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North American Yellow Bats, "Dasypterus," And a List of the Named Kinds Of the Genus Lasiurus Gray

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INTRODUCTION

Yellow bats occur only in the New World and by most recent authors have been referred to the genus *Dasypterus* Peters. The red bats and the hoary bat, all belonging to the genus *Lasiurus* Gray, also occur only in the New World except that the hoary bat has an endemic subspecies in the Hawaiian Islands.

The kind of yellow bat first to be given a distinctive name was the smaller of the two species that occur in North America. It was named *Nycticejus ega* in 1856 (p. 73) by Gervais on the basis of material from the state of Amazonas, Brazil, South America, but was early recognized as occurring also in North America (in the sense that México and Central America, including Panamá, are parts of North America). More than 40 years elapsed before subspecific names were proposed for the North American populations; Thomas named *Dasypterus ega xanthinus* in 1897 (p. 544) from Baja California, and *Dasypterus ega panamensis* in 1901 (p. 246) from Panamá.

The larger of the two North American species was named *Lasiurus intermedius* in 1862 (p. 246) by H. Allen on the basis of material from extreme northeastern México. Another alleged species, *Dasypterus floridanus*, was named in 1902 (p. 392) by Miller from Florida, but as set forth below it is only a subspecies of *L. intermedius*, a species that is seemingly limited to parts of the North American mainland and Cuba.

A third species, *Atalapha egregia*, allegedly allied to the small yellow bat, *L. ega*, was named in 1871 (p. 912) by Peters from Santa Catarina, Brazil, but Handley (1960:473) thinks that *L. egregius* is allied instead to the red bats. The species *L. egregius* has not been studied in connection with the observations reported below.

Bats of the genus concerned were given the generic name *Nycteris* by Borkhausen in 1797 (p. 66), and the name *Lasiurus* by Gray in 1831 (p. 38). For much of the latter part of the 19th century the generic name *Atalapha* proposed by Rafinesque in 1814 (p. 12) was used because it antedated the name *Lasiurus*. In this period Harrison Allen (1894:137) raised to generic rank the name *Dasypterus* that had been proposed by Peters in 1871 (p. 912) only as a subgenus for the yellow bats. Since 1894 the yellow bats ordinarily have borne the generic name *Dasypterus*. The red bats and the hoary bat continued to be referred to as of the genus *Atalapha* until early in the 20th century when it was decided that a European bat of another genus was technically the basis for the name *Atalapha*. Thereupon *Lasiurus* was again used in the belief that it was the earliest available name for the bats concerned. But in 1909 (p. 90) Miller showed that the name *Lasiurus* was preoccupied by *Nycteris* Borkhausen, 1797 (p. 66). From 1909 until 1914 in conformance with the Law of Priority *Nycteris* was used for the red bat and the hoary bat.

At this point it is desirable to digress and indicate why and how the Law of Priority came into being. In the 19th century different technical names were used for the same kind of animal depending on the opinions of individual authors. For example, one author used name A because it was most descriptive of the morphology of the animal, another author used name B because it had been used more often than any other, another author used name C because it was more euphonious, etc. In order to achieve uniformity and stability a set of rules was drawn up in 1901 at the International Zoological Congress in Berlin. Those rules were based principally on the rule, or law, of priority. In effect, the law stated that the technical name first given to a kind of animal (with starting date as of January 1, 1758, *Systema Naturae* of Linnaeus) would be the correct and official name. After the mentioned rules were adopted, some zoologists, mostly non-taxonomists, objected to the rules and in response to these objections a compromise was adopted in 1913 at the International

Zoological Congress in Monaco and the International Committee on Zoological Nomenclature was authorized to set aside, at its discretion, the Law of Priority. In 1913 it was thought by everyone that the names conserved (*nomina conservanda*) by setting aside the rules would be few.

Returning now to the generic names applied to the bats concerned, it is to be noted that from 1803 until 1909 *Nycteris* had been used as the generic name of an African bat on the erroneous assumption that the name was first applied in a valid fashion to the African bat. With the aim of conserving the name *Nycteris* for the African bat, some zoologists petitioned the International Committee on Zoological Nomenclature to set aside the Law of Priority and petitioned also that the name *Lasiurus* be validated for use again as the generic name for New World bats. This petition was granted in 1914 in the first lot of names for which exception to the rules was made. As a result, since 1914 *Lasiurus* has been used with increasing frequency, and *Nycteris* with decreasing frequency, for New World bats.

The above explanation of the application of the generic names *Nycteris*, *Atalapha*, and *Lasiurus* is given for two reasons: First, study of more abundant material than was available to Harrison Allen in 1894 when he raised *Dasypterus* to generic rank reveals, as set forth beyond, that the yellow bats are not generically different from the red bats and hoary bat and so will bear the same generic name that is applied to the red bat and hoary bat; second, a choice of generic names has to be made. Actually, the International Commission on Zoological Nomenclature since 1913 has voted to make many, instead of only a few, exceptions to the rules. The number of names resulting from these exceptions is becoming so large that some zoologists fear that the chaotic condition of nomenclature in the previous century will return. Those who hold such fears maintain that adherence to the rules of 1901, or to the Law of Priority, or at least to some rules, clearly is desirable. Certainly there is much logic in that view. According to the rules, *Nycteris* is the correct name of the bats concerned. According to the Commission, it is well to use instead the name *Lasiurus*. Perhaps the time has come to follow the rules and use *Nycteris*. But, because of the possibility that the Commission will return to its policy of 1913 and recommend only a few instead of many exceptions to the rules, the generic name *Lasiurus* is tentatively used in the following accounts.

Genus Lasiurus Gray

Hairy-tailed Bats

1797. *Nycteris* B[orkhause]n, Der Zoologe (Compendiose Bibliothek gemeinnützigsten Kenntnisse für alle Stände, pt. 21), Heft 4-7, p. 66. Type, *Vespertilio borealis* Müller [= *Lasiurus borealis*]. *Nycteris* Borkhausen is a homonym of *Nycteris* G. Cuvier and É. Geoffroy St.-Hilaire, 1795, type *Vespertilio hispidus* Schreber, 1774 [= *Nycteris hispida*], from Senegal. Although *Nycteris* Cuvier and Geoffroy St.-Hilaire is a *nomen nudum*, Opinion 111 of the International Commission of Zoological Nomenclature establishes the name as available for a genus of Old World bats. On this basis, *Nycteris* Borkhausen is not available for the New World genus. *Nycteris* É. Geoffroy St.-Hilaire, 1803, is a synonym of *Nycteris* Cuvier and Geoffroy St.-Hilaire, 1795, as given status by the Commission.

1831. *Lasiurus* Gray, Zool. Misc., No. 1, p. 38. Type, *Vespertilio borealis* Müller.

1871. *Atalapha* Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 907, and other authors [*nec Atalapha* Rafinesque, 1814].

Type species.—*Vespertilio borealis* Müller.

Diagnosis.—Interfemoral membrane large and most of its upper surface furred; mammae 4; third, fourth and fifth fingers progressively shortened; ear short and rounded; skull short and broad; nares and palatal emargination wide and shallow (width transversely exceeding length anteroposteriorly); sternum prominently keeled; i. 1/3, c. 1/1, p. 1/2 or 2/2, m. 3/3; when two upper premolars present, anterior one minute, peglike, and displaced lingually; M3 much reduced, area of its crown less than a third that of M1.

Members of this genus are notable for having three and even four young (more than other bats). In North America at least *L. borealis* and *L. cinereus*, are migratory.

Provisional Key to the Recent Species of *Lasiurus*

1. Color reddish or grayish (not yellowish); normally two premolars on each side of upper jaw.
   2. Occurring on Antillean islands (color reddish).
      3. Length of upper tooth-row less than 4.5 mm. (occurring on Hispaniola and Bahamas) *L. minor*.
      3'. Length of upper tooth-row more than 4.5 mm. (not occurring on Hispaniola and Bahamas).

4. Greatest length of skull less than 13.9 mm. (occurring on Cuba) *L. pfeifferi.*

4'. Greatest length of skull more than 13.9 mm. (occurring on Jamaica)

2'. Occurring on mainland and coastal islands of North and South America; also on Galapagos and Hawaiian islands (color reddish or grayish). *L. degelidus.*

5. Total length more than 120 mm.; color grayish *L. cinereus.*

5'. Total length less than 120 mm.; color reddish.

6. Upper parts brick red to rusty red, frequently washed with white; lacrimal ridge present.

7. Not occurring on Galapagos Islands *L. borealis.*

7'. Known only from Galapagos Islands (both ear of 7.6 mm. and thumb of 6.4 mm. allegedly shorter than in *L. borealis* of adjacent mainland; presence of lacrimal ridge not verified) *L. brachyotis.*

6'. Upper parts not brick red to rusty red; lacrimal ridge not developed.

8. Forearm more than 46.5 mm. (48 in only known specimen, a male); dorsum bright rufous (absence of lacrimal ridge not verified) *L. egregius.*

8'. Forearm less than 46.5 mm.; dorsum not bright rufous.

9. Upper parts mahogany brown washed with white; forearm less than 43 mm *L. seminolus.*

9'. Upper parts deep chestnut; forearm more than 43 mm. (44.8 in only known specimen, a female) *L. castaneus.*

1'. Color yellowish; only one premolar on each side of upper jaw.

10. Total length more than 119 mm.; length of upper tooth-row 6.0 mm. or more *L. intermedius.*

10'. Total length less than 119 mm.; length of upper tooth-row less than 6.0 mm *L. ega.*

Lasiurus intermedius

Northern Yellow Bat

Diagnosis.—Upper parts yellowish-orange, or yellowish brown, or brownish-gray faintly washed with black to pale yellowish gray; size large (forearm, 45.2-62.8; condylocanine length, 16.9-21.5).

Distribution and Geographic Variation

Lasiurus intermedius H. Allen, type from Matamoros, Tamaulipas, has been reported from the Rio Grande Valley of Texas southward to Honduras and in Cuba. *Lasiurus floridanus* (Miller), type from Lake Kissimmee, Florida, has been recorded from southeastern Texas, eastward along the Gulf of Mexico to Florida, and thence northward along the Atlantic Coast to extreme southeastern Virginia (see records of occurrence beyond and Fig. 2). Specimens of *intermedius* from the vicinity of the type locality and from other localities in México differ from specimens of *floridanus* (from Florida and southern Georgia) as follows: Larger, both externally (especially forearm) and cranially (see measurements); teeth larger and heavier; skull heavier and having more prominent sagittal and lambdoidal crests; braincase less rounded, more elongate; auditory bullae relatively smaller; upper parts averaging brighter (yellowish to yellowish-orange in general aspect, rather than yellowish-brown to brownish-gray).

The differences mentioned above are of the magnitude of those that ordinarily separate subspecies of a single species rather than two species. Miller (1902:392-393), in the original description of *floridanus*, noted that the differences between it and *intermedius* were slight and remarked (p. 393): "Indeed, it is probable that it intergrades with the Texas animal." Lowery (1936:17) also has suggested that intergradation might occur between *intermedius* and *floridanus* "in southwestern Louisiana or eastern Texas"; later (1943:223-224) he pointed out that specimens from Baton Rouge, Louisiana, averaged larger in cranial dimensions than typical *floridanus* and again mentioned the possibility of intergradation between the two kinds. Sanborn (1954:25-26) touched obliquely on the problem when he wrote: "In Florida, *Dasypterus intermedius* is referred to as a Florida yellow bat (*Dasypterus floridanus*)." Handley (1960:478) wrote that certain morphological similarities suggested "gene flow" between the two kinds.

Specimens examined from Louisiana resemble *floridanus* from Georgia and Florida to the eastward in external dimensions. Some of those specimens resemble *floridanus* in size of skull, but two skulls from Louisiana are inseparable from those of topotypes of *intermedius*. The upper parts of specimens from Louisiana are generally like those of animals to the east but average somewhat paler (less brownish). The specimens seen from Louisiana seem to be intergrades between *intermedius* and *floridanus* but clearly are assignable to the latter.

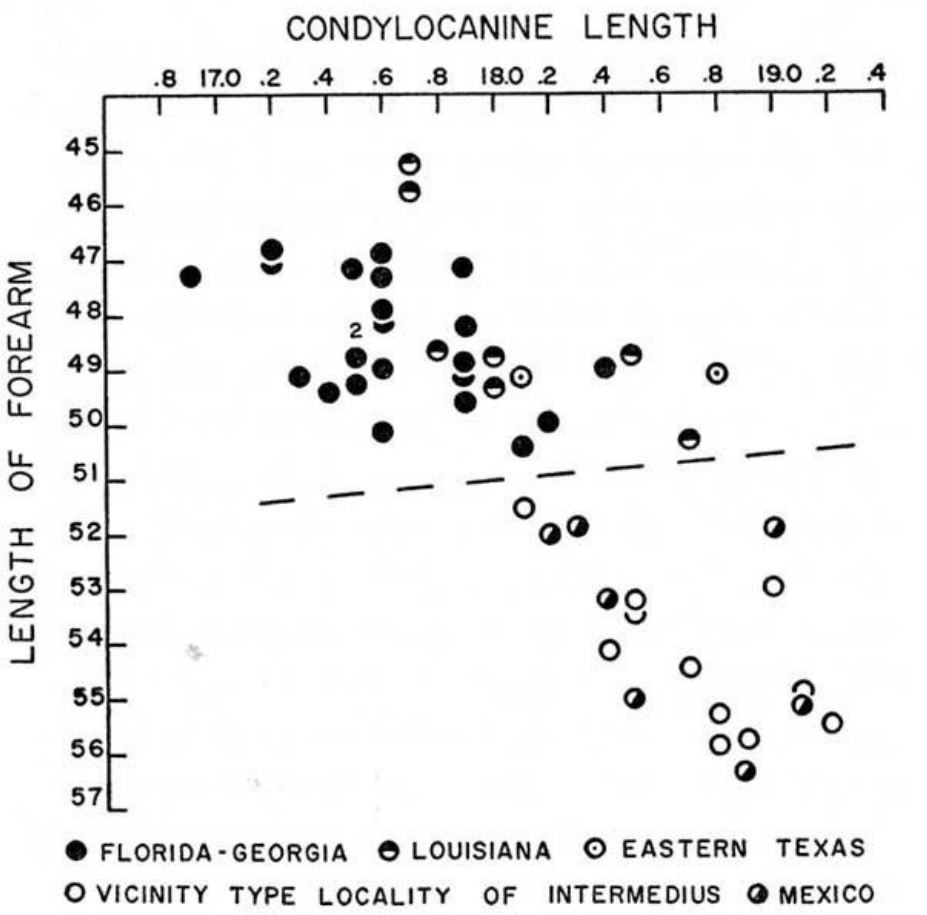

Fig. 1. Condylocanine length plotted against length of forearm for specimens of the species *Lasiurus intermedius*.

The picture is less clear as regards bats from southeastern Texas (one specimen each from Colorado and Travis counties, and four specimens from Harris County). Five of the specimens have skulls (the Travis County specimen is a skin only) and of these, four are clearly assignable, on the basis of size and shape of the skull, to *intermedius*. The fifth skull (specimen from Colorado County) is intermediate in size between *floridanus* and *intermedius* and on that basis alone could be assigned with equal propriety to either. All these specimens from Texas more closely resemble *floridanus* than *intermedius* in external size (forearms: 49.2, 49.6, 50.7, 49.9 (approximate), 49.6, 49.1). The pale yellowish-gray upper parts of the four adults, seemingly resulting from a dilution of the brownish color found in *floridanus*, differ from the color of typical specimens of both *intermedius* and *floridanus*, but the average is nearer that of *floridanus* than that of *intermedius*. Color of pre-adult pelage in the one July-taken young of the year resembles the color of adults. An August-taken young of the year is in process of acquiring the adult pelage but the hairs have not reached their full growth; it is pale yellowish but not so grayish as the other specimens. All characters considered, the specimens from eastern Texas resemble *floridanus* more than they do *intermedius*, and so are provisionally assigned to *floridanus* (as was done by Taylor and Davis, 1947:19; Eads, *et al.*, 1956:440; and, Davis, 1960:59). Additional material from southeastern Texas is needed. It will be remembered that the type locality of *intermedius* is in the Rio Grande Valley; all specimens seen, in the study here reported on, from the Texas side of the valley are unquestionably referable to that subspecies.

Intergradation, then, occurs between *L. intermedius* and *L. floridanus* in some degree in southern Louisiana and in more marked degree in southeastern Texas. Specimens from the area of intergradation vary more individually in many features than do specimens from other areas. In general the intergrades tend to resemble *floridanus* in small size externally and *intermedius* in large size of skull. The specimens from southeastern Texas differ from typical specimens of both subspecies in color, being pale yellowish-gray (instead of yellowish to yellowish-orange as in *intermedius* or yellowish brown to brownish-gray as in *floridanus*), and this difference is shared to some extent with animals from Louisiana, the latter being somewhat intermediate between bats from Texas and those from Florida and Georgia, although nearer those from Florida and Georgia.

An hypothesis to account for the variation noted is that in Wisconsin Time, and perhaps in earlier Pleistocene times, this yellow bat was (as it is now) a warmth-adapted animal as Blair (1959:461) would term it. Some cool period forced the mainland populations of the two species into two refugia—peninsular Florida and eastern México—and the present area of intergradation is, therefore, of a secondary rather than a primary type. Possibly also the relatively treeless area of part of southern Texas has made for a sparse population there of *Lasiurus intermedius* and gene flow now may be, and long may have been, slight between

the eastern and southern segments of the species.

It could be contended that the peculiar coloration of specimens from southeastern Texas, coupled with the tendency to have a large skull (as has *intermedius*) and small external dimensions (as has *floridanus*), justifies subspecific recognition for the animals that here are termed intergrades. But, judging by the specimens now available, such subspecific recognition would tend to obscure rather than clarify the geographic variation noted.

Life History

Probably bats of the species *Lasiurus intermedius* seek retreats primarily in trees (see Moore, 1949*a*:59-60) but Baker and Dickerman (1956:443) reported "approximately 45 yellow bats" concealed on July 22, 1955, "among dried corn stalks hanging from the sides of a large open tobacco shed" in the state of Veracruz. Young are born in late spring, three being the only number known except that Davis (1960:59) was told that in the vicinity of Mission, Texas, two was the usual number "born in May and June." Sherman (1945:194) reported a female with young (number not given) taken on June 7, 1918, at Seven Oaks, Florida, and another with three young taken on June 20, 1941, at Ocala, Florida. Lowery (1936:17) recorded a female, having three young, obtained on June 17, 1932, at Baton Rouge, Louisiana. A specimen taken on May 19, 1940, at Baton Rouge contained three embryos. Baker and Dickerman (*loc. cit.*) reported four adult females from Veracruz as lactating on July 22, 1955, but they were accompanied by flying young of the year and probably were near the end of the lactation period. Among specimens examined, juveniles are available by date as follows: 5 mi. N Baton Rouge, Louisiana (June 26, 1953); Palm Beach, Florida (July 6, 1950); and Izamal, Yucatán ("taken with mother" on July 28, 1910). Breeding probably takes place in autumn and winter; Sherman (*op. cit.*:196) reported males from Florida as sexually "mature" from the beginning of September to mid-February. Late winter segregation of sexes has been reported.

Subspecies

In the following accounts, localities of occurrence in each state are listed from north to south; if two lie in the same latitude, the westernmost is listed first. Localities that are italicized are not shown on the distribution map (Fig. 2), either because undue crowding of symbols would result or, in several cases, because we could not precisely place the localities. Length of forearm is the average of both forearms in individuals in which both forearms could be measured.

Lasiurus intermedius intermedius (H. Allen)

1862. *Lasiurus intermedius* H. Allen, Proc. Acad. Nat. Sci. Philadelphia, 14:246, "April" (between May 27 and August 1), type from Matamoros, Tamaulipas.

Geographic distribution.—Southern México (Yucatán, Chiapas and Oaxaca), northward along Gulf Coast to Rio Grande Valley of southern Texas (see Fig. 2).

Diagnosis.—Size medium (see measurements); sagittal crest present (height above braincase averaging 0.4 mm. in 12 from Brownsville, Texas); interorbital region relatively broad; M3 relatively broad (see comparisons in account of the Cuban subspecies beyond); mesostyle of M1 and M2 and 2nd commissure and cingulum of M3 large; pelage yellowish to yellowish-orange.

Comparisons.—See p. 79 and under accounts of *Lasiurus intermedius floridanus* and the Cuban subspecies.

External measurements.—Three adult males from the Sierra de Tamaulipas in Tamaulipas: Total length, 146, 136, 142; length of tail-vertebrae, 69, 67, 70; length of hind foot, 11, 11, 11; length of ear from notch, 17, 16, 17; length of forearm (dry), 53.2, 51.8, 51.9. Corresponding measurements for two adult females from 1 mi. SW Catemaco, Veracruz: 149, 155; 64, 69; 11, 12; 17, 17; 51.8, 55.2. Weight in grams of the Tamaulipan specimens, respectively: 24, 21, 24. For cranial measurements see Table 1.

Records of occurrence.—Specimens examined, 45, as follows: Texas: 5½ mi. N Mission, 2 (Texas A & M); *Santa Ana National Wildlife Refuge*, 1 (USNM); Brownsville, 13 (4 AMNH; 1 Texas A & M; 8 USNM). Tamaulipas: *Matamoros*, 2 (USNM); Sierra de Tamaulipas, 1200 ft., 10 mi. W, 2 mi. S Piedra, 1 (KU); *Sierra de Tamaulipas, 1400 ft, 16 mi. W, 3 mi. S Piedra*, 2 (KU). Veracruz: 16 mi. SW Catemaco, 15 (KU). Oaxaca: Oaxaca, 1 (British Mus.). Chiapas: San Bartolomé, 1 (USNM). Yucatan: Tekom, 1 (Chicago Mus.); Izamal, 5 (USNM). Honduras: Río Yeguare, between Tegucigalpa and Danli, 1 (MCZ).

Additional records: Texas: *Padre Island* (Miller, 1897:118); *Cameron County* (*ibid.*).

Oaxaca: Tehuantepec (Handley, 1960:478). Yucatan: *Yaxcach* (not found, Gaumer, 1917:274).

Lasiurus intermedius floridanus (Miller)

1902. *Dasypterus floridanus* Miller, Proc. Acad. Nat. Sci. Philadelphia, 54:392, September 12, type from Lake Kissimmee, Oceola Co., Florida.

Geographic distribution.—Extreme southeastern Virginia, south along Atlantic Coast to and including peninsular Florida (except possibly extreme southern tip), thence westward to southern Louisiana and the southern part of eastern Texas (see Fig. 2).

Diagnosis.—Size small (see measurements); sagittal crest present but low; interorbital region relatively broad; teeth essentially as in *L. i. intermedius* except averaging smaller; pelage yellowish-brown to grayish-brown. For comparison with the Cuban subspecies, see account of that subspecies.

Comparisons.—From *Lasiurus intermedius intermedius*, *L. i. floridanus* differs as follows: averaging smaller (see measurements), especially in forearm and skull; teeth smaller; skull having less prominent sagittal and lambdoidal crests; braincase more nearly round; tympanic shields over petrosals approximately same size and therefore relatively larger; pelage of upper parts duller, yellowish-brown to brownish-gray instead of yellowish to yellowish-orange.

External measurements.—Average (and extremes) of 14 February-taken males from along the Aucilla River, Jefferson Co., Florida: Total length, 126.8 (121-131.5); length of tail-vertebrae, 54.2 (51-60); length of hind foot, 9.8 (8-11); length of ear from notch (13 specimens), 16.3 (15-17); forearm (dry, 13 specimens), 48.1 (46.7-50.0). Corresponding measurements of the holotype, an adult female (after Miller, 1902:392): 129, 52, 9, 17, 49. Average (and extremes) weight in grams of the series of males: 17.7 (15.5-19.5). For cranial measurements see Table 1.

Records of occurrence.—Specimens examined, 65, as follows: Texas: Austin, 1 (Texas U.); *4 mi. N Huffman*, 1 (Texas A & M); Houston, 3 (1 KU; 2 MVZ); Eagle Lake, 1 (Texas A & M). Louisiana: 5 mi. N Baton Rouge, 1 (LSU); *1 mi. W LSU Campus, Baton Rouge*, 1 (LSU); *Baton Rouge*, 7 (1 AMNH; 5 LSU; 1 USNM); *½ mi. E Baton Rouge*, 1 (LSU); North Island, Grand Lake, 1 (LSU); Lafayette, 2 (USNM); Houma, 2 (USNM). Georgia: Beachton, 11 (6 Chicago Mus.; 5 USNM). Florida: *2 mi. S Tallahassee*, 1 (AMNH); 5 mi. W Jacksonville, 1 (AMNH); Aucilla River, 15 mi. S Waukenna, 7 (Univ. Fla.); *Aucilla River, at U.S. Hgy. 98*, 8 (Univ. Fla.); *W of Gainesville*, 1 (Univ. Fla.); Gainesville, 3 (2 Univ. Fla.; 1 Univ. Mich.); *near Gainesville*, 1 (Univ. Fla.); *Alachua County*, 1 (Univ. Mich.); 2 mi. SW Deland, 2 (Univ. Fla.); head of Chassahowitzka River, 1 (USNM); Lakeland, 2 (Univ. Fla.); Seven Oaks [near present town of Safety Harbor], 2 (1 AMNH; 1 USNM); Lake Kissimmee, 1 (USNM); Palm Beach, 1 (Univ. Fla.); *Mullet Lake* (not found), 1 (USNM).

Additional records: Virginia: Willoughby Beach (Rageot, 1955:456). South Carolina: 5 mi. NW Charleston (Coleman, 1940:90). Louisiana: New Orleans (Lowery, 1943:223). Mississippi: Hancock County (Hamilton, 1943:107). Georgia: W edge Camilla (Constantine, 1958:65). Florida (Sherman, 1945:195, unless otherwise noted): *St. Marys River* [near Boulogue]; *vicinity Palm Valley* (Ivey, 1959:506); *6 mi. N Lake Geneva* (Sherman, 1937:108); Old Town; Welaka (Moore, 1949a:59); Bunnell; Ocala; *Davenport*; *Hillsborough River State Park*; 1 mi. NE Punta Gorda (Frye, 1948:182); Miami (Moore, 1949*b*:50).

Lasiurus intermedius insularis, new subspecies

Holotype.—Adult female, preserved in alcohol but having skull removed, formerly in the Poey Museum, University of Havana, now No. 81666, Museum of Natural History, University of Kansas, from Cienfuegos, Las Villas Province, Cuba; obtained on January 23, 1948, by D. Gonzáles Muñoz.

Geographic distribution.—Known only from the island of Cuba (see Fig. 2).

Diagnosis.—Large throughout (see measurements); sagittal crest enormously developed, especially posteriorly (height above braincase averaging 1.7 mm. in 4 specimens); interorbital region narrow; M3 narrow; mesostyle of M1 and M2 and 2nd commissure and cingulum of M3 small; pelage yellowish to reddish-brown.

Comparisons.—From *Lasiurus intermedius intermedius* of the adjacent mainland of México, *L. i. insularis* differs as follows: Larger, both externally and cranially; sagittal crest relatively higher, especially posteriorly; interorbital region relatively narrower; palate longer posterior to tooth-rows; teeth distinctly larger throughout except M3, which is relatively (frequently actually) narrower, averaging 66.1 (62.5-71.0) per cent width of M2 in *insularis* rather than 74.1 (66.6-79.3) per cent in 10 *intermedius* from Brownsville, Texas; mesostyle of M1 and M2 relatively smaller as are second

commissure and cingulum of M3; coloration of No. 254714 USNM resembling that of *L. i. intermedius*, but coloration of three specimens, preserved in alcohol, averaging somewhat darker (more reddish-brown) than in *intermedius*.

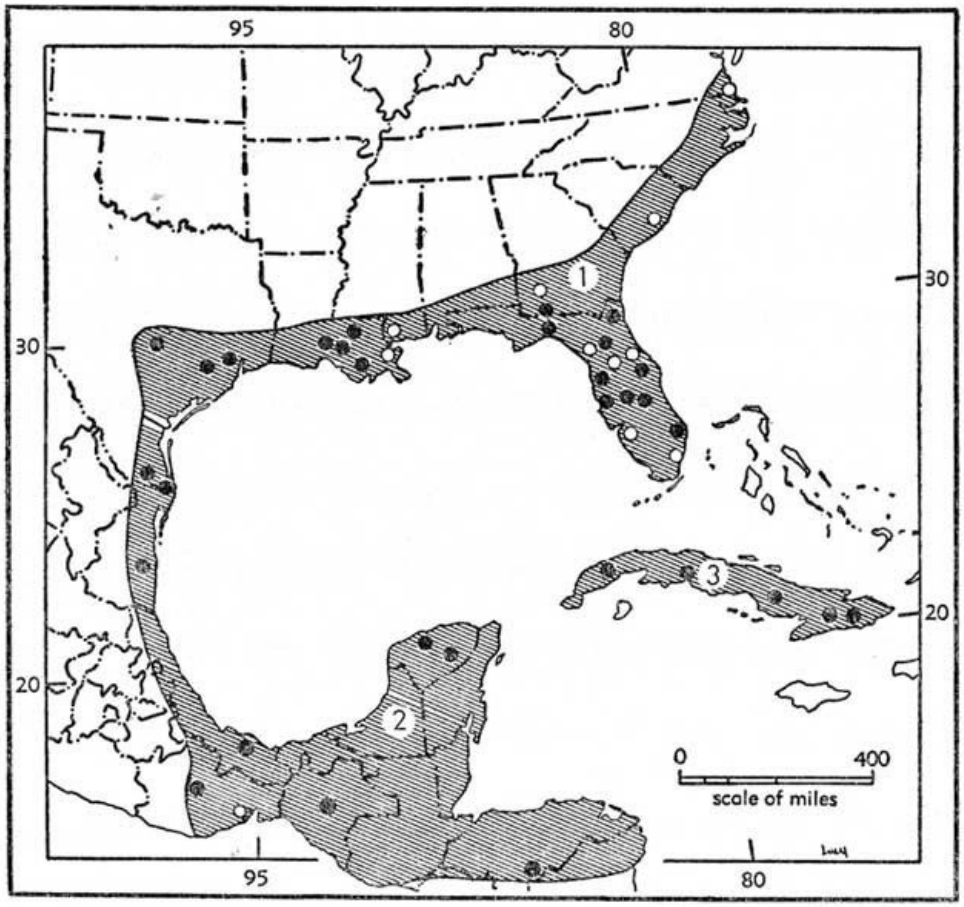

FIG. 2. Geographic distribution of the three subspecies of *Lasiurus intermedius*.

1. *L. i. floridanus* 2. *L. i. intermedius* 3. *L. i. insularis*

Black dots represent localities of capture of specimens examined. Hollow circles represent localities of capture of other specimens recorded in the literature but not examined by us (Hall and Jones).

From *Lasiurus intermedius floridanus* of the adjacent Floridan mainland, *L. i. insularis* differs in many of the same ways that it differs from *L. i. intermedius*, except that the differences are even more trenchant because *floridanus* is smaller than *intermedius*. Indeed, the difference in size between *floridanus* and *insularis* is approximately the same as between *Lasiurus borealis* and *Lasiurus cinereus*.

Measurements.—External measurements (all taken from specimens preserved in alcohol) of the holotype, followed by those of two other females, one from Laguna La Deseada, San Cristóbal, Pinar del Río Province, and the other from Bayate, Guantánamo, Oriente Province, are, respectively: Total length, 164, 161, 150; length of tail-vertebrae, 68, 76, 77; length of hind foot, 12, 12, 13; length of ear from notch, 20, 17, 19; length of forearm, 61.2, 62.6, 61.8. The length of forearm of a study skin from San Germán (that otherwise lacks external measurements) having wings spread is approximately 55.4. For cranial measurements see Table 1.

Remarks.—Four of the five specimens on which the name *L. i. insularis* is based differ to such a degree from mainland populations of the species *L. intermedius* that specific rather than subspecific recognition for the Cuban bat might seem warranted. It is because of the fifth specimen (USNM 254714) that we accord subspecific rank to *insularis*. It is smaller than the other Cuban specimens and except for longer condylocanine length, longer mandibular tooth-rows, narrower interorbital region, and heavier dentition is indistinguishable in measurements from the largest specimens of *L. i. intermedius* from the mainland. In addition, it appears not to have the enormously developed sagittal crest of the other specimens of *insularis* although posteriorly the dorsal part of the skull (where the crest is most prominent) is missing. USNM 254714 agrees with the other Cuban specimens in having the mesostyle of M1 and M2 somewhat reduced and in having a small M3 on which the cingulum and second commissure are poorly developed, and this specimen is regarded as representative of the lower size limits of the Cuban population.

The skull from San Bias was found in an owl pellet (see de Beaufort, 1934:316).

Records of occurrence.—Specimens examined, 5, all from Cuba, as follows: Pinar del

Río Prov.: Laguna La Deseada, San Cristóbal, 1 (Poey Museum). Las Villas Prov.: Cienfuegos, 1 (KU, the holotype). Camaguey Prov.: San Bias, 1 (Amsterdam Zoological Museum). Oriente Prov.: San Germán, 1 (USNM); Bayate, Guantánamo, 1 (Ramsdem Museum, Univ. Oriente).

TABLE 1.—CRANIAL MEASUREMENTS (IN MILLIMETERS) OF THREE SUBSPECIES OF LASIURUS INTERMEDIUS

Catalogue number or number of specimens averaged	Museum	Sex	Locality	Condylocanine length	Zygomatic breadth	Interorbital breadth	Alveolar length	Breadth of rostrum (between anterior openings of intraorbital canals)	Mastoid breadth	Length of mandibular tooth-row (i-m3)
			Lasiurus intermedius floridanus							
Ave. 10	UF	♂♂	[1]Aucilla River, Florida	17.6	12.8	5.0	6.2	7.2	10.0[2]	8.0
Min.	—	—	—	17.0	12.6	4.7	6.0	6.9	9.6	7.8
Max.	—	—	—	18.2	13.0	5.3	6.4	7.5	10.2	8.2
1788	LSU	♀	Baton Rouge, La.	18.7	—	5.1	6.7	7.7	—	8.8
1820	LSU	♀	Baton Rouge, La.	18.5	—	—	6.7	7.2	10.1	8.7
1840	LSU	♂	Baton Rouge, La.	18.0	12.7	5.0	6.4	7.1	9.9	8.0
6790	LSU	♂	Baton Rouge, La.	18.0	12.8	4.9	6.5	7.2	9.9	8.2
3681	LSU	♂	7 mi. SE Baton Rouge, La.	17.7	12.6	5.0	6.4	7.0	9.8	8.2
6791	LSU	♀	[3]Grand Lake, La.	17.9	12.6	4.9	6.3	7.2	9.9	8.3
84218	MVZ	♀	Houston, Texas.	19.1	13.8	5.1	6.6	7.5	10.3	8.7
769	TAMC	♀	4 mi. N Huffman, Texas	18.8	13.4	5.0	6.7	7.7	—	8.7
3805	TAMC	♂	Eagle Lake, Texas.	18.1	12.9	4.8	6.6	7.2	9.8	8.5
			Lasiurus intermedius intermedius							
1437	USNM	?	Matamoros, Tamaulipas	18.9	13.6	5.1	6.6	7.5	10.7	8.9
1439	USNM	?	Matamoros, Tamaulipas	19.0	14.0	5.3	6.6	7.8	10.7	8.8
Ave. 12	USNM[4]	?[5]	Brownsville, Texas	18.7[6]	13.8[6]	5.2	6.6	7.7	10.4[6]	8.7
Min.	—	—	—	18.1	13.0	4.9	6.4	7.4	10.0	8.4
Max.	—	—	—	19.2	14.7	5.5	7.0	8.2	11.1	9.0
55317	KU	♂	[7]Sierra de Tamaulipas	18.2	13.2	5.5	6.2	7.6	10.3	8.0
55322	KU	♂	[8]Sierra de Tamaulipas	18.4	13.7	5.2	6.5	7.4	10.6	8.4
55324	KU	♂	[8]Sierra de Tamaulipas	18.3	13.2	5.1	6.5	7.6	10.3	8.1
67549	KU	♀	Catemaco, Veracruz	19.0	13.5	5.0	6.5	7.5	10.2	8.8
67550	KU	♀	Catemaco, Veracruz	19.0	13.5	4.7	6.4	7.6	10.3	8.7
			Lasiurus intermedius insularis (all from Cuba)							
2395	AZM	?	Cave near San Bias	21.4	15.1	4.8	7.3	8.4	11.9	9.5+
254714	USNM	♂	San Germán, Oriente	19.5	14.1	4.8	6.9	7.8	11.0	9.3
81666	KU	♀	Cienfuegos, Las Villas	20.5	15.2	4.6	7.2	8.2	11.9	9.6
	Poey Mus.	♀	San Cristóbal, Pinar del Río	21.5	15.6	4.7	7.5	8.9	1.8	9.7
	Ramsdem Oriente Univ.	♀	Bayate, Guantánamo, Oriente	20.9	14.8	4.6	7.3	8.4	11.2	9.7

[1] "Rt. 98" and "15 mi. S Waukenna" both in Jefferson Co.

[2] Only nine specimens.

[3] N Island, Grand Lake, Iberville Parish."

[4] Some in Amer. Mus. Nat. History.

[5] Females, 8; males, 3; unsexed, 1.

[6] Only 11 specimens.

[7] 10 mi. W, 2 mi. S Piedra, Tamaulipas.

[8] 16 mi. W, 3 mi. S Piedra, Tamaulipas.

Lasiurus ega

Southern Yellow Bat

Diagnosis.—Upper parts yellowish-brown (much as in *Lasiurus intermedius floridanus* from Louisiana) having overlay of grayish or blackish anterior to shoulders; hair on basal half of interfemoral membrane more yellowish than elsewhere; size medium (forearm 42.7-52.2; condylocanine length 14.6-16.3).

This species occurs from the southwestern United States (Palm Springs, California, and Tucson, Arizona) southward into Uruguay and northeastern Argentina. Of the six currently (see Handley, 1960) recognized subspecies of *L. ega*, four occur only in South America, and two occur only in North America.

Cabrera (1958:115) regarded *Dasypterus ega fuscatus* Thomas (1901:246), based on three specimens from Río Cauquete, Río Cauca, Colombia, as a synonym of *Dasypterus ega panamensis* Thomas (*loc. cit.*) that was based on a specimen from Bogava, 250 meters elevation, Chiriquí, Panamá. The latter name has line priority over *fuscatus*. Cabrera (1958:116) remarked that: "Las diferencias que Thomas señaló entre el *Dasypterus* de Panamá y el de Colombia (*fuscatus*) nos parecen estar dentro de los límites de la variación individual, siendo además muy raro que una especie de quiróptero este representada en Colombia y en Panamá por razas diferentes."

On July 16, 1958, at the British Museum of Natural History, one of us (Hall) examined the holotypes of *panamensis* and *fuscatus*, as well as other materials used by Thomas, and readily perceived the differences that he pointed out. Thomas' description, although terse, is accurate. *L. e. fuscatus* is much more blackish than *panamensis*. We are inclined to retain the two names as applicable to two subspecies. Whether or not *fuscatus* is synonymized under *panamensis*, the holotype of *panamensis* is an intergrade between the almost black Colombian animal (*fuscatus*) and the paler individuals in Central America and territory north thereof. Even so, the holotype of *panamensis* more closely resembles the blackish Colombian population than the paler populations to the north and the name *panamensis*, therefore, is correctly applicable to the bat from Panamá, but not to bats of the species *Lasiurus ega* from farther north as most authors (see, for example, Hall and Kelson, 1959:194, map 143; and Handley, 1960:474) suggested was the case. For the populations north of Panamá the name *Lasiurus ega xanthinus* (Thomas) (1897:544) needs to be used.

Lasiurus ega xanthinus (Thomas)

1897. *Dasypterus ega xanthinus* Thomas, Ann. Mag. Nat. Hist., ser. 6, 20:544, December, type from Sierra Laguna, Baja California.
1953. *Lasiurus ega xanthinus*, Dalquest, Louisiana State Univ. Studies, Biol. Ser., 1:61, December 28.

Geographic distribution.—Southern California, southern Arizona, and northern Coahuila southward through México to southern Costa Rica.

Diagnosis.—Yellowish-brown with an overlay of grayish anterior to the shoulders; forearm, 42.7-47.2.

Remarks.—Specimens from Baja California and the adjacent western part of the mainland of México average paler than specimens from Veracruz and some places in Central America but the differences are slight.

Records of occurrence.—Specimens examined, 21, as follows: Baja California.—Comondú, 1 (USNM); Sierra Laguna, 4 (1 USNM, 3 British Mus.). Coahuila.—4 mi. W Hacienda La Mariposa, 2300 ft., 2 (KU). Zacatecas.—Concepción del Oro, 7680 ft., 4 (KU). Tamaulipas.—Sierra de Tamaulipas, 1200 ft., 10 mi. W, 2 mi. S Piedra, 5 (KU); 16 mi. W, 3 mi. S Piedra, 1 (KU). Sinaloa.—1 mi. S Pericos, 1 (KU). Veracruz.—Achotal, 1 (Chicago Mus.). Yucatan.—Yaxcach, 1 (USNM). Costa Rica.—Lajas, Villa Quesada, 1 (AMNH); San José, 1 (AMNH).

Additional records: California: Palm Springs (Constantine, 1946:107). Arizona: Tucson (Cockrum, 1961:97). Baja California (Handley, 1960:474): Santa Ana; Miraflores. Sinaloa: Escuinapa (Handley, 1960:475). Durango: Aguajequiroz, 12 mi. SSW Mapimí, 5000 ft. (Greer, 1960:511). San Luis Potosi (Dalquest, 1953:62): 1½ mi. E Río Verde; 19 km. SW Ebano; 4 mi. SSW Ajinche. Quintana Roo: 7 mi. N, 37 mi. E Puerto de Morelos (Ingles, 1959:384). Honduras: Tegucigalpa (Handley, 1960:474).

Lasiurus ega panamensis (Thomas)

1901. *Dasypterus ega panamensis* Thomas, Ann. Mag. Nat. Hist., ser. 7, 8:246, September, type from Bogava [= Bugaba], Chiriquí, 250 meters, Panamá.
1960. *Lasiurus ega panamensis*, Handley, Proc. U.S. Nat. Mus., 112:474, October 6.

Geographic distribution.—Panamá; also recorded by Handley (1960:474) from Venezuela.

Diagnosis.—"General colour dark brownish clay-color, something between Ridgway's 'raw-umber' and 'clay-color'. Fur black basally, then dull brownish buffy, the extreme tips black. Center of face similar to back, cheeks from eyes to lips contrasting black. Rump and hairy part of interfemoral verging toward brownish fulvous. Under surface similar to upper." (Thomas, 1901:246.) Forearm of holotype, 46.5.

Remarks.—Notes taken down by one of us (Hall) on July 16, 1958, at the British Museum, Natural History, contain the following: "Color accurately described by Thomas. The blackish stands out. The difference between the types of *D. e. panamensis* and *D. e. xanthinus* is tremendous."

Record of occurrence.—Specimen examined, one, the type (British Mus.).

RELATIONS BETWEEN THE SPECIES OF LASIURUS

As suggested by Dalquest in 1953 (p. 62) and by Handley in 1959 (p. 119) and 1960 (p. 473), the yellow bats, *Lasiurus ega* (Gervais) and *Lasiurus intermedius* H. Allen, so closely resemble the hoary bat, *Lasiurus cinereus* (Palisot de Beauvois), and the red bats, *Lasiurus borealis* (Müller) and the seven related species listed below, that all are properly included in a single genus. Many of the common characteristics are enumerated above in the diagnosis of the genus (see also Handley, 1960:473).

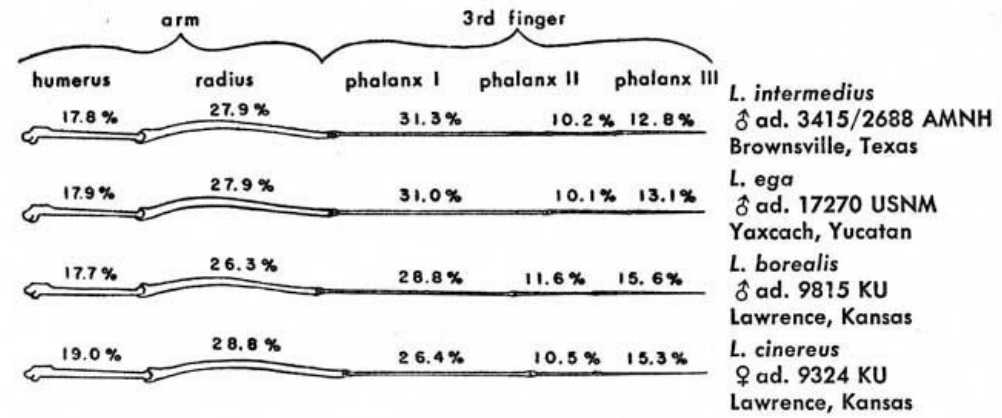

FIG. 3. Diagram of bones of right arm and third finger (middle digit) including cartilage on distal end of terminal (3rd) phalanx. Percentages are in terms of the over-all length of the arm and third finger.

A listing of the differences between the species is less impressive than a listing of the resemblances. The yellow bats differ less from the red bats than does the hoary bat, *L. cinereus*, which differs from all of the others as follows: talonid on m3 larger; p4 single-rooted instead of double-rooted; hypocone on M1 and M2 smaller; coronoid process lower; ossified part of tympanic ring, which shields the petrosal, larger; humerus relatively shorter; forearm relatively longer; first phalanx of middle finger relatively shorter; presternum including keel longer than wide instead of *vice versa*. The differences in the sternum and proportions of the forelimb reflect the more rapid flight of the hoary bat. The yellow bats differ from the red bats and hoary bat in long rostrum, pronounced sagittal crest, high coronoid process, absence of the first upper premolar, long first phalanx of the third digit and short terminal (3rd) phalanx of the same digit. Features in which the red bats are extreme in the genus are short rostrum, short forearm, and relatively longer second phalanx of the third finger. The red bats differ only slightly one from another.

Next to nothing is known of extinct Tertiary ancestors of species of the genus *Lasiurus*. Also relatively little is known about *Lasiurus* in the Pleistocene. Consequently, evolution of the living species has to be inferred almost entirely from what is known about their structure, habits, and geographic distribution. Figure 4 presents some ideas concerning relationships.

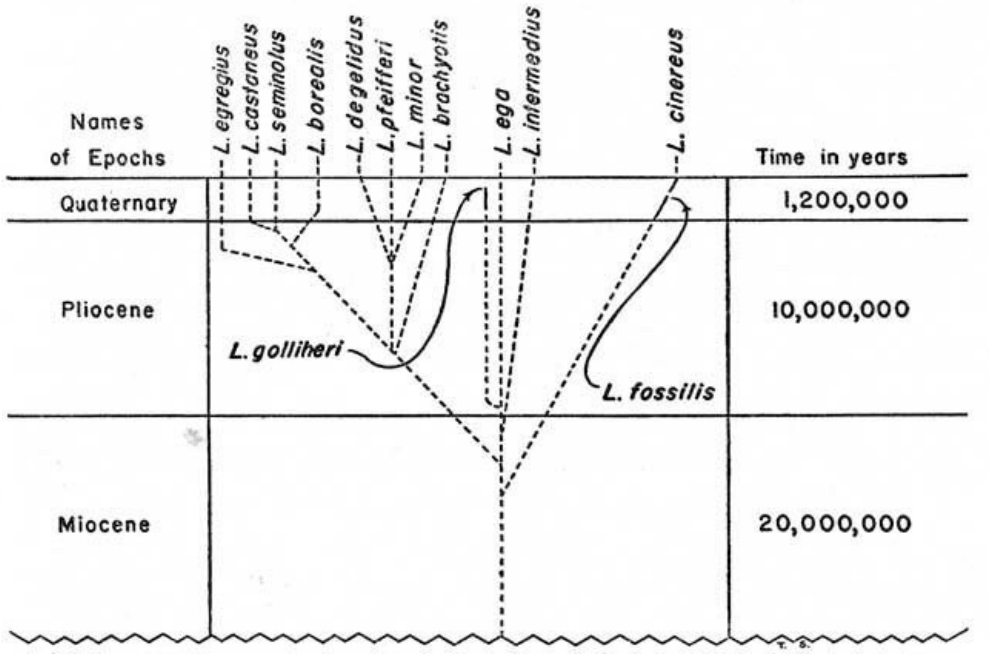

FIG. 4. Postulated relationships of species of the genus *Lasiurus*.

LIST OF NAMED KINDS OF THE GENUS LASIURUS

The words "type from" indicate that a specimen or specimens served as basis for the name. The words "type locality" signify lack of knowledge as to whether a specimen was preserved.

Red Bats

Lasiurus borealis borealis (Müller), 1776, type from New York.

[*Vespertilio*] *noveboracensis* Erxleben, 1777, based, in part, on "Der Neujorker" of Müller (*ante*).

Vespertilio lasiurus Schreber, 1781, type locality, North America.

Vespertilio rubellus Palisot de Beauvois, 1796, type locality unknown.

Vespertilio rubra Ord, 1815, based on the red bat of Wilson, Amer. Ornith., 6:60.

Vespertilio tesselatus Rafinesque, 1818, type locality unknown.

Vespertilio monachus Rafinesque, 1818, type locality unknown.

Vespertilio rufus Warden, 1820, based on the red bat of Wilson, *ibid.*

Lasiurus funebris Fitzinger, 1870, type locality, Tennessee.

Myotis quebecensis Yourans, 1930, type from Anse-à-Wolfe, Quebec.

Lasiurus borealis frantzii (Peters), 1871, type from Costa Rica.

Lasiurus borealis teliotis (H. Allen), 1891, type probably from California.

Lasiurus borealis ornatus Hall, 1951, type from Penuela, Veracruz.

Lasiurus borealis varius (Poeppig), 1835, type from Antuco, Provincia de Bió-Bió, Chile.

Nycticeus poepingii Lesson, 1836, type from Chile.

Lasiurus borealis salinae Thomas, 1902, type from Cruz del Eje, Cordoba, Argentina.

Lasiurus borealis blossevillii Lesson and Garnot, 1826, type from Montevideo, Uruguay.

Vespertilio bonariensis Lesson, 1827, type from Buenos Aires, Argentina.

Lasiurus enslenii Lima, 1926, type from São Lourenço, Rio Grande do Sul, Brazil.

Lasiurus pfeifferi (Gundlach), 1861, type from Cuba.

Lasiurus degelidus Miller, 1931, type from Sutton's, District of Vere, Jamaica.

Lasiurus minor Miller, 1931, type from "Voute l'Eglise," 1350 ft., a cave near the Jacmel road a few kilometers N Trouin, Haiti.

Lasiurus seminolus (Rhoads), 1895, type from Tarpon Springs, Pinellas Co., Florida.

Lasiurus castaneus Handley, 1960, type from Tacarcuna Village, 3200 ft., Río Pucro, Darién, Panamá.

Lasiurus egregius (Peters), 1871, type from Santa Catarina, Brazil.

Lasiurus brachyotis (J. A. Allen), 1892, type from San Cristóbal Island, Galapagos Islands.

Yellow Bats

Lasiurus golliheri (Hibbard and Taylor), Contributions Mus. Paleo., Univ. Michigan, 16:162, fig. 10F, July 1, 1960 [an extinct species], type from [a stratum of Late Pleistocene Age] "Below the caliche bed in the Kingsdown formation; Cragin Quarry local fauna, locality 1 (Sangamon age); Big Springs Ranch, SW ¼ sec. 17, T. 32 S., R. 28 W. (Kansas University Locality 6), Meade County, Kansas."

Lasiurus ega xanthinus (Thomas), 1897, type from Sierra Laguna, Baja California.

Lasiurus ega panamensis (Thomas), 1901, type from Bugaba, Chiriquí, Panamá.

Lasiurus ega fuscatus (Thomas), 1901, type from Río Cauquete, Colombia.

Dasypterus ega punensis J. A. Allen, 1914, type from Isla de Puná, Ecuador.

Lasiurus ega ega (Gervais), 1856, type from Ega, Estado de Amazonas, Brazil.

class="indent2" *Lasiurus caudatus* Tomes, 1857, type from Pernambuco, Brazil.

Lasiurus ega argentinus (Thomas), 1901, type from Goya, Province of Corrientes, Argentina.

Lasiurus intermedius intermedius H. Allen, 1862, type from Matamoros, Tamaulipas, México.

Lasiurus intermedius floridanus (Miller), 1902, type from Lake Kissimmee, Osceola Co., Florida.

Lasiurus intermedius insularis Hall and Jones, 1961, type from Cienfuegos, Las Villas Province, Cuba.

Hoary Bats

Lasiurus fossilis Hibbard, Contributions Mus. Paleo., Univ. Michigan, 8(No.6): 134, fig. 5, June 20, 1950 [an extinct species], type from [an early Pleistocene or a late Pliocene deposit] "Rexroad formation, Rexroad fauna. Locality UM-K1-47, Fox Canyon, XI Ranch, Meade County, Kansas."

Lasiurus cinereus cinereus (Palisot de Beauvois), 1796, type from Philadelphia, Pennsylvania. Known from Late Pleistocene time as well as from Recent time (see Hibbard and Taylor, Contributions Mus. Paleo., Univ. Michigan, 16:159, fig. 10A, July 1, 1960, for occurrence in Cragin Quarry local fauna, Sangamon Age, Meade County, Kansas).

> *Vespertilio pruinosus* Say, 1823, type from Engineer Cantonment, Washington Co., Nebraska.
>
> *A[talapha]. mexicana* Saussure, 1861, type from an unknown locality, probably from Veracruz, Puebla, or Oaxaca.

Lasiurus cinereus villosissimus É. Geoffroy St.-Hilaire, 1806, type locality, Asunción, Paraguay.

Lasiurus grayi Tomes, 1857, type from Chile.

> *Atalapha pallescens* Peters, 1871, type from Paramo de la Culata, Andes de Mérida, Venezuela.
>
> *Atalapha cinerea brasiliensis* Pira, 1905, type from Ignape, São Paulo, Brazil.

Lasiurus cinereus semotus (H. Allen), 1890, type from Hawaii.

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