of *cozumelae*, USNM; Izamel, Yucatan, 2, USNM.

*Mimon crenulatum crenulatum* E. Geoffroy St. Hilaire: Type locality, Brazil.<sup>1</sup> DIAGNOSIS: body size small (forearm averages 50 mm.); dorsal coloration blackish-brown, marked with whitish postauricular patch and median dorsal stripe, both varying from fairly prominent to obscure; fur medium-long, lax; underparts whitish to rusty, bases of hairs grayish; ears large; noseleaf more or less crenulated on margins toward the base, fringed with long hairs;  $P^1$  about equal to  $I^2$  in size; lower incisor as wide as long; auditory bullae large; zygomata stout; rostrum

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<sup>1</sup> Cabrera (1958, p. 66) further restricted the type locality to Bahia, but in view of the uncertainty of the distribution of variation in the species in eastern Brazil, the restriction appears premature and perhaps detrimental. Present indications are that the subspecies *crenulatum* occurs at least from eastern Venezuela and Trinidad to the lower Amazon.

relatively short, shallow, and posteriorly narrowed; posterior palatal extension short and narrow; sagittal crest relatively low; molariform teeth relatively small. SPECIMENS EXAMINED: Brazil: Santarém, Rio Tapajoz, 4, MCZ. Trinidad: Port-of-Spain, 1, AMNH.

*Mimon crenulatum keenani* Handley: Type locality, Fort Gulick, Panama Canal Zone. DIAGNOSIS: see description and comparisons above. Specimens from Río Tocuyo, Venezuela, show intergradation with *crenulatum*. These are as ornate as typical *keenani*, but are duller and have gray ventral hair bases. In shape of rostrum and shortness of calcar, they approach *crenulatum*. Specimens from Bahía de Caráquez, Ecuador, seem to show intergradation with *longifolium*. Colorwise they are close to *keenani*, but are slightly duller and have gray based ventral hairs. Skull is most like that of *longifolium*. SPECIMENS EXAMINED: Ecuador: Bahía de Caráquez, 5, AMNH. Panama Canal Zone: Fort Gulick, 1, USNM. Venezuela: Río Tocuyo, 500 meters, 16, AMNH.

*Mimon crenulatum longifolium* Wagner: Type locality, Villa Maria, Mato Grosso, Brazil (*peruanum* Thomas, type locality Río Pachitea, Huanuco, Peru, is a synonym). DIAGNOSIS: This is the least ornate subspecies. Dorsal coloration dull blackish brown; ventral hairs gray based; postauricular patches and median dorsal stripe usually reduced, often obscure, and occasionally absent; rostrum relatively long, deep, and not dorsally flattened; sagittal crest high; calcar long. SPECIMENS EXAMINED: Brazil: Cacao Pereira Igarapé, Rio Negro, 3, AMNH; Santo Antonio da Uayará, Rio Madeira, 4, AMNH. Colombia: Tahuapunto, Río Vaupes, 8, AMNH. Ecuador: Boca de Río Curaray, 1, AMNH. Peru: Montealegre?, 2, AMNH. Venezuela: Mount Duida, 350 meters, 1, AMNH. No exact locality, 1, USNM.

*Mimon crenulatum picatum* Thomas: Type locality, Lamarão, 300 meters, Bahia, Brazil. DIAGNOSIS: Apparently similar to *crenulatum* in length of calcar and rostrum, but may be brighter and more ornate in coloration. *M. c. picatum* may be a synonym of *crenulatum*, or it may represent a bright-colored southeastern population. It is known only by Thomas' type specimen.

#### *Anoura cultrata*, new species

HOLOTYPE: USNM 309396, adult female, skin and skull, collected February 7, 1959, by Charles O. Handley, Jr., and B. R. Feinstein, Tacarcuna Village, 3,200 ft., Río Pucro, Darién, Panama, original number 4747.

DISTRIBUTION: Known only from the type locality, where in February and March 1959 eight specimens were caught in mist nets set over a stream in a mountain forest.

DESCRIPTION: Coloration shiny blackish (between Blackish Brown-3 and Black) throughout; individual hairs of dorsum pale grayish on basal two-thirds, those of underparts black to base. Pelage short and crisp; interfemoral membrane reduced to a narrow, densely furred band; tail present. Skull most like that of *Anoura geoffroyi*, but differing as follows: larger; braincase more tapering anteriorly; rostrum thickened; zygomata complete; posterior margin of palate more deeply incised beside posterior palatal extension; pterygoids inflated posteriorly so as to narrow the elongated mesopterygoid fossa. Symphysial region of mandibles shortened and trough between canines deepened and broadened (anterior end of mandible correspondingly depressed); coronoid process reduced in height; ventral edge of mandible with a low process just anterior to the angular process. Outer upper incisor (I<sup>2</sup>) enlarged, bladelike; upper canine enlarged, roughly triangular in cross-section at base, with distinct anterointernal, antero-external, and posterior basal cusps; internal face anteroposteriorly concave, and anterior face flat, with prominent longitudinal sulcus from base of crown to near tip; P<sup>3</sup> and P<sup>4</sup> reduced in height and thickness and in prominence of cusps; M<sup>2</sup> and M<sup>3</sup> reduced in size; lower canine reduced in height, with distinct cingulum on anterior and internal faces, and with a posterointernal cingular cusp; anterior lower premolar (P<sub>1</sub>) bladelike and enormously enlarged (lengthened and thickened), with its highest point in the posterior half of the tooth; P<sub>3</sub> and P<sub>4</sub> reduced in height and thickness and in prominence of cusps.

MEASUREMENTS (HOLOTYPE): Total length 94, tail vertebrae 6, hind foot 14, ear from notch 16, forearm 43.2, tibia 15.9, calcar 3.8. Greatest length of skull 26.3, zygomatic breadth 10.7, interorbital breadth 4.7, braincase breadth 10.3, braincase depth 8.0, maxillary tooth row length 9.0, postpalatal length 9.4, palate breadth outside of M<sup>3</sup> 5.7, rostral breadth at base of canines 4.7.

COMPARISONS: Probably the closest relative of *cultrata* is *Anoura geoffroyi*, but as indicated in the description above it is strongly differentiated from this species in many characters.

SPECIMENS EXAMINED: Panama: Tacarcuna Village, 3,200 ft., Río Pucro, Darién, 8, USNM.

#### *Chiroderma gorgasi*, new species

HOLOTYPE: USNM 309903, adult male (testis 6 x 3 mm.), skin and skull, collected March 6, 1959, by Charles O. Handley, Jr., and B. R. Feinstein, Tacarcuna Village, 3,200 ft., Río Pucro, Darién, Panama, original number 5436.

DISTRIBUTION: Known only from the type locality in eastern Panama, where five individuals were caught in February and March 1959 in mist nets set over a stream in a mountain forest.

DESCRIPTION: Body size small (forearm 37.5–38.5 mm., greatest length of skull 20.2–20.9 mm.). Dorsal coloration yellowish brown, brown (between Sudan Brown and Prout's Brown in holotype), or grayish, paler anteriorly; a white median stripe extends from upper back to base of tail; prominent white stripes above and below eye, extending from noseleaf to crown at inner base of ear and from posterior part of upper lip to outer base of ear; area about eye a little darker than remainder of body; individual hairs of dorsum tricolored, dusky at base, buffy medially, and brown or gray at tip; underparts uniformly grayish or brownish gray, very slightly washed with whitish. Membranes blackish; tragus and basal portion and margins of ear yellow; tip of ear yellowish gray. Eye large; noseleaf broad, with simple tip; interfemoral membrane hairy at base but naked on posterior margin. Nasal aperture short, extending only to level of anterior edge of orbits; supraorbital region scarcely ridged, but lachrymal region sharply ridged; sagittal and lambdoidal crests poorly developed; inner upper incisors slender; canines and  $P_4$  low, but anterior lower premolar ( $P_1$ ) large and anterior cusp half or two-thirds the height of  $P_4$ .

MEASUREMENTS: Male holotype of *gorgasi*, followed by female paratype (USNM 309902), and in parentheses the female holotype of *trinitatum*: total length 56, 57 (–); hind foot 10, 11 (12); ear from notch 17, 18 (15 in alcohol); forearm 38.5, 37.6 (41.0); tibia 12.4, 12.4 (15.2); calcar 4.9, 4.5 (4.5). Greatest length of skull 20.9, 20.7 (22.2); zygomatic breadth 12.8, 13.1 (13.9); interorbital breadth 5.4, 5.6 (5.6); braincase breadth 9.4, 9.6 (9.8); braincase depth 7.8, 7.9 (7.8); maxillary tooth row length 7.3, 7.3 (7.7); postpalatal length 5.4, 6.0 (5.8); palatal breadth outside of  $M^3$  9.5, 9.4 (9.7); rostral breadth behind canines 4.8, 4.9 (5.1).

COMPARISONS: The closest relative of *gorgasi* appears to be *trinitatum* Goodwin, which is known only by the type specimen from Trinidad. Together these species stand well apart from all other known *Chiroderma*, and additional collecting may show them to be conspecific. *C. gorgasi* may be distinguished from *trinitatum* by smaller size; relatively broader skull; relatively deeper braincase and more bulging forehead; shorter rostrum; sharper lachrymal ridge; more rounded supraorbital region; heavier zygomata; larger outer upper incisors ( $I^2$ ); shorter (anterior-posterior)  $M^1$ . Coloration of *trinitatum* is unknown.

The facial stripes, small size, low canines and  $P_4$ , large  $P_1$ , short nasal aperture, and lack of a supraorbital ridge are characters of *gorgasi* that distinguish it from the sympatric *villosum* Peters and *salvini* Dobson.

REMARKS: *Chiroderma jesupi* J. A. Allen (1900), known only by the type specimen from northern Colombia, was described as a small species. The type is a juvenile with phalangeal epiphyses not ossified. It is the same as the bat subsequently described as *C. isthmicum* by Miller (1912), and it is conspecific with *Chiroderma villosum* Peters, type locality Brazil (not Venezuela as stated by Cabrera, 1958, p. 85). The valid species of the genus *Chiroderma* are thus as follows:

*Chiroderma doriae* Thomas: type locality, Minas Gerais, Brazil (*dorsale* Lund and *villosum* Dobson are synonyms).

*Chiroderma gorgasi* Handley: type locality, Tacarcuna Village, Darién, Panama.

*Chiroderma salvini* Dobson: type locality, Costa Rica.

*Chiroderma trinitatum* Goodwin: type locality, Cumaca, Trinidad.

*Chiroderma villosum villosum* Peters: type locality, Brazil.

*Chiroderma villosum jesupi* J. A. Allen: type locality, Cacagualito, Santa Marta, Colombia (*isthmicum* Miller is a synonym).

SPECIMENS EXAMINED: *C. gorgasi*: Panama: Tacarcuna Village, Darién, 5, USNM. *C. salvini*: Costa Rica: Angostura, Cartago, 1, USNM; Cañas Gordas (Agua Buena), Puntarenas, 1, AMNH. Honduras: La Flor Archaga, 32, AMNH; San Marcos, 1, AMNH; Department of Yoro, 2,800 ft., 1, MCZ. Panama: Cana, Darién, 1, USNM; Cerro Azul, 2, USNM; Tacarcuna Village, Darién, 99, USNM. *C. trinitatum*: Trinidad: Cumaca, 1, type of *trinitatum*, AMNH. *C. villosum villosum*: Brazil: Calama, 1, AMNH. Trinidad: Diego Martin, 1, AMNH; Maracas Valley, 1, AMNH; Port-of-Spain, 2, MCZ. Venezuela: San Esteban, 1, AMNH. *C. v. jesupi*: Colombia: Cacagualito, 1, type of *jesupi*, AMNH. Panama: Barro Colorado Island, 6, USNM; Cabima, 2, including type of *isthmicum*, USNM; Cerro Azul, 1, USNM; Culebra, 1, USNM; Paya Village, Darién, 1, USNM; Río Cangandí, San Blas, 1, USNM; Tacarcuna Village, Darién, 7, USNM. Mexico: Presidio, Veracruz, 1, USNM.

***Myotis simus riparius*, new subspecies**

HOLOTYPE: USNM 310255, adult female (with one embryo, 7 mm. crown-rump), skin and skull, collected February 9, 1959, by Charles O. Handley, Jr., and B. R. Feinstein, Tacarcuna Village, 3,200 ft., Río Pucro, Darién, Panama, original number 4843.

DISTRIBUTION: Eastern Panama.

DESCRIPTION: Fur short and woolly; dorsum buffy brown (between Warm Sepia and Bister); individual hairs slightly burnished at tip, slightly grayer toward base; underparts yellowish brown, individual hairs fuscous at base; lips, ears, membranes, and feet blackish. Calcar keeled; wing membrane attached to foot at base of toes. Body size large; zygomata heavy and wide spreading; braincase relatively narrow; sagittal and lambdoidal crests high and forming a triangular



“helmet” at their juncture in the interparietal region; rostrum long and shallow; inner cutting edge of outer upper incisor ( $I^2$ ) usually not crenulated; middle upper premolar ( $P^3$ ) about two-thirds the size of  $P^1$ ;  $M^1$  and  $M^2$  with protoconule, hypocone, metaloph, and cingulum fairly well developed.

MEASUREMENTS: Holotype and a female paratype (USNM 310256) from the type locality, together with measurements, in parentheses, of two female topotypes of *simus* (AMNH 76244 and 76246): Total length 89, 86 (-, -); tail vertebrae 40, 36 (-, -); hind foot 8, 8 (9, 10); ear from notch 14, 13 (-, -); forearm 39.1, 35.7 (-, -); tibia 14.3, 13.5 (-, -); calcar 12.8, 13.2 (-, -). Greatest length of skull 13.9, 13.8 (14.0, 13.7); zygomatic breadth 8.8, 8.9 (9.4, -); interorbital breadth 3.5, 3.5 (3.9, 3.7); braincase breadth 6.4, 6.3 (7.0, 6.7); braincase depth 5.0, 5.0 (5.1, 4.9); maxillary tooth row length 5.3, 5.4 (5.1, 5.1); post-palatal length 4.5, 4.7 (4.7, 4.6); palatal breadth outside of  $M^3$  5.5, 5.7 (5.7, 5.2); rostral breadth behind canines 3.7, 3.6 (4.0, 3.8).

COMPARISONS: Compared with Amazonian *simus*, the Panamanian specimens have the rostrum longer, shallower, and narrower at the tip; the braincase narrower, less inflated; the tooth row is longer and less crowded; the middle upper premolar ( $P^3$ ) is larger (two-thirds the size of  $P^1$  as opposed to one-fourth to one-third the size of  $P^1$ ); the protoconule, hypocone, metaloph, and cingulum are better developed in  $M^1$  and  $M^2$ ; the inner cutting edge of the outer upper incisor ( $I^2$ ) is entire in four of six specimens, rather than consistently crenulated; the sagittal crest is lower and expanded at the juncture with the lambdoidal crests in the interparietal region to form a triangular helmet not seen in the Amazonian specimens; the fur of the dorsum is slightly longer and more burnished (thus brighter).

REMARKS: Coloration and length of fur are seasonally variable in *simus*. In a series of sixteen specimens from Boca de Río Curaráy, Ecuador, those collected in February and March have short (2-3 mm. on rump), orange-brown fur, with the individual hairs monocolored on all parts of the body. The remainder of the series, collected in October and December, are quite different in appearance. The fur is longer (3-4 mm. on rump), chocolate brown, with slightly burnished tips, and the individual hairs of the underparts are sharply bicolored. Several Brazilian and Peruvian specimens (*e.g.* AMNH 74378, 74380, 74105, 91889, 92702) show molt from short, orange, monocolored fur to the longer, brown, bicolored pelage.

Several characters ascribed to *simus* by Thomas (1901, p. 541) and subsequent authors cannot be substantiated in the specimens of *simus* that I have examined. Most important is the supposed insertion of the wing at the ankle. Possibly this feature had been distorted in Thomas' specimen by labels tied to the ankles, as in the two USNM

specimens relaxed by Miller (1928, p. 206). Actually the wing is attached to the foot at the base of the toes in *simus* as in most other *Myotis*. The calcaral keel, described as practically absent, indeed is absent in a few specimens, but as a rule it is well developed. The width of the rostrum and crowding of the maxillary tooth row are geographically variable. Coloration and length of fur are seasonably variable.

Thus, *Myotis simus* is not so strikingly differentiated from other species of *Myotis* as Thomas and Miller supposed, and there is little basis for the subgeneric name *Hesperomyotis* proposed for it by Cabrera (1958, p. 103).

The Panamanian specimens were caught in mist nets set over streams in a lowland semideciduous forest and a mountain forest, and at the edge of a clearing in a mountain forest.

**SPECIMENS EXAMINED:** *M. s. riparius*: Panama: Boca de Paya, Darién, 1, USNM; Cerro Azul, 2,100 ft., 1, USNM; Tacarcuna Village, 3,200 ft., Río Pucro, Darién, 4, USNM. *M. s. simus*: Brazil: Auará Igarapé, Rio Madeira, 7, AMNH; Cacao Pereira Igarapé, Rio Negro, 8, AMNH; Igarapé Amorin, Rio Tapajoz, 3, AMNH; Rosarinho, Rio Madeira, 4, AMNH; Villa Bella Imperatriz, South bank of Rio Amazonas, 14, AMNH. Ecuador: Boca de Río Curaráy, 16, AMNH, 2, USNM. Peru: Apayacu, Río Amazonas, 4, AMNH; Orosa, Río Amazonas, 3, AMNH; Panya, Boca de Río Topaya, Ucayali, 1, AMNH; Río Pisqui, Ucayali, 1, AMNH; Sarayacu, Río Ucayali, 12, topotypes of *simus*, AMNH.

#### *Lasiurus castaneus*, new species

**HOLOTYPE:** USNM 310263, adult female (with 2 embryos, 13 mm. crown rump), skin and skull, collected March 6, 1959, by Charles O. Handley, Jr., and B. R. Feinstein, Tacarcuna Village, 3,200 ft., Río Pucro, Darién, Panama, original number 5445.

**DISTRIBUTION:** Known only from the type locality, where a single specimen was taken in a mist net over a stream in a mountain forest.

**DESCRIPTION:** Dorsum deep chestnut (between Morocco Red and Chestnut), shading on rump, interfemoral membrane, and feet to mahogany (between Maroon and Claret Brown); median band of individual dorsal hairs Cinnamon-Rufous; individual hairs tricolored, with individual bands (black-amber-chestnut) about equal in extent; face and muzzle entirely black; underparts blackish brown with only scattered buff-tipped hairs except on collar; throat not differentiated from remainder of underparts in color; hairs surrounding white humeral spot black tipped; ears, wings, membranes, and lips entirely blackish. Distal fourth of interfemoral membrane naked; auricle and antitragus relatively large.  $M^3$  much reduced, second com-

missure shorter than first; hypocone much reduced on  $M^1$  and  $M^2$ ;  $P_4$  double rooted. Rostrum broad and deep; lachrymal ridge not developed; braincase narrow, deep, and tilted up away from plane of palate. Otherwise similar to *Lasiurus borealis*.

MEASUREMENTS OF HOLOTYPE: Total length 112, tail vertebrae 48, hind foot 11, ear from notch 14, forearm 44.8, tibia 19.5, calcar 15.1. Greatest length of skull 13.0, zygomatic breadth 9.9, interorbital breadth 4.2, braincase breadth 7.6, braincase depth 6.2, maxillary tooth row length 4.7, postpalatal length 5.7, palatal breadth at  $M^3$  6.7, rostral breadth at canine 5.7.

COMPARISONS: *Lasiurus castaneus* is a member of the *borealis* group. Its coloration is unique, and extreme tilting of the braincase relative to the palatal plane and reduction of parts of the upper molars like wise set it apart from other species of the *borealis* group. In overall size and in size of auricle and antitragus it resembles the remote northern *borealis* and southern *varius*, but its wings are unusually long. Like *seminolus* it lacks development of a lachrymal ridge, has a black face, and has the median band of the dorsal hairs reduced. Like *varius* it has black ears and membranes and darkened face. It scarcely needs comparison with the sympatric *frantzii*, which is much smaller, paler and brighter colored, and plain faced and has a globose braincase and a shorter, narrower rostrum.

REMARKS: Variation in coloration is remarkably slight in the *borealis* group. Specimens from California (*teliotis*), Central America (*frantzii*), and Chile (*varius*) are scarcely distinguishable colorwise. Differentiation in coloration has occurred in the extreme northeast (*borealis*) and extreme southeast (*blossevillii*) along similar lines—overlay of the red mass effect with white (sort of a "frosting"). *Castaneus* in Central America, *seminolus* in the northeast, and perhaps *egregius* in Brazil, appear to be independent variables. Sexual dimorphism in size and coloration is marked in *borealis* and *seminolus* but is slight in western North America, Central America, and South America (see also table 2 on next page). Extension of fur onto the membranes varies with latitude and perhaps with altitude (more at higher latitudes, less at lower latitudes) and is of limited taxonomic value.

Bats of the mainland of North and South America that belong to the *Lasiurus borealis* group are:

*Lasiurus borealis blossevillii* Lesson and Garnot: Type locality, Montevideo, Uruguay (*bonariensis* Lesson, Buenos Aires, Argentina; *enslenii* Lima, São Lourenço, Rio Grande do Sul, Brazil; and *salinae* Thomas, Cruz del Eje, Cordoba, Argentina, are probably synonyms).

DIAGNOSIS: slightly larger than *frantzii*, smaller than *varius* (larger toward the south); dorsum washed with whitish ("frosted"); reddish



Maxillary tooth row length		number	5	1	2	3	2	2	2	2	2	1	4	3	3	1
		♀	minimum	4.6	4.1	4.0	3.9	4.0	4.0	3.8	3.9	4.1	4.0	4.1	4.2	4.7
	maximum	4.9		4.0	4.0	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.4	4.8	4.7	
♂	number	3	1	1		1	1		1	1	1	1	3	4	3	
	minimum	4.4	3.9	3.8					3.9			4.0	3.9	4.2	4.4	
	maximum	4.7				3.9	3.8				4.0		4.0	4.7	4.7	

tips of dorsal hairs shading terminally to blackish (dominantly blackish in south, more reddish to north); buffy median band of dorsal hairs the dominant band; ears and membranes with reddish markings; females slightly larger and paler than males; lachrymal ridge developed. SPECIMENS EXAMINED: Argentina: Yuto, Jujuy, 2, AMNH. Brazil: Maracaju, Mato Grosso, 1, AMNH; São Sebastião, São Paulo, 1, USNM. Paraguay: Villa Rica, 3, USNM. Uruguay: Montevideo, 1, AMNH.

*Lasiurus borealis borealis* Müller: Type locality, New York. DIAGNOSIS: larger than *teliotis*; dorsum reddish, washed with whitish; buffy median band of dorsal hairs the dominant band; ears and membranes with reddish markings; females distinctly larger and paler than males; lachrymal ridge developed. SPECIMENS EXAMINED: many from southern Canada, eastern United States, and northeastern Mexico.

*Lasiurus borealis frantzii* Peters: Type locality, Costa Rica. DIAGNOSIS: smaller than contiguous races; dorsal color clear reddish without white wash; buffy median band of dorsal hairs the dominant band; ears and membranes with reddish markings; females scarcely differentiated from males in size and coloration; juveniles similar to adult *blossevillii* in coloration; lachrymal ridge developed. SPECIMENS EXAMINED: Colombia: Pacho, near Bogota, 1, AMNH; Villavicencio, Meta, 1, AMNH. Costa Rica: San Sebastián, San José, 1, AMNH. Honduras: La Flor Archaga, 1, AMNH. Panama: Boquete, 3,500 ft., Chiriquí, 1, USNM; Tacarcuna Village, 3,200 ft., Darién, 2, USNM; no exact locality, 1, USNM. Peru: Juliaca, 6,000 ft., 1, AMNH. Venezuela: Paya, 10 miles north of El Sombrero, Guárico, 1, AMNH; Macuto, 1, USNM; Merida, 1, AMNH.

*Lasiurus borealis teliotis* H. Allen; Type locality, unknown, probably California (*ornatus* Hall, Peñuela, near Cordoba, Veracruz, is a synonym). DIAGNOSIS: larger than *frantzii* but similar to it in coloration (slightly paler northward) and cranial characters. SPECIMENS EXAMINED: many from the western United States, Baja California, Jalisco, Michoacan, Oaxaca, and Veracruz.

*Lasiurus borealis varius* Poeppig: Type locality, Antuco, Bío-Bío, Chile (*poepingii* Lesson is a synonym). DIAGNOSIS: much larger than *frantzii*; similar to *frantzii* in color, except for darker face; ears and membranes entirely black; lachrymal ridge developed. SPECIMENS EXAMINED: Chile: Angol, 3 AMNH; Maquehue, Temuco, 1, AMNH, 2, USNM; Río Blanco, 4,900 ft., 4, USNM.

*Lasiurus castaneus* Handley: Type locality, Tacarcuna Village, 3,200 ft., Darién, Panama (see description above).

*Lasiurus egregius* Peters; type locality, Santa Catarina, Brazil. DIAGNOSIS: Similar to *castaneus* but larger (forearm 48 mm. in male

type, the only known specimen); dorsum bright rufous, darkening almost to chestnut on interfemoral membrane; face noticeably more red tinged than crown and nape; underparts bright red; membranes black (this diagnosis is from notes that G. S. Miller, Jr., made at the Berlin Museum in the early 1900's).

*Lasiurus seminolus* Rhoads: Type locality, Tarpon Springs, Pinellas County, Florida. DIAGNOSIS: similar in size to *borealis*; dorsum mahogany, washed with whitish; black basal band of dorsal hairs the dominant band; face black; ears and membranes with reddish markings; females larger than males, but similar in coloration; juveniles darker; lachrymal ridge not developed. SPECIMENS EXAMINED: many from southeastern United States.

It should be noted that previous authors have followed Peters (1871) in aligning *egregius* with the genus *Dasypterus*, because it lacked the minute upper premolar ( $P^1$ ), although in other characters it agreed with the *borealis* group of the genus *Lasiurus*. Absence of  $P^1$  in a single specimen of *Lasiurus* (*egregius* apparently is still known only by the type specimen) is not significant, for although  $P^1$  seems always to be absent in *Dasypterus*, it is also absent in one or both maxillae of about 10 percent of *Lasiurus*. Table 3, on page 475, lists some of the conspicuous differences between the species of *Lasiurus* and *Dasypterus*. More impressive are the following similarities linking these nominal genera and distinguishing them from other vespertilionids and in some cases from all other bats:

- Four mammae and average of two or three young per litter.
- Spiral effect in scale arrangement on hairs.
- Reduction of sebaceous glandular tissue and location of the submaxillary salivary gland in the facial area.
- Bright coloration.
- Baculum short, J-shaped, with high base and narrow shaft.
- Distally enlarged and spiny penis.
- Furry interfemoral membrane.

It seems more reasonable to stress the important similarities of these bats and regard them as congeneric, rather than to stress the insignificant differences and regard them as representing distinct genera. I do not believe that *Dasypterus* is useful even as a subgenus.

Recent bats of the *ega* group may be arranged in the genus *Lasiurus* as follows:

*Lasiurus ega argentinus* Thomas: Type locality, Goya, Corrientes, Argentina (*caudatus* Tomes, Pernambuco, Brazil, is a synonym). DIAGNOSIS: dorsum pale whitish buff, washed lightly with black; orange hairs of interfemoral membrane contrasting with remainder of dorsum; face blackish; underparts dull whitish buff. Paler than *ega*. Body size small. SPECIMENS EXAMINED: Argentina: Tucuman, 1, CNHM, 1, USNM. Bolivia: Caiza, 1, USNM. Brazil: Ipiranga,

São Paulo, 1, CNHM; Lago Hyanuary, Pernambuco, 2, MCZ; Salto Grande, Paraná, 1, USNM; São Marcello, Bahia, 1, CNHM; Villa Bella Imperatriz, south bank of Rio Amazonas, 2, AMNH. Paraguay: near Asuncion, 1, CNHM; Colonia Nueva Italia, Chaco, 1, CNHM; Villa Montes, Chaco, 1, CNHM; Villa Rica, 1, USNM. Uruguay: Salto, 2, CNHM.

*Lasiurus ega ega* Gervais: Type locality, Ega, Amazonas, Brazil. DIAGNOSIS: dorsum yellowish orange (darker than *argentinus*), with inconspicuous blackish wash; hairs of interfemoral membrane not contrasting with remainder of dorsum; face black; underparts paler. The Amazonian specimens become progressively darker upstream. Body size small. SPECIMENS EXAMINED: Bolivia: Buena Vista, Santa Cruz, 1, CNHM. Brazil: Baião, Rio Tocantins, 2, AMNH; Borba, Rio Madeira, 1, AMNH; Manaus, Rio Negro, 1, AMNH; Rosarinho, Rio Madeira, 1, AMNH; Santarém, Rio Tapajoz, 1, MCZ; Santo Antonio da Uayará, Rio Madeira, 1, AMNH. Peru: Pebas, Loreto, 1, ANSP; Sarayacu, Río Ucayali, 1, AMNH.

*Lasiurus ega fuscatus* Thomas: Type locality, Río Cauquete, Río Cauca, Colombia (*punensis* J. A. Allen, Puna Island, Ecuador, is a synonym). DIAGNOSIS: dorsum orange with heavy black wash (compared with *panamensis*, coloration is much darker and richer, broad subterminal band of dorsal hair orange rather than buff, and black tip longer and more dominant in mass effect); hairs of interfemoral membrane not contrasting with remainder of dorsum; entire head blackish; underparts dusky, becoming buffy posteriorly. Body size small. SPECIMENS EXAMINED: Colombia: Cali, 1, AMNH. Ecuador: Guayaquil, 1, MCZ; Puna Island, 5, including type of *punensis*, AMNH.

*Lasiurus ega panamensis* Thomas: Type locality, Bugaba, Chiriquí, Panama. DIAGNOSIS: dorsum dull sooty yellowish (paler than *fuscatus* and duller and more black washed than *ega*); hairs of interfemoral membrane not contrasting with remainder of dorsum; face black; underparts dull drabby buff, paler posteriorly. Body size small. SPECIMENS EXAMINED: Costa Rica: San José, 1, AMNH; Villa Quesada, Alajuela, 1, AMNH. Honduras: Tegucigalpa, 1, AMNH. Venezuela: Lagunillas, Zulia, 3, CNHM. Mexico: Achotal, Veracruz, CNHM; Yaxcach, Yucatan, 1, USNM.

*Lasiurus ega xanthinus* Thomas: Type locality, Sierra Laguna, Baja California, Mexico. DIAGNOSIS: dorsum pale yellowish, lightly washed with black (paler, more yellowish, and less mantled with black than *panamensis*); hair of interfemoral membrane bright yellow, contrasting with remainder of dorsum; face not blackened; underparts orangish, not becoming significantly paler posteriorly. Body size small. SPECIMENS EXAMINED: Mexico: Comondú, Baja California, 1, USNM; Miraflores, Baja California, 2, AMNH; Santa Anita, Baja California,



3, USNM; Sierra Laguna, Baja California, 1, USNM; Esequinapa, Sinaloa, 1, AMNH.

*Lasiurus floridanus* Miller: Type locality, Lake Kissimmee, Osceola County, Florida. DIAGNOSIS: dorsum buffy yellow, lightly washed with black (similar to *xanthinus*; paler, less orange and with more black than *intermedius*); hairs of interfemoral membrane not contrasting with remainder of dorsum; face blackish; underparts similar to dorsum in coloration. Body size large. SPECIMENS EXAMINED: a

TABLE 3.—Differentiating characters of the species groups of the genus *Lasiurus*

Red bats ( <i>L. borealis</i> , etc.)	Hoary bats ( <i>L. cinereus</i> , etc.)	Yellow bats ( <i>L. ega</i> , etc.)
Size small (forearm 37–44 mm.)	Size large (forearm 46–57 mm.)	Size large (forearm 44–57 mm.)
Lateral wings of presternum equal to body of presternum in width	Lateral wings of presternum equal to body of presternum in width	Lateral wings of presternum considerably broader than body of presternum
Presternum about as long as wide	Presternum much longer than wide	Presternum about as long as wide
Auditory bullae not enlarged	Auditory bullae slightly enlarged	Auditory bullae not enlarged
Rostrum relatively short	Rostrum medium	Rostrum relatively long
Sagittal crest very weak	Sagittal crest weak	Sagittal crest strong
Coronoid process medium height	Coronoid process low	Coronoid process high
P <sup>1</sup> usually present	P <sup>1</sup> usually present	P <sup>1</sup> always absent
Hypocone slightly reduced on M <sup>1</sup> and M <sup>2</sup>	Hypocone much reduced on M <sup>1</sup> and M <sup>2</sup>	Hypocone slightly reduced on M <sup>1</sup> and M <sup>2</sup>
M <sup>3</sup> very reduced	M <sup>3</sup> reduced	M <sup>3</sup> slightly reduced
P <sub>4</sub> double rooted	P <sub>4</sub> single rooted	P <sub>4</sub> double rooted
M <sub>3</sub> talonid reduced	M <sub>3</sub> talonid only slightly reduced	M <sub>3</sub> talonid much reduced

TABLE 4.—Selected measurements of adult specimens of the *Lasius ega* group

Paris	Sex	Specimens	<i>L. e. argentinus</i>				<i>L. e. ega</i>				<i>L. e. fuscatus</i>				<i>L. e. panamensis</i>				<i>L. e. zambinus</i>				<i>L. intermedius</i>				<i>L. floridanus</i>			
			Argentina	Brazil	Paraguay	Bolivia	Brazil	Peru	Bolivia	Ecuador	Colombia	Venezuela	Costa Rica	Yucatan & Veracruz	Sinaloa	Baja Calif.	Cuba	Southern Mexico	Lower Rio Grande	Louisiana	Georgia	Florida								
♀		number	3	3	1	5		2			3		1	3	3	juv. ♀ (?)	3	10	2	2	3									
		minimum	46.9	47.1		47.2		48.8			46.5			45.4			55.0	53.6	48.6	50.2	49.3									
		maximum	49.5	48.6	49.7	50.7		52.2			47.8		47.2	46.6		54.2	58.0	56.2	51.3	52.6	50.7									
♂		number	2	3	1		1		1			2	2	3			1	5	1	12	7									
		minimum	45.7	46.7	44.3		43.8		47.0			44.4	42.7	44.0				50.4	46.3	47.8	45.5									
		maximum	46.5	47.3								45.7	44.0	45.2			56.5	54.6		50.7	50.1									
♀		number	3	3	1	5	1	1			3		1	3			3	10	2	2	3									
		minimum	15.7	15.7		15.4					15.6			15.7			18.5	17.8	17.6	17.9	17.7									
		maximum	16.1	16.1	16.0	16.2		16.0			16.3		16.1	16.2			19.2	19.3	18.0	18.5	18.3									
♂		number	2	1	1	1	1					1	1	3			1	5	2	12	7									
		minimum	15.8	14.9	14.8		14.8					14.7	14.6					17.2	17.4	16.9	16.8									
		maximum	15.9			15.7									15.0		18.6	18.3	17.7	18.4	17.8									

Maxillary tooth row length		3	3	3	1	5	1	1	2	3	1	1	1	1	10	2	2	3
♀	number	5.3	5.5			5.4				5.7				5.7	6.6	6.1	6.6	6.5
	minimum								5.9									
	maximum	5.7	5.9	5.9	5.6	5.7	5.6		6.0	5.9		5.8			7.1	6.7	6.8	6.7
♂	number	2	1	1	1	1	1	1		1	2	2	3		5	2	12	7
	minimum	5.4	5.1	5.3	5.4	5.0	5.7	5.4		5.3	5.3	5.1	5.2		6.4	6.4	6.0	6.0
	maximum	5.7									5.6	5.5	5.3		6.9	6.4	6.8	6.4

total of 47, including the type, from Florida, Georgia, Mississippi, and Louisiana.

*Lasiurus intermedius* H. Allen: Type locality, Matamoros, Tamaulipas, Mexico. DIAGNOSIS: dorsum clear yellowish orange with very fine blackish wash (brighter, clearer orange than *panamensis*, with which it is sympatric); hairs of interfemoral membrane not contrasting with remainder of dorsum; face slightly blackened; underparts colored like dorsum. Body size large. SPECIMENS EXAMINED: Cuba: San German, Oriente Province, 1, USNM. Honduras: Río Yeguaré, between Tegucigalpa and Danli, 1, MCZ. Mexico: San Bartolomé, Chiapas, 1, USNM; Tehuantepec, Oaxaca, 1, AMNH; Izamal, Yucatan, 5, USNM; Tekom, Yucatan, 1, CNHM; Matamoros, Tamaulipas, 5, USNM. United States: Brownsville, Texas, 4, AMNH, 1, ANSP, 3, CNHM, 49, USNM; Cameron County, Texas, 6, USNM; Padre Island, Texas, 1, USNM.

Although geographic variation in coloration is considerable, geographic variation in body size is not apparent in the small samples of *ega* that I have examined (see table 4, pp. 476-477).

*L. intermedius* and *floridanus* must be closely related. Together they stand well apart from *ega* in larger body size, more massive skull, stronger rostrum, higher crests, and more widely spreading zygomata. Southern Texas and Latin American populations of *intermedius* average larger in body size than do specimens of *floridanus* from Louisiana, Georgia, and Florida, but they overlap. Neither this variation nor the variation in coloration appears to be clinal in *intermedius* and *floridanus*. However, similarity of the antorbital structure in specimens from Mexico, Texas, and Louisiana, in contrast to this structure in specimens from Georgia and Florida, suggests gene flow between *intermedius* and *floridanus*. I have not seen specimens from Texas north of the Río Grande Valley, where intergradation would be expected to occur if *floridanus* and *intermedius* are conspecific.

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